# CITY OF OWEN SOUND

# ASSET MANAGEMENT PLAN

CORE INFRASTRUCTURE

2025

# Table of Contents

# 1. Asset Management Plan - Core

## 1.1. Executive Summary

The City of Owen Sound's (the City's) ability to provide services to the community relies on the existence of a network of assets and is limited by the condition that those assets are in good condition. Choosing a financially sustainable level of service and maintaining, rehabilitating and replacing assets in order to meet that level of service in the most cost-effective manner is not only important for the fiscal health of the community, but it is also at the core of what asset management is all about.

*Asset management* is the coordinated activity in place to manage the way in which the City realizes value from its assets in order to provide services effectively and in a financially sustainable manner. It helps to reduce risk and allows municipalities to provide reliable and affordable services to residents of the community while ensuring the needs and expectations of current and future users are being met.

The 2025 Asset Management Plan builds upon the City's 2014, 2022, and 2024 Asset Management Plan for Core Assets. This plan covers the City's core assets, including:

- Road Network
- Bridge Network
- Stormwater Network
- Water Network
- Wastewater Network

The City's core assets have a combined replacement value of over $1.3 billion. Specific details on the components within each of the above categories, as well as the total current replacement value, annual deficit, and overall rating for each asset category, can be seen in the next Table.

### Table 1.1.1: Core Asset Network Overview

| Asset Category | Asset Details | Replacement Value $ (2025) | Average Annual Deficit $ | Average Condition Rating |
|---|---|---|---|---|
| **Road Network** | Roads (paved and unpaved)<br>Sidewalks<br>Curbs<br>Guiderails | 130,129,589 | 1,642,619 | Fair |
| **Bridge and Culvert Network** | Bridges (Vehicular)<br>Trails & Pedestrian Bridges<br>Culverts | 35,553,627 | - | Good |
| **Stormwater Network** | Collection Pipes<br>Manholes<br>Catch Basins<br>Ditch Inlets<br>Leads<br>Stormceptors<br>Retention Ponds<br>Drainage Channels<br>Stormwater Services | 252,356,453 | 4,191,519 | Good |
| **Water Network** | Watermains<br>Valves<br>Water Chambers<br>Fire Hydrants<br>Services<br>Meters<br>Pumping Stations<br>Water Treatment Plant | 486,791,142 | 17,993,232 | Fair |
| **Wastewater Network** | Collection Pipes<br>Manholes<br>Force Mains<br>Wastewater Services<br>Pump stations<br>Wastewater Treatment Plant | 429,009,367 | 9,145,017 | Fair |
| **Total Core Assets** | | 1,333,840,178 | 32,851,120 | Fair |

The City’s asset management plan measures the current performance of assets against criteria determined by the Province and by the City itself. The expectations of users of the City’s services, along with the performance of these assets, can be thought of as *Levels of Service (LOS).* LOS describe what people experience from a municipality’s infrastructure. Levels of service may be either qualitative or quantitative in nature.

This plan highlights the lifecycle activities and associated costs that are required to maintain the current level of service. As with anything, there is a certain level of risk associated with any actions (or inactions) the City takes. Risks and the City’s current risk profile for its core assets are also discussed in this plan.

In order to maintain the current LOS provided, the City requires an average annual investment of $50.1m, however, given the current capital and operating budgets, only approximately half (34.5%) of this amount is anticipated to be funded. The City has an expected annual infrastructure deficit of $32.8m. The annual requirement for operations is nearly, if not fully, funded in all asset categories with the exception of the bridge network. Therefore, the large majority of this infrastructure deficit is the result of capital shortfalls. If more money is not put into the capital budget, the City can expect this funding shortfall to continue to grow and accumulate, putting the City at risk of not being able to provide the current levels of service.

As the City moves forward in its asset management journey, this asset management plan will continue to be refined and further developed to ensure the accuracy and reliability of information. This report includes an analysis of the state of the infrastructure, identifying condition, remaining life, and performance trends across core asset classes. The report also presents an overview of the current and target Level of Service (LOS) for all core infrastructure assets, including both customer and technical performance measures.

A 10-year LOS outlook has been established to guide service delivery and support future performance targets across asset categories. The target LOS outlined in this report is based on the best available information; however, in many cases, the data is outdated or incomplete. To establish meaningful and realistic target LOS, a systematic condition assessment program must be implemented, supported by more current and accurate data. As such, the City’s primary strategy is to sustain current service levels as a baseline, while working toward a more robust LOS framework grounded in reliable, up-to-date asset data. Based on this enhanced LOS, more tailored and effective lifecycle strategies are expected to be developed for each asset within its respective category.

A high-level lifecycle analysis (LCA) was carried out, along with a replacement cost-based risk assessment to prioritize asset reinvestment needs. While the LCA provides strategic direction, future updates should incorporate asset-specific customization to enhance accuracy and strategic value.

A 10-year financial analysis and implementation plan have also been developed to align capital investment with asset condition, risk and service expectations. This integrated framework supports long-term asset sustainability, regularity compliance, and informed decision-making for all core municipal assets. The ultimate goal is for the City's asset management plans to become living documents that are continually updated as new information is obtained and capital work is undertaken. This will allow for the City's asset management plan to act as a resource for staff and Council when making decisions that impact how funds are raised, allocated and ultimately how projects are prioritized as those funds are spent.

### 1.1.1. Scope of the Core Asset Management Plan

In order to adhere to the requirements set out under the Municipal Infrastructure Investment Initiative Program, in 2014, the City developed an asset management plan that addressed roads (including sidewalks), bridges, stormwater, water, and wastewater systems. The completion of this plan allowed the City to qualify for future Provincial funding programs and acted as a tool to allocate other funding sources to renewal projects in the most efficient and cost-effective manner.

This AMP covers the City's core assets, including *Roads, Bridges and Culverts, Stormwater, Water,* and *Wastewater*.

For the purposes of this plan, *water assets* mean any asset that "relates to the collection, production, treatment, storage, supply or distribution of water." *Wastewater assets* mean any asset that "relates to collection, transmission, treatment or disposal of wastewater, including any wastewater asset that from time to time manages stormwater." *Stormwater management assets* mean any asset that "relates to the collection, transmission, treatment, retention, infiltration, control or disposal of stormwater[1]."

[1] https://www.ontario.ca/laws/regulation/170588

For each category, this plan will include the following elements:

- A summary of assets;
- The replacement cost of assets;
- The average age of assets;
- The condition of assets;
- The current and target levels of service (for the next 10-year) being provided (both qualitative and technical);
- The current performance of assets;
- Risk assessment
- The lifecycle activities that would need to be taken to maintain the current level of service and the associated costs to do so; and
- A description of assumptions regarding future changes in population or economic activity.
- Financial strategy
- Improvement plan

The state of local infrastructure summarizes the “who, what and where” of the City’s assets. It inventories the City’s assets and provides replacement cost information as well as other attributes such as age, expected useful life, and condition. Ideally, this component of the plan should be updated annually to ensure that inventories are complete and accurate. Condition assessments should be performed on a rotating schedule to ensure that the physical attribute information does not get out of date.

Levels of service will be measured in several ways for each type of asset including operational indicators such as number of breaks in a water main or the pavement condition index on road segments. Strategic indicators could include the percentage of reinvestment over the total value of the asset category while tactical indicators may be the operating cost per asset unit of measure.

For the purposes of this AMP, both current and target LOS have been identified for all core asset categories. Current LOS reflects the municipality's existing performance based on available data and measurable technical and community indicators. Target LOS have been defined to guide service delivery over the next 10 years, aligning with O. Reg. 588/17 requirements and community expectations. These targets are intended to support strategic planning and long-term sustainability; however, achieving these targets will depend on the availability of more accurate, up-to-date data, and sufficient funding, and may be constrained by financial limitations. Ongoing monitoring, evaluation and refinement will be necessary to balance service goals with fiscal realities.

The asset management strategy includes the activities that will be required to meet the current levels of service. These actions may include regular maintenance and renewal activities, timing the replacement of assets that have reached the end of their useful lives, as well as non-infrastructure solutions such as implementing policies and using land use planning to lower costs and maximize the useful lives of assets. The management strategy will take risk assessments into consideration in prioritizing projects and maintenance activities.

Next, the financing strategy section provides a brief overview of financial planning and available funding sources. This section will be substantially expanded upon in future iterations of the plan. Eventually, the financing strategy will consider all available funding sources including but not limited to reserves, debt instruments, user fees and the tax levy as well as known contributions from third parties. The ultimate result will be a deficit or surplus that is the difference between expenditure requirements and available financing.

Finally, the improvement plan outlines key areas of focus for future iterations of the plan. This could range from further investigation into/validation of data, increased resident engagement/feedback, expanding on existing sections of the plan, or adding new sections of the plan, among other items. The plan outlines recommended actions over a 10-year horizon, including targeted reinvestment, condition monitoring, and lifecycle interventions. It supports the achievement of recommended target LOS, strengthens risk management, and aligns capital planning with long-term sustainability goals. Currently, the City's strategy is to maintain existing LOS as a baseline while these improvements are developed. However, to ensure future strategies are both realistic and effective, a more accurate and technically informed LOS framework based on most recent data will need to be established.

### 1.1.2. State of Local Infrastructure

#### 1.1.2.1. Introduction

This section of the AMP will provide an overview of the City's current position as it relates to core assets. The State of Local Infrastructure section contains key asset data such as inventory, replacement cost, average age, and condition for assets in each category.

As part of the development of the City's 2014 AMP, the City retained the services of a consultant to review and extract asset information from various incomplete asset databases, dated inventory maps, and over 3,500 as-built drawings. The consultant also conducted limited in-field data collection and assessment for the entire road network including the guiderail and sidewalk components as well as 3D-imaging for almost all sanitary manholes. For this AMP, the 2014 data have been reviewed, verified, updated, and supplemented by more recent asset data as contained within the City's asset management systems, regularly completed third-party asset assessment/condition reports and other reports, data collected and maintained by field staff, and professional judgment and expertise.

#### 1.1.2.2. Asset Condition

The City can undertake numerous investigative techniques to determine and track the physical condition of its infrastructure. For instance, the interior of sanitary and stormwater pipes can be routinely inspected using CCTV (closed circuit television) inspection. These inspections are guided by standard principals of defect coding and condition rating that allow for a physical condition "score" for the infrastructure to be developed. For infrastructure without a standardized approach to condition assessment scoring, information such as visual inspections, bridge audits, annual pavement inspections, watermain break records and other maintenance related observations can be used in establishing the condition of the asset.

The Table below provides a summary of the assets covered by this plan, along with the total replacement value of assets in each category and the percentage of the City's total core infrastructure replacement value each category represents.

**Table 1.1.2: Core Asset Summary**

| Asset Category | Asset Details | Replacement Value $ (2025) | Replacement Value (%) |
|---|---|---|---|
| **Roads** | Roads (arterial, collector, local, unpaved)<br>Sidewalks<br>Curbs<br>Guiderails | 130,129,589 | 10% |
| **Bridges and Culverts** | Bridges (Vehicular)<br>Trails & Pedestrian Bridges<br>Culverts | 35,553,627 | 3% |
| **Stormwater** | Collection Pipes<br>Manholes<br>Catch Basins<br>Ditch Inlets<br>Leads<br>Stormceptors<br>Retention Ponds<br>Drainage Channels<br>Stormwater Services | 252,356,453 | 19% |
| **Water** | Watermains<br>Valves<br>Water Chambers<br>Fire Hydrants<br>Services<br>Meters<br>Pumping Stations<br>Water Treatment Plant | 486,791,142 | 36% |
| **Wastewater** | Collection Pipes<br>Manholes<br>Force Mains<br>Wastewater Services<br>Pump Stations<br>Wastewater Treatment Plant | 429,009,367 | 32% |
| **Total Core Assets** | | 1,333,840,178 | **100%** |

## 1.1.3. Levels of Service

The goal of every asset manager should be to move away from reactive and "worst first" planning to maintenance of assets in a "state of good repair."

This is the most economical way to manage assets and provide higher levels of service. The path to get there requires a long-term strategy and customer buy-in to assure change.

Levels of service (LoS) describe what people (residents, users of assets, etc.) experience from a municipality's infrastructure. Levels of service can be qualitative in nature (based on customer values) and describe what is important to users of the service and how users feel about the services, or they can be quantitative in nature (based on specific data, measurables, and metrics).

For the purposes of this AMP, current and target LoS have been established for all core assets. The current LoS captures how infrastructure is performing today, while the 10-year targets provide direction for future service delivery in line with regulatory standards and community needs. Although these targets help focus planning efforts, prioritize investments, and promote sustainable asset management, it is essential to refine them using the most accurate and up-to-date data available. This is why, in the interim, the City's primary strategy is to maintain current Levels of Service (LOS) until a more robust and data-driven framework can be established.

### 1.1.4. Asset Management Strategy

#### 1.1.4.1. Overview

An asset management strategy is a set of planned actions that will enable the asset to provide the agreed upon levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost.

For the purposes of the AM strategy, lifecycle activities of an asset can be viewed in the context of four phases: minor maintenance, major, rehabilitation, and replacement as detailed in the Table below.

**Table 1.1.3: Lifecycle Activities Overview**

| Activity | Definition | Asset Age |
|---|---|---|
| **Minor Maintenance** | Planned activities such as bridge or pavement inspections, monitoring, cleaning and flushing sewers, hydrant flushing, pressure testing, visual inspections, etc. | 0 - 25% of asset life |
| **Major Maintenance** | Maintenance and repair activities that are generally unplanned; however, they can be anticipated and would generally be accounted for with the City's annual operating budget. These would include such events as repairing water main breaks, replacing individual sections of sewer pipe, or repairing erosion from stormwater run-off. | 25 - 50% of asset life |
| **Rehabilitation** | Are generally one-time events that rebuild or replace components of an asset to restore the asset to a required functional condition and extend the asset's useful life. Typically involves repairing the asset to deliver its original level of service without resorting to significant upgrading or renewal, using available techniques and standards. | 50 - 75% of asset life |
| **Replacement** | Assets will reach the end of their useful life and require replacement. The expected life of an asset is impacted by the natural properties of its materials and can vary greatly depending on a number of environmental factors that impact the degree of deterioration and performance. | 75 - 100% of asset life |

The asset management strategy will develop a process that can be applied to the lifecycle of an asset that will assist in the development of a multi-year plan to ensure the best overall health and performance of the City's infrastructure.

Maintaining accurate asset data, in addition to having proper planning and budgeting processes in place, is paramount to the success of effective asset management. If an organization can accurately monitor the condition of its assets and anticipate when issues may arise (i.e. deterioration of an asset over time based on age), it will be able to plan for timeline maintenance and renewal investments for those assets. This will not only help to ensure the asset reaches (or perhaps even exceeds) its useful life, but it will also help the organization to accurately forecast how much money it should be budgeting for investments at which points in time. As can be seen in the next Figure, timely investments are extremely important to help an organization manage assets in the most cost-effective manner. By making smaller but more frequent pre-emptive investments into the asset over the course of its life (for things such as operations, maintenance, and rehabilitation), an organization will actually save money over the life of the asset in comparison to if the organization does not make any pro-active investments and waits until the asset has reached the need for complete renewal.

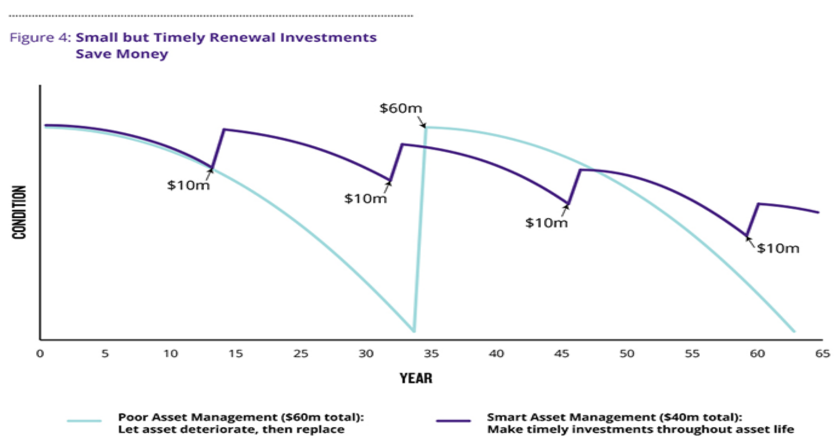



**Figure 1.1.1: Renewal Investment Curve**[2]

### 1.1.4.2. Risk Management

A large component of managing risk is ensuring that decision makers are informed about the potential consequences of actions (or inactions). There are many types of risk, such as planning risks, management risks, delivery risks, and physical asset risks (risk of asset failure).

All organizations have to accept some level of risk. The important aspect is ensuring the acceptance of risk occurs at the right level.

The risk process is comprised of many stages, such as establishing the context, identifying risks, analyzing risks, evaluating risks, and finally treating risks.

Service consequences, as it relates to risk, are the potential impacts to the reliability and/or quality of a service being provided by an asset. Risk consequences is a broader term that can include financial implications, loss

[2] https://www.ontario.ca/document/building-better-lives-ontarios-long-term-infrastructure-plan-2017/chapter-2-planning-future

of reputation from users, impacts to the environment, injury to staff or the public, and loss or reduction in service.

While it is important to be aware of the risks associated with all asset types and components, a municipality should place the highest focus on critical assets (those that would have a highly significant impact if the risk occurred). In order to determine which assets are critical, a municipality can assess the risk of each asset through assigning it a risk score. A risk score can be calculated by multiplying the likelihood that a risk will occur (Probability of Failure; PoF) by the possible consequences (impact or magnitude of the effect or Consequence of Failure; CoF) if the risk does occur. Possible consequences can be determined based on one of the risk consequences elements mentioned above.

It is important that municipalities are aware of their risks, develop a risk management plan/strategy, and build risk resilience into their services and operations.

An estimated risk matrix for the City's core assets can be seen in the below Figure.

| PoF | CoF 1 | CoF 2 | CoF 3 | CoF 4 |
|---|---|---|---|---|
| 4 | $ 19,136,901 | $ 19,795,299 | $ 128,680,525 | |
| 3 | $ 69,514,425 | $ 42,645,316 | $ 33,228,667 | $ 31,033,985 |
| 2 | $ 37,187,247 | $ 49,773,943 | $ 277,025,916 | $ 75,729,804 |
| 1 | $ 26,219,861 | $ 270,981,772 | $ 116,316,655 | $ 107,892,759 |

**Figure 1.1.2: Risk Matrix**

## 1.1.5. Financial Strategy

### 1.1.5.1. Financial Planning Overview

The ultimate goal is to have the Asset Management Plan linked to the long-term financial plan and future years' budgets. Future iterations of the AMP will include the development of a comprehensive financial plan that will allocate dedicated financial resources to meeting the funding needs identified in the Asset Management Plan.

A fully funded scenario would include costs for regular operating and maintenance (operating budget), debt payments (operating budget), major capital rehabilitation (capital budget), and future replacement including amortization of historical costs and indexed to include inflation, growth of the network and changes in service levels.

#### 1.1.5.2. Sources of Financing

Typically, the financing sources available to the municipality for inclusion in the long-term financial plan include the following:

- Municipal Tax Levies;
- User fees (including Water and Sewer charges);
- Reserve balances;
- Debenture Issues;
- Sale of assets;
- Municipal partnerships; and
- Dedicated government grants (gas tax and other programs where there is an agreement in place that is expected to be ongoing and remain stable).

The funding sources identified in this Asset Management Plan include property taxation, the Ontario Community Infrastructure Fund (OCIF), and the federal Gas Tax Fund.

### 1.1.6. Future Changes in Population or Economic Activity

According to a third-party study completed at the request of Grey County, the upper-tier municipality in Grey-Bruce, the population of the City of Owen Sound is expected to increase by just over 10% over the next 25-years, bringing the total population of the municipality to just under 25,000. Owen Sound has also seen a surge in development in the past couple of years and this trend is expected to continue with more residential and commercial builds projected to occur in the coming years.

The City has also spent significant time rebranding and renewing its downtown core, now known as the *River District*, to highlight its natural beauty and local businesses, making it more of a tourist attraction. This renewal includes increased advertising and promotion of the downtown area, the introduction of new events (such as a bi-weekly Music at the Market event in the summer), among other initiates. With changes such as this, the City can anticipate more tourism and an increased ability to attract those from out of town as well as City residents to the area, thus increasing the amount of money spent in the City.

Despite being good for the City's local economy and small businesses, this anticipated increase in population and tourism will put additional strain on the City's existing infrastructure which may cause it to wear out faster than previously expected, thus decreasing its Estimated Useful Life (EUL) and remaining lifespan; however, with increased tourism comes an increase in spending in the City which may lead to increased revenues for the City which could help to offset some of the costs associated with more frequent or aggressive performance of the lifecycle activities for the City's core assets.

### 1.1.7. Improvement Plan

Asset management is a process. While the development of this AMP is a great start in helping the City better understand its current position and future goals, there is always room to improve. In addition to working towards the completion of the upcoming requirements under O. Reg. 588/17, the following Table identifies some areas of improvement that the City should work towards as part of future iterations of this AMP.

**Table 1.1.4: Improvement Plan**

| Task # | Task Details | Responsibility | Resources Required | Timeline |
|---|---|---|---|---|
| **1** | Obtain Council endorsement of AMP for core assets | Director of Corporate Services | Director of Corporate Services, Asset Coordinator, Council | Immediately |
| **2** | Verify and update inventory of all core assets | Asset Coordinator, Field Staff (i.e. Engineering, PW, etc.), Finance, GIS | Asset Coordinator, Field Staff (i.e. Engineering, PW, etc.), Finance, GIS | 1 – 2 years |
| **3** | Verify and update estimated useful life and actual age of all core assets | Asset Coordinator, Field Staff (i.e. Engineering, PW, etc.), Finance, GIS | Asset Coordinator, Field Staff (i.e. Engineering, PW, etc.), Finance, GIS | 1 – 2 years |
| **4** | Investigate benefit of acquiring additional data to enhance annual requirement calculation | Asset Coordinator, Finance Staff | Asset Coordinator, Finance Staff | 1 – 2 years |

| | | | | |
|---|---|---|---|---|
| **5** | Verify and update condition of all core assets | Asset Coordinator, Field Staff (i.e. Engineering, PW, etc.), Finance, GIS, may require a consultant to determine asset conditions | Asset Coordinator, Field Staff (i.e. Engineering, PW, etc.), Finance, GIS, may require a consultant to determine asset conditions | 2 years |
| **6** | Update levels of service for all core assets to include proposed level of service | Asset Coordinator, Field Staff (i.e. Engineering, PW, etc.) | Asset Coordinator, Field Staff (i.e. Engineering, PW, etc.), Finance | 2 years |
| **7** | Collect further data on stormwater infrastructure in the City to be able to better understand the current performance of assets | Engineering, potentially may require the assistance of a consultant to collect data | Engineering, potentially may require the assistance of a consultant to collect data | 2 years |
| **8** | Obtain input of residents and incorporate feedback into customer values section and current performance section | Asset Coordinator in consultation with Communications department and Senior Leadership | Asset Coordinator, Communications, Senior Leadership | 2 years |
| **9** | Integrate asset management plan with long-term financial plan and strategic plan | City Manager and Senior Leadership in consultation with Finance and Asset Coordinator | City Manager, Senior Leadership, Finance, Asset Coordinator | 3 years |

The City's Core Asset Improvement Plan is designed to ensure the long-term sustainability, reliability, and resilience of essential infrastructure systems, including transportation, water, wastewater, and stormwater networks.

Moreover, given the City's projected population growth of approximately 10% over the next decade, infrastructure systems must be strategically upgraded and expanded to meet increasing service demands.

Additionally, the growing frequency of extreme weather events due to climate change introduces new vulnerabilities, particularly to aging and exposed assets.

All improvement actions will be aligned with the City's Level of Service (LOS) goals, risk assessments, lifecycle timing, and adaptive planning strategies that account for both climate-related and demographic shifts.

To support these priorities, the City will adopt a forward-looking infrastructure investment approach that:

- Strengthens resilience against environmental and operational risks
- Meets rising service expectations from a growing population
- Maintains sustainable and equitable service delivery across a changing community and climate

This plan positions the City to proactively manage its core assets while adapting to future challenges and opportunities.

owen sound
where you *want* to live

# 2025

# Asset Management Plan

# Road Network

# 1.2. Core Road Network

## 1.2.1. Introduction

The City's road services components are categorized into 6 asset classes and include the following:

- **Arterial Roads:** Arterial roads are high-capacity urban roads designed to deliver traffic from collector roads to highways or expressways. They facilitate the movement of large volumes of traffic at relatively high speeds and often have limited access to adjacent properties

- **Collector Roads:** Collector roads serve to move traffic from local streets to arterial roads. They provide access to residential properties and are typically wider and busier than local roads. They often feature a mix of signaled intersections, roundabouts, and stop signs.
- **Local Roads:** Local roads primarily provide access to adjacent properties and discharge traffic onto collector roads. They have lower traffic volumes and speeds compared to arterial and collector roads.
- **Unpaved Roads:** Unpaved roads are roads that have not been covered with a hard, flat surface like asphalt or concrete. They are often found in rural areas and can be made of gravel, dirt, or other natural materials
- **Sidewalks:** Sidewalks are paved paths for pedestrians located alongside roads. They are designed to provide a safe walking space separate from vehicular traffic.
- **Guiderails:** Guiderails, also known as guardrails, are systems designed to guide vehicles back onto the roadway and away from hazardous situations. They are commonly found along roads and bridges to enhance safety.

In the 2022 Asset Management Plan, core road network assets were meticulously documented to ensure a comprehensive understanding of the infrastructure. By 2024, field data for paved roadways was collected and analyzed using established procedures and presented in this report, incorporating the latest field data and complying with Ontario Regulation 588/17. By adhering to these guidelines and regulations, the municipality ensures that its road network is evaluated consistently and accurately, facilitating informed decision-making for maintenance and improvements. This proactive approach helps in maintaining the quality and safety of the roadways, ultimately benefiting the community by providing reliable and well-maintained infrastructure. This report supports the development of the City's 2025 AMP, focusing on road network assets within the Core Assets category.

## 1.2.2. State of Infrastructure

### 1.2.2.1. Road Network

The following information regarding road network asset data is compiled from various incomplete databases, professional expertise, and third-party reports (such as the pavement condition evaluation report).

#### 1.2.2.1.1. Inventory

The road network that serves the City of Owen Sound consists of various types of arterial, collector, and local roadways as well as other associated asset components such as curbs, guiderails, and sidewalks. These components have been identified in the next Table.

**Table 1.2.1: Road Network Inventory**

| Asset Type | Asset Component | Quantity (km) | Lane (km) |
|---|---|---|---|
| **Road Network** | Arterial | 27.0 km | 69.5 km |
| | Collector | 20.9 km | 42.3 km |
| | Local | 69.6 km | 138.1 km |
| | Unpaved | 2.6 km | |
| | **Total Roads** | **120.1 km** | **249.9 km** |
| | | | |
| | Sidewalks | 106.6 km | |
| | | | |
| | Guiderail | 6.8 km | |
| | **Total Other Road Network** | **113.4 km** | |
| | | | |
| | **Total Road Network** | **233.5km** | |

#### 1.2.2.1.2. Current Replacement Cost

The replacement cost for the road network was estimated using current standards, historical tender pricing, and current market replacement values.

The estimated replacement value of the road network and associated components, based upon current dollar value (2025) is $130.1 million. The following table and associated Figure provide a breakdown of the contribution of each of the network components to the overall system value.

**Table 1.2.2: Road Network Replacement Value**

| Asset Type | Asset Component | Quantity (km) | Lane (km) | Replacement Value $ (2025) |
|---|---|---|---|---|
| **Road Network** | Arterial | 27.0 km | 69.5 km | 32,866,455 |
| | Collector | 20.9 km | 42.3 km | 18,520,196 |
| | Local | 69.6 km | 138.1 km | 54,493,922 |
| | Unpaved | 2.6 km | | 1,422,923 |
| | **Total Roads** | **120.1 km** | **249.9 km** | 107,303,494 |
| | | | | |
| | Sidewalks | 106.6 km | | 21,560,305 |
| | | | | |
| | Guiderail | 6.8 km | | 1,265,789 |
| | **Total Other Road Network** | **113.4 km** | | 22,826,094 |
| | | | | |
| | **Total Road Network** | **233.5 km** | | 130,129,589 |

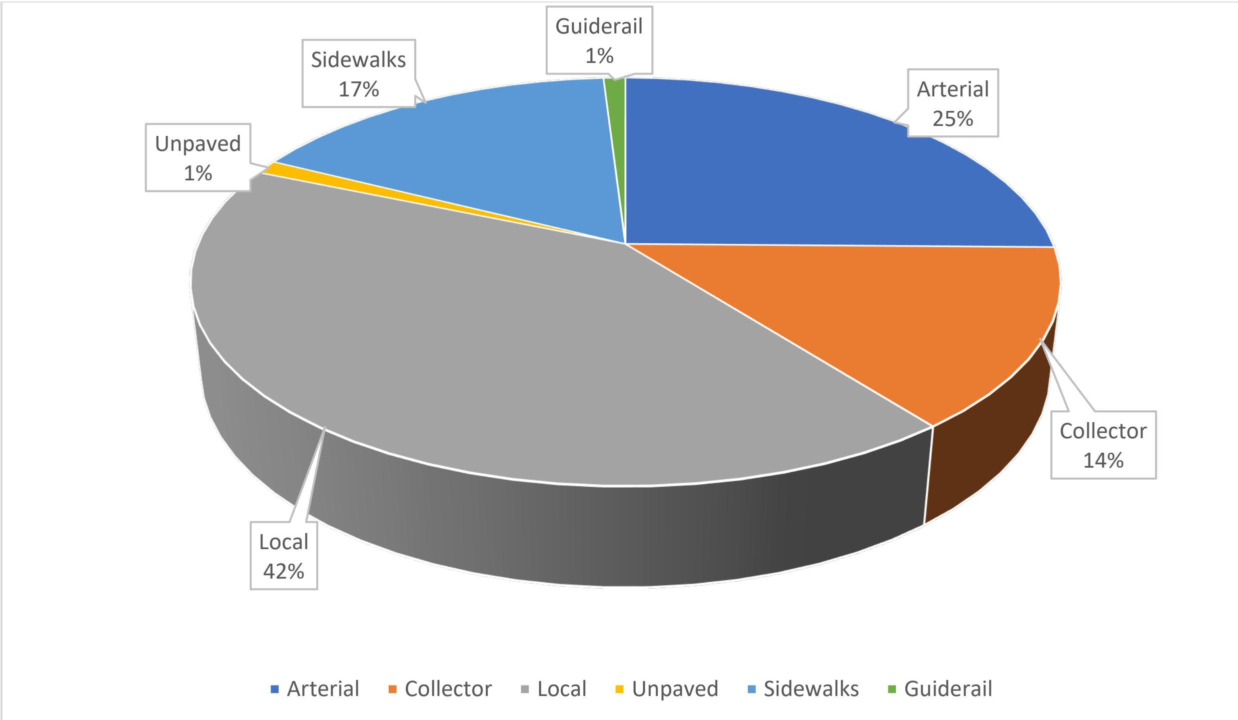



**Figure 1.2.1: Breakdown of Road Network Components by Replacement Value**

If the total asset value for the City's road network ($130.1 million) is translated to an average value per household assuming 10,140 dwellings, then the average household would have an investment of approximately $12,833 in road network assets.

#### 1.2.2.1.3. Average Age

The generalized values used for the typical expected useful life of the road network assets are summarized in the Table below. It should be recognized that the actual asset life is influenced by many variables such as installation, traffic patterns, local weather conditions, etc., and may be greater than the expected useful life in favourable conditions. City staff will continue to refine the asset's expected useful life as more specific data becomes available.

**Table 1.2.3: Road Network Useful Life and Age**

| Asset Type | Asset Component | Average Estimated Useful Life (EUL) | Average Age |
|---|---|---|---|
| **Road Network** | Arterial | 40 years | 24.8 years |
| | Collector | 40 years | 28 years |
| | Local | 60 years[3] | 34.7 years |
| | Unpaved | 50 years | 30 years |
| | | | |
| | Sidewalks | 40 years | 40.3 years |
| | Guiderail | 40 years | 30 years |

### 1.2.2.1.4. Condition

To determine pavement and road condition, the City relies on regularly completed municipal road network studies, which produce a Pavement Condition Index (PCI) score. This score provides a standardized measure of the overall condition of each road segment. For other road network assets (sidewalks and guiderails), an age-based condition[4] approach has been applied. The following Table outlines the road condition rating ranges.

**Table 1.2.4: Pavement Condition Index Scoring Criteria**

| Condition | PCI |
|---|---|
| Excellent | 80.0 – 100 |
| Good | 65.0 -79.9 |
| Fair | 45.0 – 64.9 |
| Poor | 40.0 – 44.9 |
| Very Poor | 0 – 39.9 |

Road condition is primarily assessed using PCI, supported by asset age, and remaining useful life. Arterial, collector, and local roads show varying performance levels, with most segments falling within the fair condition range. This indicates that while the network remains serviceable, many road sections are approaching the threshold for major maintenance or rehabilitation. Guiderails and sidewalks are evaluated using an age-based

[3] Local roads have a substantially higher EUL than arterial or local due to lack of heavy truck traffic which puts significant pressure on the road network and leads to faster deterioration. It is worth noting that within this 60-year lifespan, the road will have to be resurfaced one or two times, but not completed replaced.

4 The age-based condition assessment approach estimates the condition of assets such as sidewalks and guiderails based on their installation date, expected service life, and deterioration curves. This method assumes a predictable decline in condition over time, allowing for condition ratings to be assigned in the absence of detailed physical inspections.

approach, due to limited inspection data. Their condition ratings are estimated by comparing average age against expected useful life. Future condition validation through field assessments is recommended to improve accuracy. The Table below summarizes the condition of road network assets.

**Table 1.2.5: Road Network Condition Analysis**

| Asset Type | Asset Component | Average Age | Average PCI | Condition |
|---|---|---|---|---|
| **Road Network** | Arterial | 24.8 years | 67.7 | Good (near the transition to fair) |
| | Collector | 28 years | 62.7 | Fair |
| | Local | 34.7 years | 55.5 | Fair |
| | Unpaved | 30 years | - | Fair |
| | Sidewalk | 40.3 years | - | Very Poor |
| | Guiderail | 30 years | - | Poor |

The following Table and associated Figure outline the condition of each component in the road network based on current replacement cost.

**Table 1.2.6: Road Network Condition by Replacement Value**

| Asset Type | Asset Component | Excellent $ | Good $ | Fair $ | Poor $ | Very Poor $ |
|---|---|---|---|---|---|---|
| **Road Network** | Arterial | 8,619,255 | 10,723,057 | 8,135,342 | 768,777 | 4,620,024 |
| | Collector | 5,307,984 | 3,459,158 | 5,829,263 | 1,786,517 | 2,137,274 |
| | Local | 8,762,748 | 8,428,353 | 17,154,161 | 3,969,070 | 16,179,590 |
| | Unpaved | - | 889,327 | 355,731 | - | 177,865 |
| | **Total Roads** | 22,689,987 | 23,499,894 | 31,474,497 | 6,524,364 | 23,114,753 |
| | | | | | | |
| | Sidewalks | - | 1,569,840 | 3,141,060 | 2,335,273 | 14,514,133 |
| | Guiderail | - | 19,836 | 755,305 | 201,758 | 288,890 |
| | **Total Other Road Network** | | 1,589,676 | 3,896,365 | 2,537,031 | 14,803,023 |
| | | | | | | |
| | **Total Road Network** | 22,689,987 | 25,089,571 | 35,370,862 | 9,061,394 | 37,917,776 |

Based on the above criteria, nearly 37% of the City's road network is in *good* or *excellent* condition (representing approximately $47.7 million) and about

36% is in *poor* or *very poor* condition (representing approximately $47million).

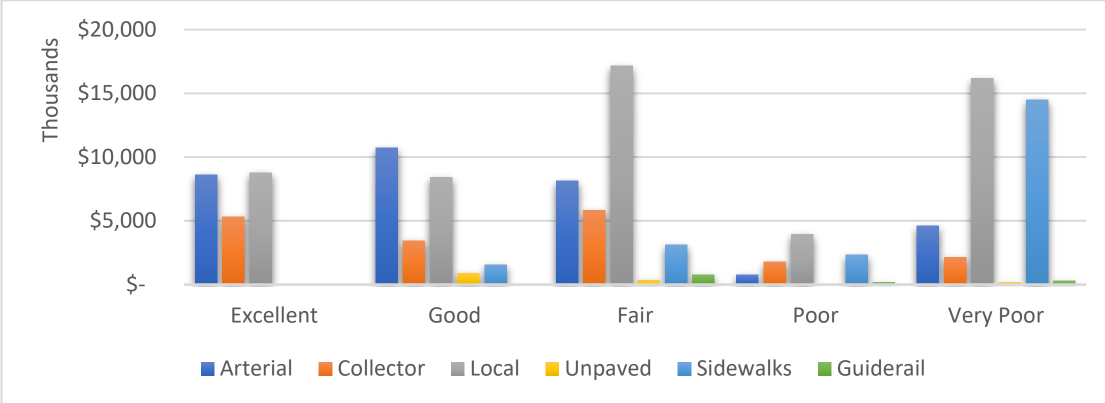



**Figure 1.2.2: Breakdown of Road Network Component Conditions by Replacement Value**

## 1.2.3. Levels of Service (LOS)

### 1.2.3.1. Overview

The goal of every asset manager should be to move away from reactive and "worst first" planning to maintenance of assets in a "state of good repair." This is the most economical way to manage assets and provide higher levels of service. The path to get there requires a long-term strategy and customer buy-in to assure change.

Levels of service (LoS) describe what people (residents, users of assets, etc.) experience from a municipality's infrastructure. Levels of service can be qualitative in nature (based on customer values) and describe what is important to users of the service and how users feel about the services, or they can be quantitative in nature (based on specific data, measurables, and metrics).

For the purposes of this AMP, the LoS metrics are focused on the scope and reliability of the service. They will address community levels of service (qualitative) and technical levels of service or technical metrics (quantitative). The levels of service discussed in this plan will only be based on *current* levels of service. For future iterations of the City's AMP, *proposed* levels of service may be considered.

## 1.2.3.2. Scope

The following map illustrates the City's road network infrastructure.

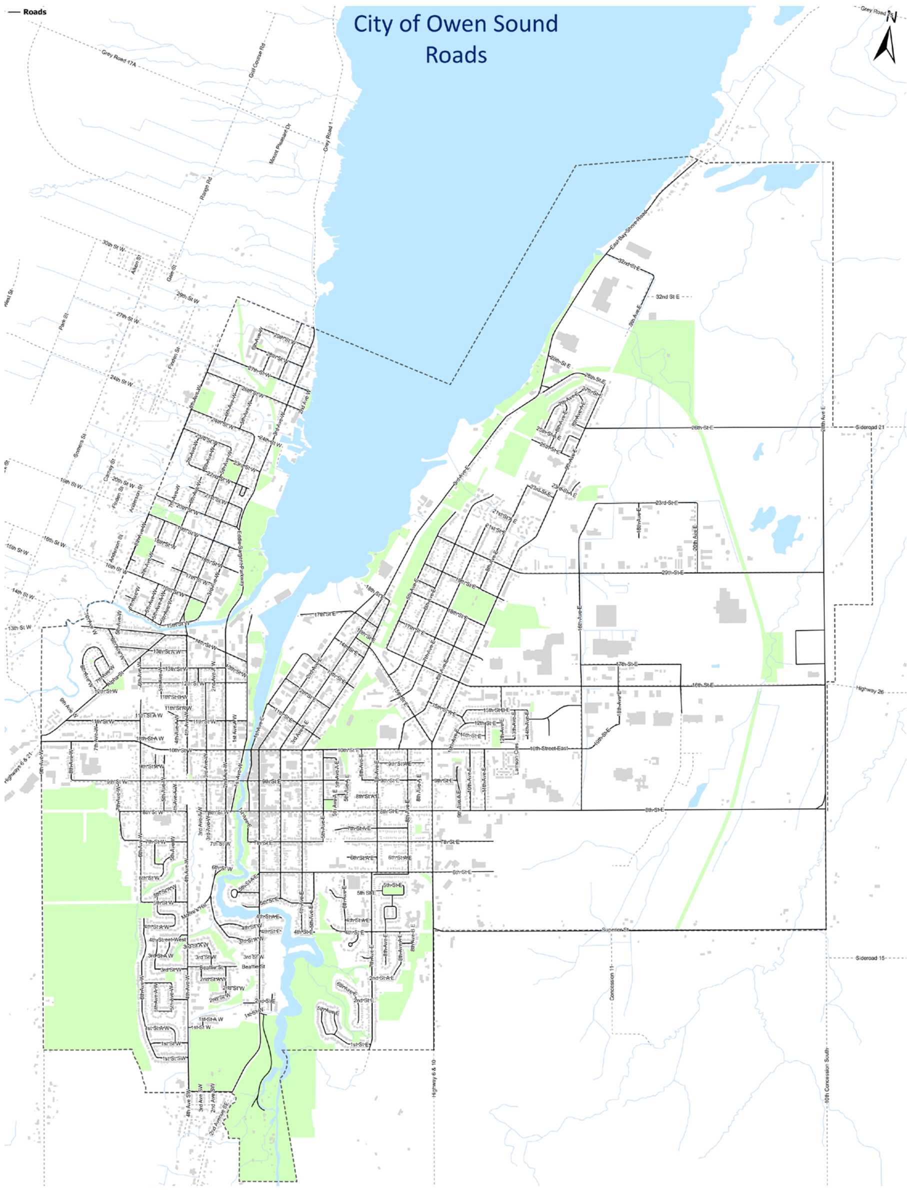



**Figure 1.2.3: Overview of the City's Road Network**[5]

## 1.2.3.3. Community Levels of Service

The Customer LOS for the City of Owen Sound focuses on how well the road network supports public needs expectations, and accessibility. This includes evaluating the connectivity of the network across all land use areas, the

[5] This is an image for illustrative purposes.

availability, and surface type of roads, and the extent to which residents are satisfied with the infrastructure provided. The network spans 681 road segments totaling 120.1 km, designed to ensure safe, efficient movement for people, goods and services.

Accessibility remains high throughout all zones and the City strives to maintain this standard while continuing to reduce its reliance on gravel roads and increase pavement quality. Customer feedback (the information can be found in City-wide public survey analysis section in the Non- Core Assets Executive Summary Report) generally reflects fair satisfaction with road quality, reliability and availability. The City aims to improve user experience through proactive communication, responsive maintenance, and transparent condition reporting.

### 1.2.3.4. Technical Levels of Service (Quantitative Metrics):

The Technical LOS addresses the measurable, data driven aspects of the road infrastructure performance in City. It encompasses quantitative indicators such as road density, pavement condition, ride quality, and financial investment in maintenance and renewal activities. Technical LOS helps assess how well the physical road assets are managed and maintained to ensure durability, safety and functionality over time.

#### 1.2.3.4.1. Methodology

The City retained StreetScan for the 2024 road condition assessment using automated digital data collection

The StreetScan technology utilizes digital instruments that collect data from a vehicle as it drives on the roads. The primary rating criteria is the Pavement Condition Index (PCI), and it is calculated based on the Distress Manifestation Index (DMI) and Ride Comfort Rating (RCR) determined for each road segment by the data collected and interpreted through AI and proprietary software.

#### 1.2.3.4.2. Calculating the Pavement Condition Index

The PCI is a numerical value between 0 and 100 where 0 is a failed surface and 100 is a new condition.

In the inventory and assessment of roads condition, only City roads including Provincial Connecting Links were assessed. County roads were not included.

A PCI rating of 80 to 100 is excellent, 65 to 79.9 is good, 45 to 64.9 is fair, 40 to 44.9 is poor and 0 to 39.9 is very poor.

The following Table presents expanded summary of Customer and Technical LOS for the municipal road network.

**Table 1.2.7: Customer and Technical LOS for Road Network**

| Customer Level of Service (Qualitative) | | | |
|---|---|---|---|
| **Attribute** | **Performance Measure** | **Current Performance**[6] | **Target LOS**[7] |
| Connectivity | Description of road network and connectivity | Designed for all users to travel safely and efficiently; connects neighbourhoods, business, and industrial zones. | Maintain higher connectivity with efficient and safe movement across all City zones |
| Inventory | Total length and surface types of the road network | 681 road segments; 120.1 km total (117.5 km asphalt, 2.6 km gravel) | Maintain or expand paved road coverage; reduce gravel proportion |
| Public satisfaction | Community feedback on road condition and maintenance | Generally scored as fair[8] in public feedback | Improve communication on maintenance schedules, increase visibility of completed repairs, and prioritize recurring complaint areas to enhance public satisfaction |
| **Technical Level of Service (Quantitative)** | | | |
| **Attribute** | **Performance Measure** | **Current Performance** | **Target LOS** |
| Condition Assessment Technology | Methods used to assess road condition | Automated digital assessment | Continue use of automated assessment methodology for accuracy and consistency |

[6] Most of the data is up to date based on the 2024 Pavement Condition Assessment Data; however, some portions still rely on information from the 2022 reporting period.
[7] Target Levels of Service (LOS) are intended to guide planning and investment decisions; however, they must be refined using the most current and accurate data. Until such refinements are made, the City's primary strategy remains the maintenance of existing LOS to ensure service continuity and stability.
[8] Refer to the 2025 Non-Core Asset Management Plan Executive Summary. The Customer Level of Service (LOS) was assessed through a survey conducted by the City. Both paved and unpaved roads were included in the survey, with participants rating their quality, reliability, and availability. Based on the survey data, road assets received an overall rating of "Fair."

| | | | |
|---|---|---|---|
| Arterial Road Composition | Lane-km as of % of land area (24.27 $km^2$ | 0.01002 (1%)[9] | Maintain existing density; adjust or only as per traffic demand |
| Collector Road Composition | Lane-km as of % of land area (24.27 $km^2$ | 0.00610 (0.61%) | Maintain or optimize coverage to balance neighbourhood access |
| Local Road Composition | Lane-km as of % of land area (24.27 $km^2$ | 0.019916 (1.99%) | Sustain or reduce proportion where overbuilt |
| Gravel Road Inventory | Total length of gravel roads in the network | 2.6 km | Maintain or reduce gravel proportion through capital upgrades |
| Paved Road Condition | Average PCI for paved roads | 58.8% (18% excellent, 20%, good, 31% fair, 8% poor, 22% very poor) | Maintain current level of service |
| Unpaved Road Condition | Average PCI[10] for gravel roads | 68.4% (38% excellent, 25%, good, 25% fair, 0% poor, 12% very poor) | Maintain current level of service |
| Proportion of Road Network in Excellent, Good, and Fair Condition | %of road assets in excellent, good, and fair condition | 37% in excellent /good; 64% including fair | Maintain current level of service |
| Load Restriction | Presence and type of seasonal load restrictions | No permanent or seasonal restrictions in place | Monitor network annually to determine if future restrictions may be warranted |
| Winter operations investment (as % of Replacement Value) | Winter maintenance spending as % of road network replacement value | 1.2% | Maintain current level or improve efficiency |
| Operation and maintenance (O&M) | O&M spending as % of road network replacement value | 2.8% | Maintain or reduce while preserving asset condition |

[9] Assumed width of roads is 3.5m or 0.0035km. Technical LoS metric calculated as: (69.5 x 0.0035) / 24.27. Similar assumptions and calculations apply to other two road types

[10] The data is based on 2022 reporting period. As of the publication of this report, compliance data for 2023 and 2024 is not yet fully verified. This value is therefore considered provisional and will be updated once more recent data becomes available.

| | | | |
|---|---|---|---|
| investment (as % of Replacement Value) | | | |

## 1.2.4. Asset Management Strategy

### 1.2.4.1. Overview

An asset management strategy is a set of planned actions that will enable the asset to provide the agreed upon levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost.

### 1.2.4.2. Risk Management

Risk management is essential to maintaining reliable, safe, and sustainable road networks. It helps ensure that potential service disruptions, environmental impacts, and financial losses are identified early and addressed before they escalate.

#### 1.2.4.2.1. Scoring Probability of Failure (PoF)

The Probability of Failure (PoF) represents the likelihood that a road asset will fail based on its current physical condition. PoF is assigned using a standardized 4-point scale, where assets in good condition receive a score of 1 and those in very poor condition receive a score of 4. This approach allows condition data to be translated into a consistent measure of failure risk across all asset types.

Also, PoF for road segments can be estimated based on the 2024 PCI, which provides a standardized score from 0 to 100. The table blow outlines how PCI ranges are translated into PoF ratings are translated into PoF ratings for asset management and risk prioritization purpose.

**Table 1.2.8: PCI - Based PoF**

| PCI Range | Condition Category | PoF |
|---|---|---|
| 75 - 100 | Excellent/Good | 1 |
| 50 - 74 | Fair | 2 |
| 25 - 49 | Poor | 3 |
| 0 - 24 | Very Poor | 4 |

#### 1.2.4.2.2. Scoring Consequence of Failure (CoF)

To understand the potential service impact of each road asset type, a Consequence of Failure (CoF) framework has been developed. This framework evaluates each asset class across four critical service impact categories:

- **Safety**: Failure (e.g., potholes, surface collapse) may pose collision or injury risks to drivers, cyclists, and pedestrians, especially in high-speed or school zones.
- **Service Disruption**: Poor or failed road sections can restrict mobility, delay emergency response, interrupt supply chains, and reroute traffic.
- **Financial impact:** High costs may arise from emergency repairs, claim from accidents, increased vehicle damage, or lost economic activity.
- **Environmental impact**: Eroded or poorly drained roads can lead to sediment runoff, habitat disturbance, or water contamination.

Once each asset type was scored across the four CoF categories, an average was calculated to produce a single CoF score per asset. This average serves as a concise representation of the asset's overall criticality and can be used in conjunction with condition-based Probability of Failure (PoF) scores to determine total risk. Overall, the CoF is developed based on the most readily available data. Risk assessment for road infrastructure in Owen Sound involves evaluating both the PoF and CoF across multiple criteria. To enhance decision-making, it is recommended that CoF be customized based on the asset's location, context, and function. For example, guiderails installed alongside bridges or steep embankments should be assigned higher CoF rating due to their role in preventing serious accidents. Similarly, arterial roads critical to emergency services or regional connectivity warrant elevated CoF scores due to their broader impact.

#### 1.2.4.2.3. Risk Matrix

A risk-based prioritization matrix was developed by calculating a risk score for each asset using a combination of PoF and CoF. PoF was determined based on asset condition using a standardized 1- 4 scale. CoF was assessed using multiple weighted criteria, including safety, service disruption, financial impact, and environmental impact, each scored from 1 to 4 and averaged to represent overall consequences. Once risk score was calculated, it was used to extract and aggregate the replacement value of assets falling within each risk level. This enabled the development of a color-coded 4×4 risk matrix, where the total replacement cost exposure is visualized by risk category. Each cell in the matrix represents a unique risk score calculated as PoF×CoF, with color-coding to highlight priority levels.

- **Green (Low Risk):** Minimal consequence and/or low likelihood of failure.
- **Yellow (Moderate Risk):** Manageable risk requiring routine monitoring.
- **Orange (High Risk):** Significant risk needing planned intervention.
- **Red (Very High Risk):** Critical assets with high replacement costs and failure impacts; prioritized for renewal.

An estimated risk matrix for the City's road network assets can be seen in Figure below.

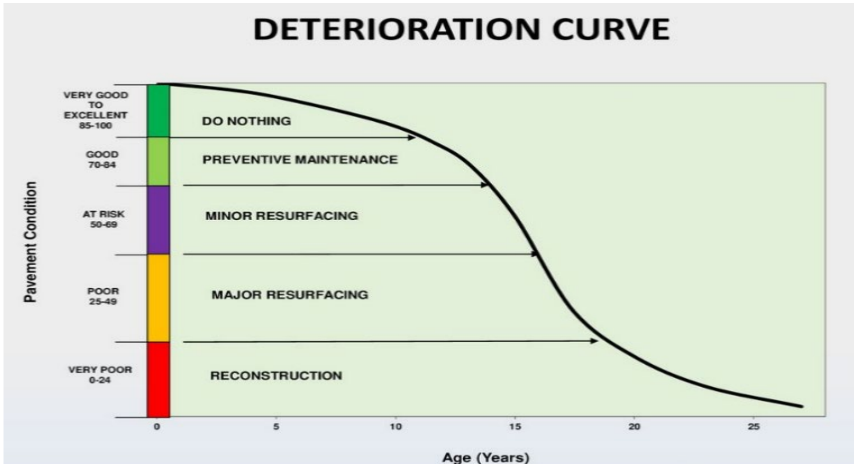
| PoF \ CoF | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 4 | | $ 14,803,023 | | |
| 3 | | $ 27,072,094 | $ 5,126,025 | $ 6,327,654 |
| 2 | $ 1,422,923 | $ 23,001,860 | $ 7,005,252 | $ 14,677,801 |
| 1 | | $ 12,443,039 | $ 6,388,919 | $ 11,861,000 |

**Figure 1.2.4: Replacement Value based Risk Matrix for Road Network**

The matrix helps to visually identify high-value assets with deteriorating conditions which pose a greater risk to service, cost, and compliance. Through the visualized information, the matrix supports data driven investment decisions.

## 1.2.5. Lifecycle Activities

Pavement deterioration is non-linear such that initially in the first five to eight years of service the rate of deterioration is slow. At mid service life the rate of deterioration increases and near the end of its service life, the rate of deterioration is quite rapid, as shown in the next figure.



[11]

**Figure 1.2.5: Road Deterioration Curve**

During a road's lifecycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows of work activity generally coincide with the assets condition.

A summary of available lifecycle work activities that could be undertaken to maintain the current levels of service for the road network, along with an estimate of associated costs, are provided in the next Tables[12].

**Table 1.2.9: Road Network Lifecycle Activities – Minor Maintenance**

| Asset Component | Minor Maintenance Activity Options | Approximate Cost |
|---|---|---|
| Asphalt Surfaces | - Pavement Condition Assessments of entire road network once every 5 years. | - $125/centerline km |
| Sidewalks | - Sidewalk Inspection Program legislatively required once per year | - $100/km |

[11] https://slideplayer.com/slide/16535156/

[12] The cost estimations presented are approximate and based on 2022 data. As many of the recommended lifecycle activities have not yet been undertaken, the estimates reflect available information at the time of analysis and may be subject to change as more accurate data becomes available.

**Table 1.2.10: Road Network Lifecycle Activities – Major Maintenance**

| Asset Component | Major Maintenance Activity Options | Approximate Cost |
|---|---|---|
| Asphalt Surfaces | - Pothole repairs<br>- Crack Sealing | - $75 to $125 /location (depending on size)<br>- $1.25/$m^2$ |
| Gravel Surfaces | - Grading and leveling<br>- Dust Control | - $150 to $175 per hour<br>- $1,800 to $2,000 per centerline km |
| Sidewalks | - Grind down elevated edges | - $10/$m^2$ |

**Table 1.2.11: Road Network Lifecycle Activities – Rehabilitation**

| Asset Component | Rehabilitation Activity Options | Approximate Cost |
|---|---|---|
| Pavement Surfaces | - **Fog Seal**; light application of slow setting asphalt emulsion diluted with water. It is used to renew old asphalt surfaces and to seal small cracks and surface voids<br>- **Microsurfacing**; a mixture of polymer modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives, properly proportioned, mixed and spread on a paved surface<br>- **Resurfacing**; a process of removing pavement material from the surface of the pavement either to prepare the surface (by removing rutting and surface irregularities) to receive overlays, to restore pavement cross slopes and profile, or even to re-establish the pavement's surface friction characteristics<br>- **Slurry Seal Coating**; a mixture of slow setting emulsified asphalt, well graded fine aggregate, mineral filler, and water. It is used to fill cracks and seal areas of old pavements, to restore a uniform surface texture, to seal the surface to prevent moisture and air intrusion into the pavement, and to provide skid resistance<br>- **Thin Overlay**; An overlay course consisting of a mix of asphalt cement and a well graded (also called dense-graded) aggregate. A well | - $1.50/$m^2$<br>- $5.00/$m^2$<br>- $8.00/$m^2$<br>- $4.00/$m^2$<br>- $6.00/$m^2$ |

| | | |
|---|---|---|
| | graded aggregate is uniformly distributed throughout the full range of sieve sizes | |
| Gravel Surfaces | - Ditching and drainage improvements<br>- Application of new gravel surface course | - $20 to $250 per hour<br>- $8 to $10 per tonne |
| Sidewalks | - Panel Replacement | - $150 to $200/m$^2$ (premium paid due to limited quantity) |

**Table 1.2.12: Road Network Lifecycle Activities – Replacement Maintenance**

| Asset Component | Replacement Activity Options | Approximate Cost |
|---|---|---|
| Pavement Surfaces | - Road replacement including excavation, Gran. A & B and asphalt base and surface coats | - $135 to $150/m$^2$ (depending on road class) |
| Sidewalks | - Replacement of sections of sidewalk panels | - $100 to $140/m$^2$ |
| Guiderails | - Deficiencies typically addressed through replacement | - $90 to $170/m (depending on type) |

There are many risks associated with lifecycle activities of assets. When developing a standard timeframe for when maintenance should occur, the municipality must balance the cost of doing frequent maintenance versus the risks of waiting long periods of time between maintenance activities.

The City is working toward implementing the above-mentioned lifecycle activities to help prevent the deterioration and structural compromise of the road network. Without these efforts, there would be a significant risk of service reductions, including potential road closures and traffic detours. Such disruptions would not only inconvenience residents and road users but could also negatively impact the City's reputation and perceived reliability.

As previously mentioned, performing lifecycle activities (such as repairs, maintenance, etc.) and investing funds on a regular basis is the most cost-effective way to manage an asset throughout its lifecycle. Although the municipality has to put funds into an asset on more occasions, the sum of the funds is less than if the municipality puts funds into the asset one time when the asset has deteriorated to such a level that it is incredibly costly to restore it to a useable condition. Therefore, it is important to perform the lifecycle activities mentioned above on a predetermined, recurring schedule. The costs of performing these lifecycle activities should be considered in terms of staff time and budgetary dollars required. In order to ensure the lifecycle activities are performed at the lowest cost, the City should make note of best practices, issue well-developed request for proposals (RFPs) to obtain competitive bids from third-parties, and stay up to date on the current and expected industry trends/standards.

## 1.2.6. Financial Strategy

### 1.2.6.1. Funding vs. Need

The Figure below plots on a timeline, the expected replacement (capital) and operating costs in current year dollars for all road assets including sidewalks, and guiderails[13]. The orange bar represents the average annual capital spending required to meet all current and future financial obligations while the green bar represents the average annual operating spending. The blue horizontal line represents the estimated average budgeted spending[14]. It should be noted that in general, operating requirements for the road network are fully covered based on the average operating budget. The average annual deficit for the road network is based on capital shortfalls.

The total average annual funding deficit for the road network is $1,642,619. The average annual requirement is $7,000,000[15] and current average spending is $ 5,317,235, giving a funding vs. need ratio of approximately 76.4%.

[13] Curbs have been excluded from the financial analysis.
[14] Average budgeted spending includes both capital and operating budget. Based on an average of the five-year capital budget and two-year operating budget.
[15] Average annual requirement (capital) is calculated based on the average of the upcoming 10-year actual anticipated requirement. Where insufficient or unreliable data exists, the average annual requirement (capital) is calculated by taking the CRC for each asset component divided by the years of life remaining (EUL – average age).

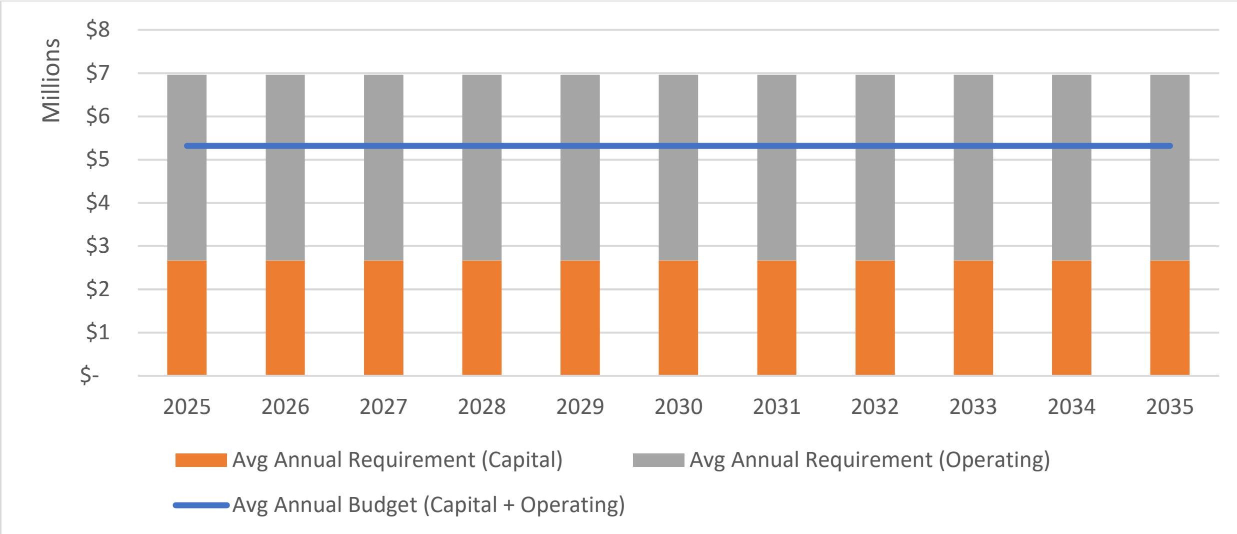



**Figure 1.2.6: Road Network Funding Requirement - Summary**

The Figure below shows the actual annual anticipated requirement[16] as well as the backlog requirement for assets that are at or beyond their estimated useful life.

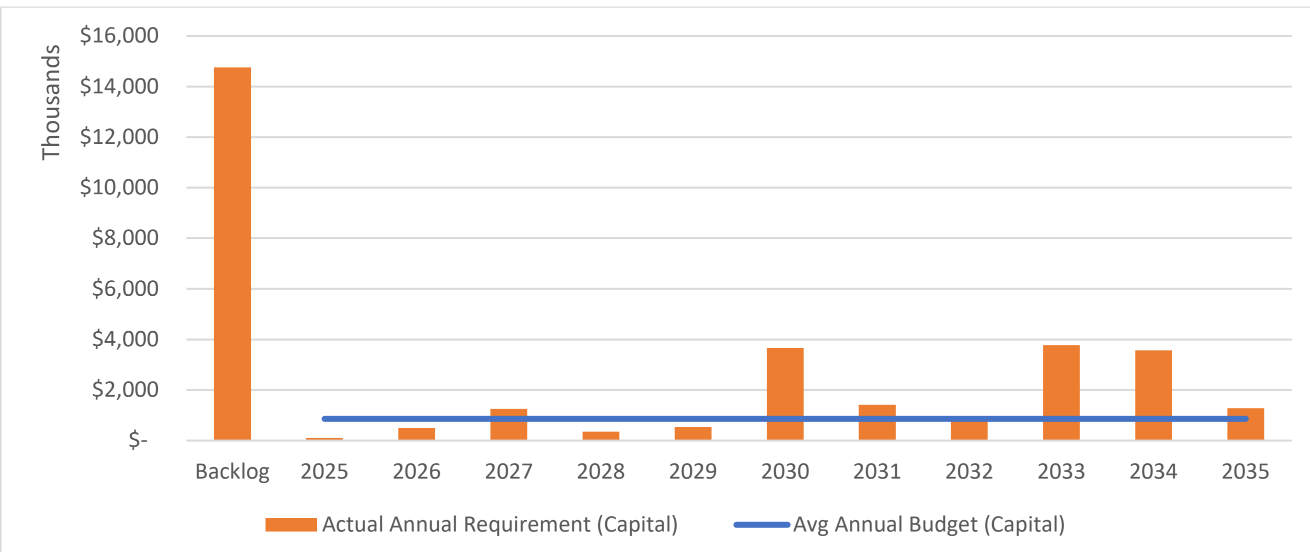



**Figure 1.2.7: Road Network Funding Requirement – Actual Annual Requirement**[17]

## 1.2.7. Improvement Plan and Recommendations

The following recommendations for the next 10-Year are based on the review of current management practices, developed LOS , inventory,

[16] Only depicts capital requirement and budget. Does not include operating data.
[17] A significant portion of the backlog is comprised of curbs and sidewalks that are at or beyond their EUL; however, asset age data should be supplemented by condition assessments to determine if the asset does need to be renewed.

valuation and condition analysis. Their achievement is contingent upon the development of a more accurate and informed Level of Service (LOS) framework. Until such a framework is in place, the City's primary strategy remains the maintenance of current service performance levels.

**Table 1.2.13: Asset Management Planning Recommendations – Road Network**

| Category | Identified Issue / Gap | Strategic Recommendation | Rationale/ Explanation | Expected Outcome by 2035 |
|---|---|---|---|---|
| Road Condition (Paved) | 30% of paved roads are in poor or very poor condition; PCI average is 58.8 | Rehabilitation of roads with PCI< 50; Preservation treatments for fair roads | Preventive rehab is more cost – effective than full reconstruction. Prioritization of arterial and collector roads. | PCI average ≥70%; <10% in poor/very poor |
| Road Condition (Unpaved) | 12% of gravel roads are very poor; Overall PCI is 68.4[18] | Targeted grading, drainage upgrades; convert high-use gravel to asphalt where feasible | Reduce maintenance, increase reliability, improve LOS. | Reduce very poor to <5%; PCI average ≥ 70 |
| Condition Category Coverage | 37% in excellent/ good; 64% including fair | Target mid-condition roads for resurfacing to prevent escalation | Prevents decline into poor/very poor, keeps lifecycle cost down. | ≥50% excellent/ good; 75% excellent/ good/fair |
| Gravel road inventory | 2.6 km of gravel roads | Upgrade gravel roads to asphalt where justified (traffic, safety) | Enhances accessibility and reduces maintenance demands. | Maintain or reduce gravel road to ≤ 2.6 km through targeted upgrades. |
| Winter Operation | Cost at 1.2 % of asset value | Optimize routing, plow timing, salt use through GIS and performance data | Balance cost-efficiency with service quality and environmental impact. | Maintain service while minimizing resource use. |
| Preventive Maintenance | About 20 % of network covered per year | Increase budget and plan to cover 25% annually | Preventive work delays deterioration and lowers overall lifecycle costs. | ≥ 25% coverage per year. |

[18] The cost estimations presented are approximate and based on 2022 data. As many of the recommended lifecycle activities have not yet been undertaken, the estimates reflect available information at the time of analysis and may be subject to change as more accurate data becomes available.

| | | | | |
|---|---|---|---|---|
| Lifecycle Analysis | Generally no predictive maintenance strategy | Develop and implement a predictive maintenance framework using PCI trends and risk indicators. | Shift asset management from reactive to proactive improving long-term cost efficiency | Predictive model in place; optimized asset lifecycles and timely interventions |
| Public Satisfaction | Fair score for availability, reliability and quality | Improve visibility of repairs and project transparency in high-use areas | Public trust improves with visible, timely action even on minor repairs | Positive shift in public perception |
| Load Restrictions | None in place currently | Monitor annually; maintain open access unless conditions require restriction | Proactive monitoring avoids reactive closures. | Maintain open access unless required. |
| Data & Technology | IRISGO used biennially; data underutilized | Integrate PCI, RCR, complaints, and costs into GIS-based dashboards | Enables real-time, data-driven planning and reporting. | Digital lifecycle dashboard with GIS. |
| Risk Integration (CoF) | CoF not tailored to location or asset type | Assign higher CoF to high – risk contexts (e.g., guiderails near bridges, arterial routes) | More accurate prioritization using asset specific criticality. | CoF integration in decision tools. |

owen sound
where you *want* to live

# 2025

## Asset Management Plan

# Bridges & Culverts

# 1.3. Bridges and Culverts

## 1.3.1. Introduction

The City's Bridge and Culvert asset components are broken out into 3 asset classes:

- **Bridges (Vehicular):** As defined under Ontario Regulation 104/97 and governed by the Canadian Highway Bridge Design Code (CHBDC), a vehicular bridge is a structure that carries a roadway or pathway for vehicular traffic over an obstacle such as a river, railway, or another road. These structures must comply with the CHBDC (CAN/CSA-S6) and are subject to inspection in accordance with the Ontario Structure Inspection Manual (OSIM). Vehicular bridges are classified as core municipal infrastructure assets under Ontario Regulation 588/17.[19]
- **Pedestrian Bridges:** A pedestrian bridge is a structure designed to carry foot traffic (and sometimes cyclists) over obstacles such as roads, railways, or bodies of water. While not explicitly defined in Ontario Regulation 104/97, these structures are typically designed in accordance with the Canadian Highway Bridge Design Code (CHBDC, CAN/CSA-S6) and may be subject to inspection under the Ontario Structure Inspection Manual (OSIM) if owned and maintained by a municipality or public agency.
- **Culverts:** A culvert is a structure that allows water to flow under a road, railway, trail, or similar obstruction. It is typically embedded in soil and constructed from materials such as concrete, steel, or plastic. Culverts are used to manage stormwater and maintain natural drainage patterns. In Ontario, culverts are considered core municipal infrastructure assets under Ontario Regulation 588/17 when they are part of a municipality's road or stormwater system. Their design and placement must follow environmental and engineering standards, including those outlined in the Ontario Structure Inspection Manual (OSIM) and Environmental Guidelines for Access Roads and Water Crossings.[20]

The Asset Management Plan (AMP) for core assets was previously addressed in the City of Owen Sound's 2022 AMP. This report supports the

[19] O. Reg. 104/97 STANDARDS FOR BRIDGES | ontario.ca
[20] Environmental guidelines for access roads and water crossings | ontario.ca

development of the City's 2025 AMP, focusing on Bridges and Culverts within the Core Assets category.

## 1.3.2. State of Infrastructure

### 1.3.2.1. Bridges/Culverts

The following information regarding bridge network asset data is compiled from various incomplete databases, professional expertise, and third-party reports (such as the bridge and culvert inspection 2022 OSIM Report[21]).

#### 1.3.2.1.1 Inventory

The bridge network that serves the City of Owen Sound consists of various types of bridge structures and culverts. These components have been identified in the Table below.

**Table 1.3.1: Bridge Network Inventory**

| Asset Type | Asset Component | Quantity ($m^2$) | Count (units) |
|---|---|---|---|
| **Bridge Network** | Bridges (Vehicular) | 1,763.6 $m^2$ | 4 units |
| | Pedestrian Bridges | 375.8 $m^2$ | 7 units |
| | Culverts | 1,329.8 $m^2$ | 16 units |
| | **Total** | **3,469.2 $m^2$** | **27 units** |

#### 1.3.2.1.2. Current Replacement Cost

The replacement cost for the bridge network was estimated using current standards, historical tender pricing, and current market replacement values. The estimated replacement value of the bridge network and associated components, based upon current dollar value (2025) is $35.5 million. The following table and associated Figure provide a breakdown of the contribution of each of the network components to the overall system value.

**Table 1.3.2: Bridge Network Replacement Value**

| Asset Type | Asset Component | Count (units) | Replacement Value $ (2025) |
|---|---|---|---|
| **Bridge Network** | Bridges (Vehicular) | 4 units | 22,146,835 |
| | Pedestrian Bridges | 7 units | 2,660,237 |
| | Culverts | 16 units | 10,746,555 |
| | **Total Bridge Network** | **27 units** | 35,553,627 |

[21] The 2025 AMP references the 2022 OSIM report, as the latest version (2024) is not yet available.

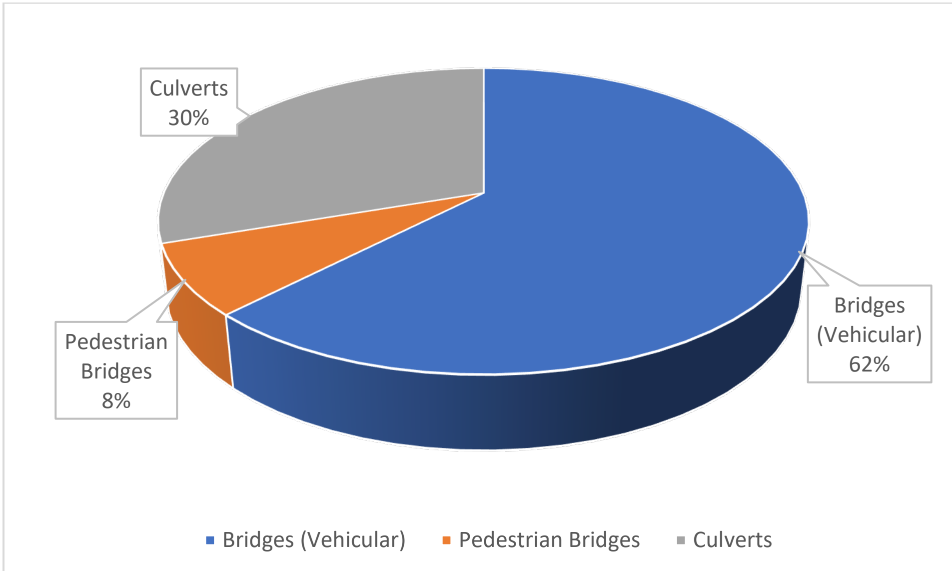



**Figure 1.3.1: Breakdown of Bridge Network Components by Replacement Value**

If the total asset value for the City's bridge network ($35.5 million) is translated to an average value per household assuming 10,140 properties, then the average household would have an investment of approximately $3,506 in bridge network assets.

#### 1.3.2.1.3. Average Age

The generalized values used for typical expected useful life of the bridge network assets are summarized in the Table below. It should be recognized that the actual asset life is influenced by many variables such as material, installation, traffic patterns, local weather conditions, etc., and may be greater than the expected useful life in favourable conditions. City staff will continue to refine the asset's expected useful life as more specific data becomes available.

**Table 1.3.3: Bridge Network Useful Life and Age**

| Asset Type | Asset Component | Average Estimated Useful Life (EUL) | Average Age |
|---|---|---|---|
| Bridge Network | Bridges (Vehicular) | 80 years | 20.7 years |
| | Pedestrian Bridges | 80 years | 50.4 years |
| | Culverts | 60 years | 46 years |

#### 1.3.2.1.4. Condition

To determine bridge/culvert conditions, the City relies on regularly completed bridge and culvert studies, which produce a Bridge Condition Index (BCI) score. This score helps to determine the overall condition of each bridge/culvert.

The following Table outlines the bridge network condition rating ranges.

**Table 1.3.4: Bridge Condition Index Scoring Criteria**

| Condition | BCI |
|---|---|
| Excellent | 80.0 – 100 |
| Good | 65.0 -79.9 |
| Fair | 45.0 – 64.9 |
| Poor | 40.0 – 44.9 |
| Very Poor | 0 – 39.9 |

The next Table below outlines the condition of each component in the bridge network based on current replacement cost.

**Table 1.3.5: Bridge Network Condition by Replacement Value**

| Asset Type | Asset Component | Excellent $ | Good $ | Fair $ | Poor $ | Very Poor $ |
|---|---|---|---|---|---|---|
| **Bridge Network** | Bridges (Vehicular) | 22,146,835 | - | - | - | - |
| | Pedestrian Bridges | 1,286,331 | 1,373,906 | - | - | - |
| | Culverts | 1,140,028 | 6,908,168 | 968,483 | 596,544 | 1,133,331 |
| | **Total Bridge Network** | 24,573,194 | 8,282,075 | 968,483 | 596,544 | 1,133,331 |

Based on the above criteria, over 92% of the City’s bridge network is in *good* or *excellent* condition (representing approximately $33 million) and only about 5% is in *poor* or *very poor* condition (representing approximately $1.7 million). The following Figure shows the total bridge network condition distribution by replacement value.

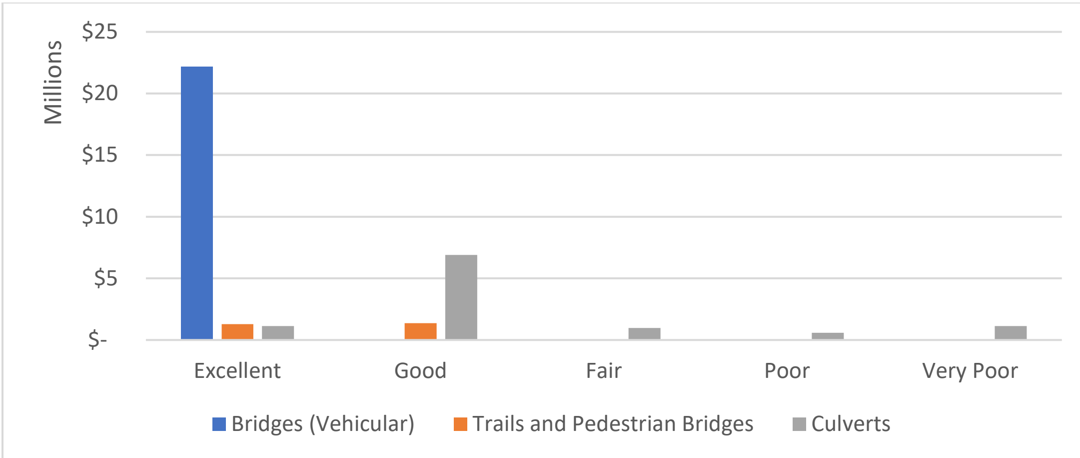



**Figure 1.3.2: Breakdown of Bridge Network Component Conditions by Replacement Value**

# 1.3.3. Level of Service (LOS)

## 1.3.3.1. Scope

The following Figure illustrates the City's Bridges and Culverts infrastructure.

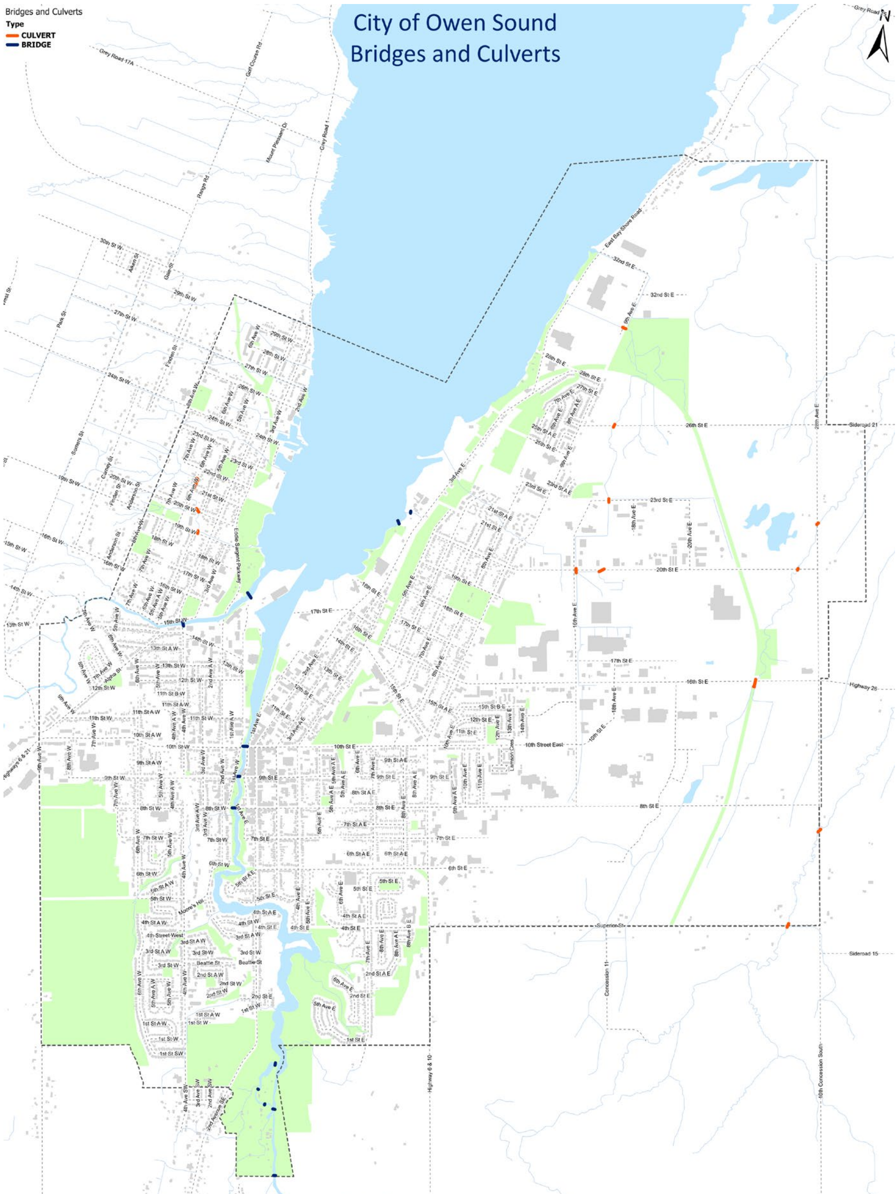



**Figure 1.3.3: Overview of the City's Bridge Network**[22]

22 This is an image for illustrative purposes.

### 1.3.3.2. Community Levels of Service

The Community LOS describes how the community experiences municipal infrastructure in terms of accessibility, reliability, safety and quality. These are typically expressed in qualitative terms such as how well infrastructure supports different users (e.g., vehicles, pedestrians), and where its condition affects usability or public satisfaction.

### 1.3.3.3. Technical Levels of Service (Quantitative Metrics)

Technical LOS are quantitative measures used to assess the performance and condition of infrastructure assets. These metrics typically include data such as structural condition rating (Bridge Condition Index), traffic volume, and load restrictions. Technical LOS provides objective insights to support maintenance planning, risk management, and long-term capital investment.

The next Table presents an expanded summary of Customer and Technical LOS for the municipal bridges and culverts.

**Table 1.3.6: Customer and Technical LOS for Bridges and Culverts**

| Customer Level of Service (Qualitative) | | | |
|---|---|---|---|
| **Attribute** | **Performance Measure** | **Current Performance[23]** | **Target LOS[24]** |
| Scope | Description of traffic supported by bridges (e.g., heavy transport, emergency Vehicles, pedestrians) | All City bridges support all traffic types (no loading/ dimensional restriction) | Maintain support for all traffic types on all bridges. |
| Scope | Description of traffic supported by culverts | Most culverts support all traffic types; one culvert has a load restriction affecting large vehicles. | Eliminate load-restricted culvert where feasible to ensure full access. |
| Scope | Traffic volume and user types on key bridges | The City's busiest bridge supports an AADT[25] of 33,076 primarily regular motor vehicle | Maintain ability to support current and projected AADT levels without restriction. |
| **Technical Level of Service (Quantitative)** | | | |

23 Most of the data is up to date based on the 2024 Bridge Condition Assessment Data; however, some portions still rely on information from the 2022 reporting period.
24 Target Levels of Service (LOS) are intended to guide planning and investment decisions; however, they must be refined using the most current and accurate data. Until such refinements are made, the City's primary strategy remains the maintenance of existing LOS to ensure service continuity and stability.
25 Average Annual Daily Traffic (AADT) is the total volume of vehicle traffic on a roadway or bridge divided by 365 days, representing the average number vehicles that trave across the structure per day over the course of a year.

| Attribute | Performance Measure | Current Performance | Target LOS |
|---|---|---|---|
| Scope | % of bridges with loading or dimensional restriction | 0% | 0% |
| Scope | % of culverts with loading restrictions | 1 culvert (less than 5%) has load restriction | Maintain or reduce number of culverts with load restrictions through rehabilitation or replacement. |
| Quality | Average BCI[26] for vehicular bridge | 92.25 | Maintain average BCI above 90 |
| Quality | Average BCI for pedestrian bridge | 81.85 | Maintain average BCI above 80 |
| Quality | Average BCI for structural culvert | 62.6 | Maintain average BCI above 70 |
| Quality | Overall average BCI across bridges and culverts | 72, reflects variations between asset types | Improve overall average through culvert upgrades while maintaining bridge performance |
| Quality | Range of BCI for culverts | BCI Range from 8 to 75 | Aim for no culverts in poor state (below BCI=50) |

## 1.3.4. Asset Management Strategy

### 1.3.4.1. Overview

An asset management strategy is a set of planned actions that will enable the asset to provide the agreed upon levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost.

### 1.3.4.2. Risk Management

Risk management is essential to maintaining reliable, safe, and sustainable bridge and culvert network. It helps ensure that potential service disruptions, environmental impacts, and financial losses are identified early and addressed before they escalate.

[26] The data is based on 2022 reporting period. As of the publication of this report, compliance data for 2023 and 2024 is not yet fully verified. This value is therefore considered provisional and will be updated once more recent data becomes available.

#### 1.3.4.2.1. Scoring Probability of Failure (PoF)

PoF for bridges and culverts can be estimated based on the 2024 BCI, which provides a standardized score from 0 to 100. The next Table outlines how BCI ranges are translated into PoF ratings.

**Table 1.3.7: BCI-Based PoF**

| BCI Range | Condition Category | PoF |
|---|---|---|
| 75 - 100 | Excellent/Good | 1 |
| 50 - 74 | Fair | 2 |
| 25 - 49 | Poor | 3 |
| 0 - 24 | Very Poor | 4 |

#### 1.3.4.2.2. Scoring Consequence of Failure (CoF)

The Consequence of Failure (CoF) for bridges and culverts represents the potential severity of impacts if these assets were to fail. Given their critical role in transportation networks and flood management, a failure can lead to serious safety, service, environmental and financial consequences. The following CoF factors are commonly used to assess risk levels:

- **Safety**: Assesses the risk of injury or loss of life due to structural collapse or failure. For example, failure of a high-traffic bridge may lead to vehicle accidents or pedestrian harm, especially if the failure is sudden and without warning.
- **Service Disruption**: Evaluates the impact on transportation continuity and emergency access. A failed culvert or bridge on an arterial road could disrupt vital transportation routes for commuters, and emergency services, leading to major delays and the need for extended detours.
- **Financial impact:** Considers the cost of emergency repairs, detour implementation, and economic disruption. Closure of a commercial route bridge could impact local business revenues and increase municipal operating costs due to detour maintenance and reconstruction efforts.
- **Environmental impact**: Reflects the CoF on surrounding ecosystems especially in culverts. For example, a culvert collapse could block fish passage, or cause upstream flooding, damaging natural habitats and water quality.

These factors are typically scored on a scale 1 to 4 and used to reflect the potential impact of asset failure. Bridges or culverts with higher CoF scores generally require more frequent monitoring, proactive maintenance, and prioritization in capital planning.

### 1.3.4.2.3. Risk Matrix

A risk-based prioritization matrix was developed by calculating a risk score for each asset using a combination of PoF and CoF. PoF was determined based on asset condition using a standardized 1- 4 scale. CoF was assessed using multiple weighted criteria, including safety, service disruption, financial impact, and environmental impact, each scored from 1 to 4 and averaged to represent overall consequences. Once risk score was calculated, it was used to extract and aggregate the replacement value of assets falling within each risk level. This enabled the development of a color-coded 4×4 risk matrix, where the total replacement cost exposure is visualized by risk category. Each cell in the matrix represents a unique risk score calculated as PoF×CoF, with color-coding to highlight priority levels.

- **Green (Low Risk):** Minimal consequence and/or low likelihood of failure.
- **Yellow (Moderate Risk):** Manageable risk requiring routine monitoring.
- **Orange (High Risk):** Significant risk needing planned intervention.
- **Red (Very High Risk):** Critical assets with high replacement costs and failure impacts; prioritized for renewal.

An estimated risk matrix for the City's bridge and culvert infrastructure assets can be seen in the Figure below.

| PoF | | | | |
|---|---|---|---|---|
| 4 | | | $ 669,696 | |
| 3 | | | $ 1,358,967 | |
| 2 | | $ 362,666 | $ 5,181,384 | |
| 1 | | $ 2,297,571 | $ 3,536,508 | $ 22,146,835 |
| | 1 | 2 | 3 | 4 |
| | CoF | | | |

**Figure 1.3.4: Replacement Value based Risk Matrix for Bridge Network**

The matrix helps to visually identify high-value assets with deteriorating conditions which pose a greater risk to service, cost, and compliance. Through the visualized information, the matrix supports data driven investment decisions.

### 1.3.5. Lifecycle Activities

For some bridges in Poor condition, a small holding strategy of repairs can be done to extend the life of the bridge by six to ten years. This will defer the major expense of structure replacement, while still maintaining the bridge in a serviceable condition. Some other bridges that are still in good condition can have work done ahead of other Poor condition bridges to help preserve the bridges before they require extensive repair.

A summary of general lifecycle activities for the bridge network and an estimate of associated costs are provided in the Tables[27] below.

**Table 1.3.8: Bridge Network Lifecycle Activities – Minor Maintenance**

| Asset Component | Minor Maintenance Activity Options | Approximate Cost |
|---|---|---|
| All Structures | - OSIM Inspections legislatively required once every two years. | - $1,500 to $1,800 per structure |

**Table 1.3.9: Bridge Network Lifecycle Activities – Major Maintenance**

| Asset Component | Major Maintenance Activity Options | Approximate Cost |
|---|---|---|
| All Structures | - Wearing Surface Crack Sealing<br>- Painting<br>- Washing & Cleaning of:<br>• Wearing surface & deck<br>• Sidewalk & railings<br>• Tops of abutments & piers<br>• Expansion joints<br>• Seats & bearings<br>• Lower chords of trusses<br>• Deck drains | - $1.25/m$^2$<br>- $35/hour<br>- $115/hour |

27 The cost estimations presented are approximate and based on 2022 data. As many of the recommended lifecycle activities have not yet been undertaken, the estimates reflect available information at the time of analysis and may be subject to change as more accurate data becomes available.

| | | |
|---|---|---|
| Concrete Structures | - Crack Repairs<br>• Bonding<br>• Routing and sealing<br>• Stitching | - $60/m$^2$ |
| Steel Structures | - Rust removal and repainting<br>- Sandblast and repainting | - $35/hour<br>-$135/hour |

**Table 1.3.10: Bridge Network Lifecycle Activities – Rehabilitation Maintenance**

| Asset Component | Rehabilitation Activity Options | Approximate Cost |
|---|---|---|
| Concrete Structures | - Spall Repairs<br>- Disintegration repairs (jacketing)<br>- Delamination repairs | - $175/m$^2$<br>- $95/m$^2$<br>- $135/m$^2$ |
| Steel Structures | - Member strengthening (plates) or replacement<br>- Connection plating or replacement | - $400 to $1,000 per location depending on complexity |

**Table 1.3.11: Bridge Network Lifecycle Activities – Replacement Maintenance**

| Asset Component | Replacement Activity Options | Approximate Cost |
|---|---|---|
| Concrete Structures | - Replacement of entire structure | - $5,000 to $6,000/m$^2$ (varies by location) |
| Steel Structures | - Replacement of entire structure | - $8,000 to $9,000/m$^2$ (varies by location) |

There are many risks associated with lifecycle activities of assets. When developing a standard timeframe for when maintenance should occur, the municipality must balance the cost of doing frequent maintenance versus the risks of waiting long periods of time between maintenance activities. The consequences associated with structural issues in the City's bridge network are extremely high.

In accordance with provincial statutes and regulations, all structures with a span greater than 3 metres must undergo formal inspections at least once every two years. These inspections are a critical component of the City's asset management strategy, ensuring the safety, functionality, and longevity of its bridge and culvert infrastructure.

As part of this ongoing lifecycle management, the City commissioned GEI to conduct a comprehensive inspection in 2024. However, due to a significant software failure on their end, the final report has not yet been delivered. Follow-up communication with GEI is underway to determine when the updated report will be available.

In the meantime, the City continues to implement a range of lifecycle activities aligned with best practices in infrastructure management. These activities typically include:

- **Routine Maintenance**: Regular cleaning, debris removal, and minor repairs to prevent deterioration.
- **Condition Assessments**: Biennial inspections and evaluations to monitor structural integrity and identify emerging issues.
- **Rehabilitation**: Targeted repairs or component replacements to extend the service life of aging structures.
- **Replacement Planning**: Long-term planning for the replacement of structures nearing the end of their useful life.
- **Monitoring and Documentation**: Maintaining detailed records of inspections, maintenance, and repairs to inform future decision-making.

The table below outlines the **recommended lifecycle activities** for bridge and culvert assets, serving as a guideline for the City's ongoing infrastructure stewardship.

**Table 1.3.12: 10-Year Life Cycle Activities (Maintenance Priority Table)**[28]

| Structure NO. (Based on Low on BSI) | BCI | BSI[29] | Repair Costs 6-10 Years $ | 1-5 Year $ | Within 1 Year $ | Urgent $ | Associated Work $ | Total Cost $ |
|---|---|---|---|---|---|---|---|---|
| OS-10 | 43 | 38 | 330,000 | | | 500 | 203,000 | 533,500 |
| OS-15 | 44 | 44 | | 69,500 | | 500 | 25,600 | 95,600 |
| OS-17 | 48 | 46 | 265,500 | | | 750 | 119,000 | 385,250 |
| OS-17 | 57 | 54 | | 60,750 | | 500 | 21,500 | 82,750 |
| OS-12 | 58 | 52 | 5,000 | 157,500 | | | 97,500 | 260,000 |
| OS-14 | 66 | 65 | | 5,000 | | 750 | 41,000 | 46,750 |
| OS-11 | 71 | 66 | 20,000 | 18,500 | | 25,000 | 45,000 | 108,500 |
| OS-26 | 70 | 67 | 3,250 | 21,250 | 5,000 | 3,500 | 20,500 | 53,500 |
| OS-20 | 73 | 69 | 5,000 | 43,000 | | | 73,000 | 121,000 |
| OS-08 | 74 | 70 | 2,500 | | | | 3,500 | 6,000 |
| OS-13 | 74 | 72 | 7,500 | 40,000 | | 500 | 63,500 | 111,500 |
| OS-19 | 76 | 72 | 15,000 | 500 | | 46,000 | 51,000 | 112,500 |
| OS-23 | 73 | 73 | 12,000 | 57,300 | | | 40,000 | 109,300 |
| OS-09b | 75 | 75 | | 635,000 | | | 296,500 | 931,500 |
| OS-24 | 76 | 76 | 20,750 | 16,000 | | | 30,000 | 66,750 |
| OS-21 | 77 | 77 | | 37,000 | | 500 | 30,000 | 67,500 |
| OS-01 | 83 | 78 | 15,000 | 47,500 | | | 30,600 | 93,100 |
| OS-04 | 86 | 83 | 18,000 | 42,500 | | | 18,000 | 78,500 |
| OS-22 | 84 | 84 | | 5,000 | 500 | 500 | 28,000 | 34,000 |
| OS-06 | 87 | 87 | $25,000 | | | | 9,000 | 34,000 |
| OS-29 | 100 | 95 | | 5,000 | | | | 5,000 |
| OS-27 | 99 | 96 | | 950 | | | | 950 |
| OS-28 | 99 | 96 | | | | | | 0 |
| OS-02 | 100 | 97 | | 12,600 | | | 4,000 | 16,600 |
| OS-25 | 100 | 99 | | | | | | 0 |
| **Total:** | | | 744,500 | 1,806,850 | 5,500 | 613,000 | 2,641,200 | 5,811,050 |

## 1.3.6. Financial Strategy

### 1.3.6.1. Funding vs. Need

In the next Figure**,** the average annual financial requirements for the Bridge and Culvert assets are shown on the timeline. The orange bar represents the average annual capital spending required to meet all current and future

[28] The data is based on 2022 Bridges and Culverts OSIM Reports. The estimates reflect available information at the time of analysis and may be subject to change as more accurate data (2024 OSIM Report) becomes available.

29 Bridge Sufficiency Index (BSI): is a numerical rating (0-100) used to evaluate a bridge's overall adequacy based on structural condition, functional obsolescence, and serviceability.

financial obligations while the green bar represents the average annual operating spending. The blue horizontal line represents the estimated average budgeted spending[30]. The average annual deficit is comprised of a mixture of capital and operating shortfalls for the bridge network.

The average annual funding requirement is $403,627[31] and the estimated average funding is $524,894. This indicates an average annual surplus of $121,267 for the bridge and culvert network, reflecting a funding-to-need ratio of just over 130%.

It should be noted that the bridge network has a relatively small number of assets with a large financial value; therefore, one asset can have a significant impact on the overall values within the bridge network.

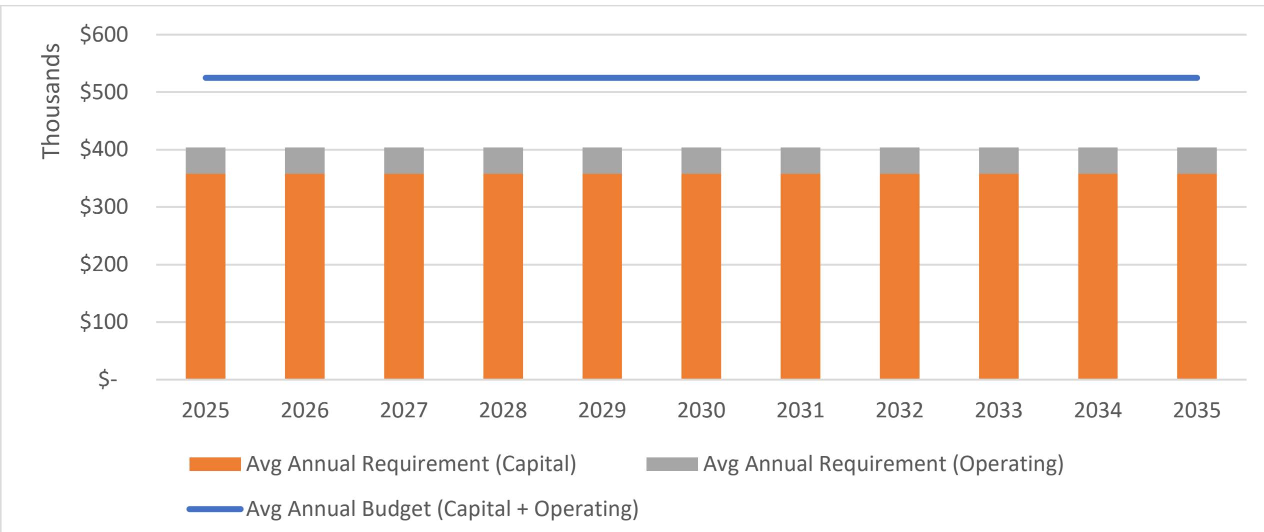



**Figure 1.3.5: Bridge Network Funding Requirement – Summary**

The Figure below shows the actual annual anticipated requirement[32] as well as the backlog requirement for assets that are at or beyond their estimated useful life.

[30] Average budgeted spending includes both capital and operating budget. Based on an average of the five-year capital budget and two-year operating budget.

[31] Average annual requirement (capital) is calculated based on the average of the upcoming 10-year actual anticipated requirement. Where insufficient or unreliable data exists, the average annual requirement (capital) is calculated by taking the CRC for each asset component divided by the years of life remaining (EUL – average age).

[32] Only depicts capital requirement and budget. Does not include operating data.

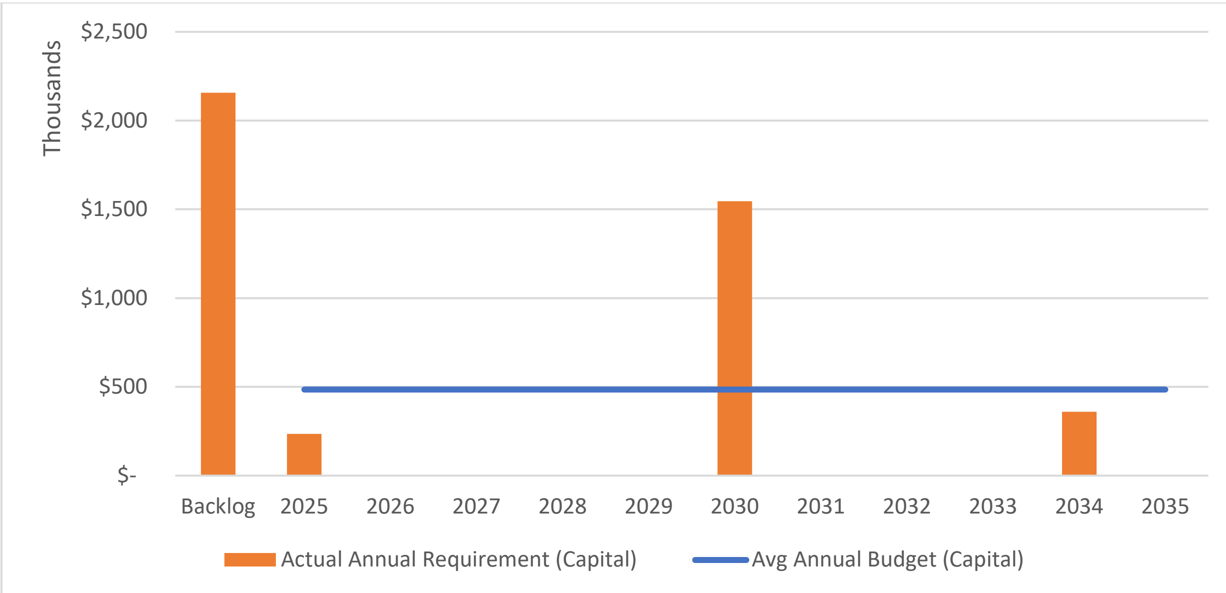



**Figure 1.3.6: Bridge Network Funding Requirement – Actual Annual Requirement[33]**

## 1.3.7. Improvement Plan and Recommendations

The following recommendations for the next 10-Year are based on the review of current management practices, developed LOS, inventory, valuation and condition analysis[34]. Their achievement is contingent upon the development of a more accurate and informed Level of Service (LOS) framework. Until such a framework is in place, the City's primary strategy remains the maintenance of current service performance levels.

[33] The full backlog is comprised of and bridges and culverts beyond their EUL; however, asset age data should be supplemented by condition assessments to determine if the asset does need to be renewed.
[34] The cost estimations presented are approximate and based on 2022 data. As many of the recommended lifecycle activities have not yet been undertaken, the estimates reflect available information at the time of analysis and may be subject to change as more accurate data becomes available.

**Table 1.3.13: Asset Management Planning Recommendations – Bridge Network**

| Category | Identified Issue / Gap | Strategic Recommendation | Rationale/Explanation | Expected Outcome by 2035 |
|---|---|---|---|---|
| Culvert load restriction | One culvert has a load restriction, limiting use by emergency and Public Works vehicles. | Rehabilitate or replace the restricted culvert to restore full traffic capacity | Ensures emergency access and service continuity across all municipal road | All culverts will be fully accessible to heavy and emergency vehicles. |
| Condition | Average Culvert BCI is 66.6 (fair) with aging inventory | Implement phased rehabilitation or replacement program for culverts below BCI 70 | Improve reliability, reduce risk of service disruption, and avoid reactive repairs. | Average Culvert BCI improved to ≥70 (Good); reduced lifecycle cost and deferred capital pressure. |
| Condition | Some Culverts have critical BCI scores as low as 7 | Prioritize urgent rehabilitation and replacement of culverts below BCI 50 | Prevents unexpected failure and potential road closure or flooding | Will deal with culverts in critical condition and preferably no culverts in critical condition (BCI <50); enhance public safety. |
| Condition | Aging Culvert stock (many pre-1980s) poses risk of material degradation | Develop culvert renewal strategy based on age, material and performance history. | Manges Long-term risk associated with aging infrastructure and informs capital planning. | Structured replacement schedule established; high-risk culverts proactively addressed. |
| Condition | Pedestrian bridge conditions vary significantly (BCI range: 63-100) | Conduct targeted preventive maintenance on pedestrian bridges with BCI <75 | Preserve service quality and accessibility for non-vehicular users. | All pedestrian bridges maintained above BCI 75; reduced condition variability. |

owen sound
where you *want* to live

# 2025

# Asset Management Plan

# Stormwater Network

# 1.4. Stormwater Network

## 1.4.1. Introduction

The City's stormwater asset components are broken out into 9 asset classes and includes the following:

- **Collection Pipes**: Underground pipes that convey stormwater from inlets (like catch basins) to outfalls or treatment facilities.
- **Manholes**: Vertical access points to underground stormwater or sewer systems, used for inspection and maintenance.
- **Catch Basins**: Structures that collect surface runoff and direct it into the storm sewer system, often with a sump to trap debris.
- **Ditch Inlets**: Openings that allow stormwater from roadside ditches to enter the storm sewer system.
- **Leads**: Smaller pipes that connect catch basins or inlets to the main storm sewer line.
- **Stormceptors**: Proprietary stormwater treatment devices designed to remove sediment, oil, and other pollutants from runoff.
- **Retention Ponds**: Engineered basins that hold stormwater temporarily to allow sedimentation and infiltration before discharge.
- **Drainage Channels**: Natural or artificial channels that convey stormwater, often lined to prevent erosion.
- **Stormwater Services**: A general term encompassing all infrastructure, operations, and maintenance activities related to managing stormwater.

The Asset Management Plan (AMP) for core assets was previously addressed in the City of Owen Sound's 2022 AMP. This report supports the development of the City's 2025 AMP, focusing on stormwater assets within the Core Assets category.

## 1.4.2. State of Infrastructure

### 1.4.2.1. Stormwater

The following information regarding stormwater network asset data is compiled from various incomplete databases, professional expertise, dated inventory maps, and as-built drawings.

#### 1.4.2.1.1. Inventory

The stormwater network that serves the City of Owen Sound consists of various types and diameters of stormwater collection pipes, manholes, catch basins, ditch inlets, leads, stormceptors, retention ponds, drainage channels, and stormwater services. These components have been identified in the below Table.

**Table 1.4.1: Stormwater Network Inventory**

| Asset Type | Asset Component | Quantity |
|---|---|---|
| **Stormwater Network** | Collection Pipes (Stormwater Mains) | 178.0 km |
| | Manholes[35] | 2,037 units |
| | Catch Basins[36] | 2,424 units |
| | Ditch Inlets | 164 units |
| | Leads | 31.9 km |
| | Stormceptors | 12 units |
| | Retention Ponds | 5 units |
| | Drainage Channels (Kenny drain and storm outfalls) | 2,980 m |
| | Stormwater Services | 2,000 units |

#### 1.4.2.1.2. Current Replacement Cost

The replacement cost for the stormwater network was estimated using current standards, historical tender pricing, and current market replacement values. The estimated replacement value of the stormwater network and associated components, based upon current dollar value (2025) is **$252.3** million. The following Table and associated Figure provide a breakdown of the contribution of each of the network components to the overall system value.

**Table 1.4.2: Stormwater Network Replacement Value**

| Asset Type | Asset Component | Quantity | Replacement Value $ (2025) |
|---|---|---|---|
| **Stormwater Network** | Collection Pipes (Stormwater Mains) | 178.0 km | 175,094,517 |
| | Manholes | 2,037 units | 30,584,793 |
| | Catch Basins | 2,424 units | 10,032,724 |
| | Ditch Inlets | 164 units | 1,198,164 |
| | Leads | 31.9 km | 23,093,642 |
| | Stormceptors | 12 units | 707,882 |

[35] Includes manholes, single catch basin manholes, and double catch basin manholes
[36] includes single and double catch basins

| | | | |
|---|---|---|---|
| | Retention Ponds | 5 units | 4,264,000 |
| | Drainage Channels (Kenny drain and storm outfalls) | 2,980 m | 3,446,915 |
| | Stormwater Services | 2,000 units | 3,933,817 |
| | **Total Stormwater Network** | | 252,356,453 |

As can be seen from the Figure below, the City's stormwater collection pipes make up over 69% of the stormwater collection network based on replacement value.

If this total asset value ($252.3 million) is translated to an average value per household assuming 10,140 properties, then the average household would have an investment of approximately $24,887 in stormwater network assets.

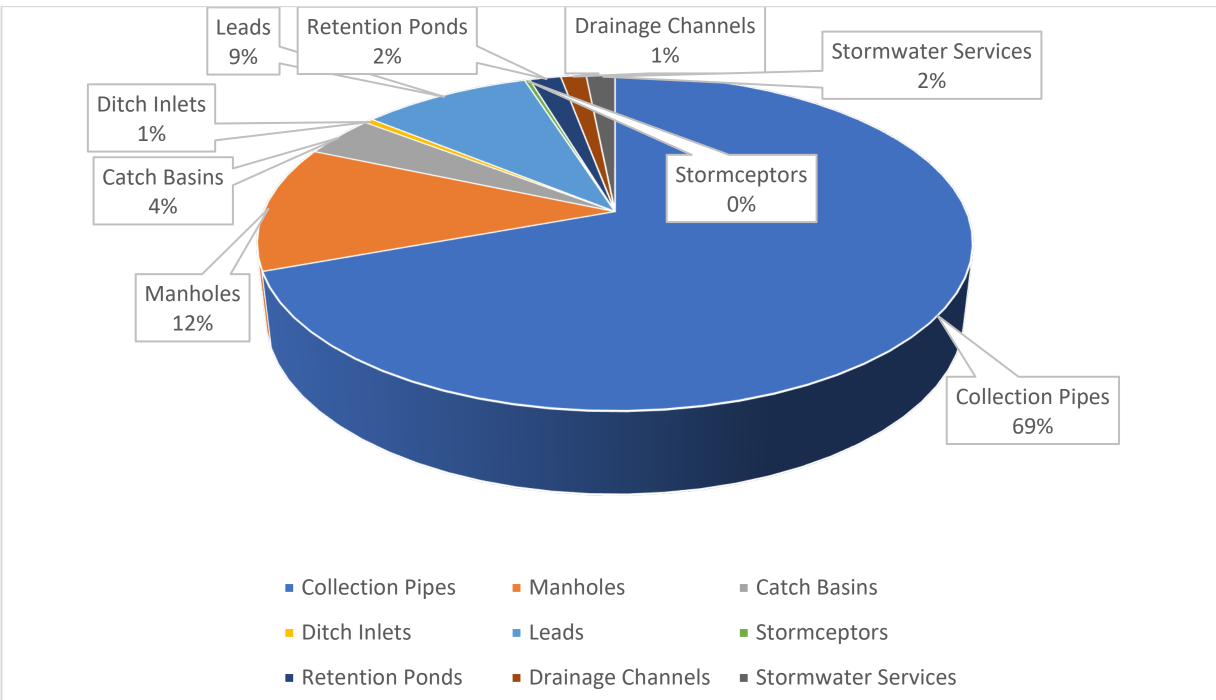



**Figure 1.4.1: Breakdown of Stormwater Network Components by Replacement Value**

### 1.4.2.1.3. Average Age

The generalized values used for the typical expected useful life of the stormwater network assets are summarized in the next Table. It should be recognized that the actual asset life is influenced by many variables such as installation practices, soil conditions, uneven manufacturing quality, local weather conditions, etc., and may be greater than the expected useful life in favourable conditions. City staff will continue to refine the asset's expected useful life as more specific data becomes available.

**Table 1.4.3: Stormwater Network Useful Life and Age**

| Asset Type | Asset Component | Estimated Useful Life (EUL) | Average Age | Condition |
|---|---|---|---|---|
| **Stormwater Network** | Collection Pipes (Stormwater Mains) | 80 years | 37.7 years | Fair |
| | Manholes | 80 years | 39.5 years | Fair |
| | Catch Basins | 80 years | 42 years | Fair |
| | Ditch Inlets | 80 years | 19 years | Good |
| | Leads | 80 years | 40.2 years | Fair |
| | Stormceptors | 80 years | 7 years | Good |
| | Retention Ponds | 100 years[37] | 18 years | Good |
| | Drainage Channels (Kenny drain and storm outfalls) | 80 years | 6 years | Good |
| | Stormwater Services | 80 years | 40 years | Fair |

### 1.4.2.1.4. Condition

Condition of stormwater assets is determined through a mix of analyzing CCTV images (where possible), completing visual inspections, analyzing the material and/or age of asset components, and supplemented by professional judgment.

The below Table outlines the condition of each component in the stormwater distribution network based on current replacement cost.

**Table 1.4.4: Stormwater Network Condition by Replacement Value**

| Asset Type | Asset Component | Good $ | Fair $ | Poor & Very Poor $ |
|---|---|---|---|---|
| **Stormwater Distribution** | Collection Pipes (Stormwater Mains) | 53,734,421 | 83,247,909 | 38,112,187 |
| | Manholes | 9,532,622 | 17,873,880 | 3,178,290 |
| | Catch Basins | 2,667,431 | 5,886,221 | 1,479,072 |
| | Ditch Inlets | 634,860 | 563,303 | - |
| | Leads | 7,382,828 | 11,787,457 | 3,923,357 |
| | Stormceptors | 707,882 | - | - |
| | Retention Ponds | 2,558,400 | 852,800 | 852,800 |
| | Drainage Channels (Kenny drain and storm outfalls) | 2,412,840 | 517,037 | 517,037 |

[37] needs to be maintained (i.e. cleaned out) at least every 25 years

| | | | | |
|---|---|---|---|---|
| | Stormwater Services | 2,360,290 | 1,180,145 | 393,382 |
| | **Total Stormwater Distribution Network** | 81,991,575 | 121,908,753 | 48,456,125 |

The Figure below demonstrates that over 80% of the stormwater collection network is in good and fair conditions, representing $203.9 million, and approximately 19% is in poor condition, representing about $48.4 million.

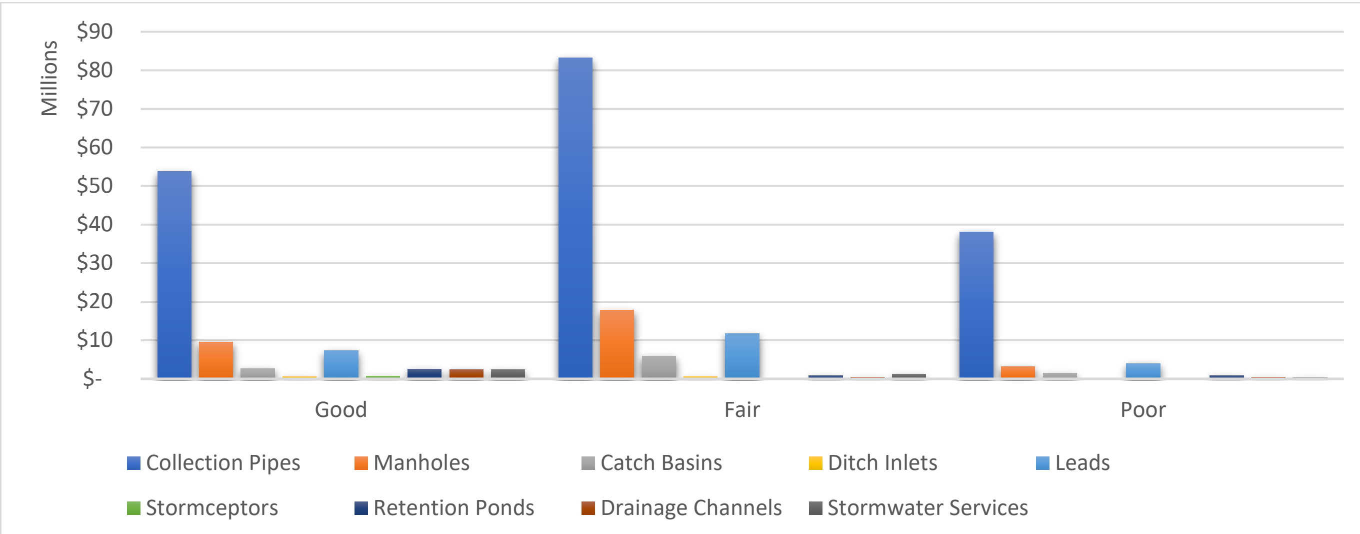



**Figure 1.4.2: Breakdown of Stormwater Network Component Condition by Replacement Value**

## 1.4.3. Level of Service (LOS)

This document outlines both the Customer (qualitative) and Technical (quantitative) Levels of Service for the municipal stormwater system. Due to limited data availability on the condition and capacity of the stormwater infrastructure, most performance metrics cannot currently be measured quantitively. However, mitigation programs for residential and commercial properties are in place to reduce stormwater system loading.

## 1.4.3.1. Scope

**Figure 1.4.3** provides an overview of the City's stormwater infrastructure.[38]

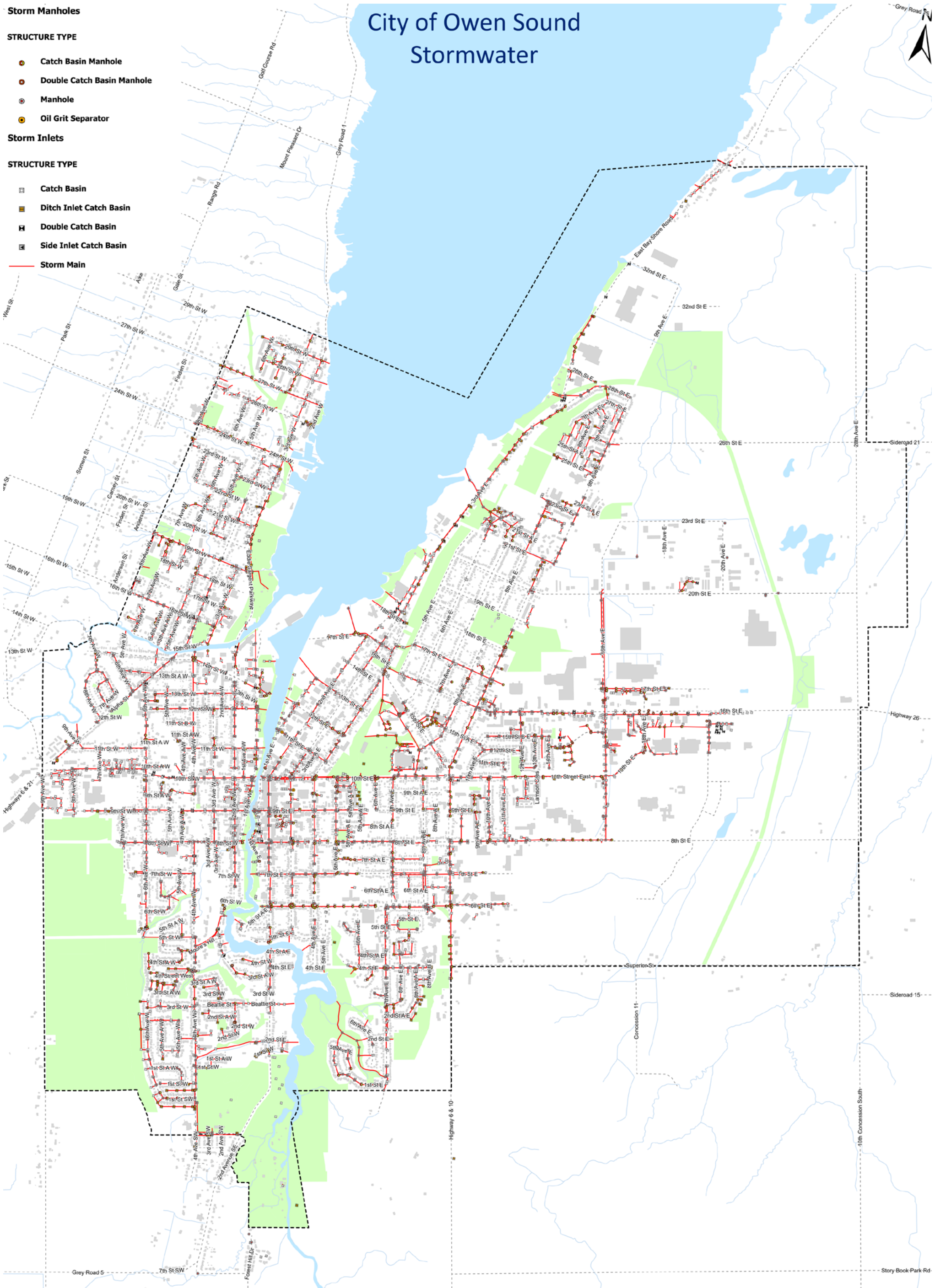



**Figure 1.4.3: Overview of the City's Stormwater Infrastructure[39]**

[38] This figure includes properties within the City of Owen Sound as well as the neighbouring municipality of Georgian Bluffs
[39] This is an image for illustrative purposes.

### 1.4.3.2. Community Levels of Service (Qualitative Descriptions)

Stormwater service to the community is evaluated based on its ability to protect residents and properties from flooding, integration of environmental protection measures and the presence of community-based mitigation programs.

**Flood protection coverage:** At present, there is no clear delineation of which user groups or areas are protected by the municipal stormwater system, largely due to insufficient system mapping and hydraulic data. The City's aim is to develop flood risk zones and define service coverage using GIS and hydraulic modeling tools, targeting coverage of 90% of known flood-prone areas.

**Environmental Impact Considerations:** To support systematic implementation of ongoing watershed health monitoring, the City plans to enhance its approach by establishing watershed health metrics and integrating them into stormwater planning processes.

**Community-Based Mitigation Measures:** The City currently promotes residential sump pump installations and storm drain disconnections, as well as roof water diversion program for larger businesses. The goal is to expand program uptake to cover 80% of eligible properties in high-risk areas.

All explanations of Customer Level of Service (LOS) have been summarized in Table 5.

### 1.4.3.3. Technical Levels of Service (Quantitative Metrics)

The technical evaluation of stormwater LOS includes the system's resilience to storm events, the completeness of asset inventories, and the efficiency of maintenance operations.

**Resilience to 100-Year Program and 5-Year Storm**: At this time, the City does not have reliable data to estimate the system's performance under 100-year or 5-year storm conditions. Establishing these benchmarks through updated modeling and system analysis is a critical objective.

**Asset Inventory and Condition**: Asset data is incomplete or inconsistently maintained. A comprehensive inventory and condition assessment of stormwater infrastructure must be conducted to support data driven planning and risk assessment.

**Maintenance Activity Tracking**: Maintenance activities are largely reactive, with no centralized tracking. The City will implement a computerized maintenance management system (CMMS) to transition to a preventive maintenance model.

All explanations of Customer and Technical Level of Service (LOS) have been summarized in the next Table.

**Table 1.4.5: Customer and Technical LOS for Stormwater Network**

| Customer Level of Service (Qualitative) | | | |
|---|---|---|---|
| **Attribute** | **Performance Measure** | **Current Performance[40]** | **Target LOS[41]** |
| Service Coverage | Flood Protection Coverage | Protection coverage for user groups or areas cannot be clearly defined due to data limitation. | Define and map flood protection zones using GIS mapping and hydraulic modeling by 2027; aim to document protection for 90% of flood-prone zones. |
| Environmental Governance | Environmental impact consideration | Stormwater impacts are considered in new developments and site plans; however watershed health not systematically monitored. | Implement ongoing watershed health monitoring in all planning zones; and integrate reporting into stormwater strategic management planning by 2027. |
| Community Engagement/ Risk Reduction | Community based mitigation measures | Residential sump pump and storm drain disconnection program are in place; roof water diversion program for larger businesses | Expand participation 80% of eligible properties by 2030; Ensure annual reporting on performance of these programs. |
| **Technical Level of Service (Quantitative)** | | | |
| **Attribute** | **Performance Measure** | **Current Performance** | **Target LOS** |
| System Resilience to Extreme Events | Resilience to 100-year storm | Unknown – no reliable data available to determine % of | Conduct storm system modeling (hydraulic modeling) and establish baseline |

[40] The data is based on 2022 reporting period. As of the publication of this report, compliance data for 2023 and 2024 is not yet fully verified. This value is therefore considered provisional and will be updated once more recent data becomes available.

[41] Target Levels of Service (LOS) are intended to guide planning and investment decisions; however, they must be refined using the most current and accurate data. Until such refinements are made, the City's primary strategy remains the maintenance of existing LOS to ensure service continuity and stability.

| | | | |
|---|---|---|---|
| | | properties resilient to a 100-year storm. | resilience. Achieve 70% system resilience to 100-year storm based on updated hydraulic modeling by 2032 |
| System Resilience to Frequent Events | Resilience to 5 – year storm | Unknown – no reliable data available to determine resilience of the system to a 5-year storm. | Complete data collection and modeling; design system upgrades to achieve 90% resilience to 5-year storm events by 2029. |
| Asset Data Completeness | Asset inventory and condition | Partial or incomplete inventory data | Complete asset inventory and condition assessment for majority of assets by 2027 |
| Preventive Maintenance Coverage | Maintenance activity tracking | Maintenance is reactive and lacks centralized tracking; inspection and scheduling are not standardized | Implement centralized maintenance management system; aim for 70% of activities to be preventive (vs reactive) by 2029. |
| Condition | % of stormwater network in fair/ good/excellent condition | 81% | Maintain current condition |

## 1.4.4. Asset Management Strategy

### 1.4.4.1. Overview

An asset management strategy is a set of planned actions that will enable the asset to provide the agreed upon levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost.

### 1.4.4.2. Risk Management

Risk management is essential to maintaining reliable, safe, and sustainable stormwater services. It helps ensure that potential service disruptions, environmental impacts, and financial losses are identified early and addressed before they escalate.

#### 1.4.4.2.1. Scoring Probability of Failure (PoF)

The Probability of Failure (PoF) represents the likelihood that a stormwater asset will fail based on its current physical condition. PoF is assigned using a standardized 4-point scale, where assets in good condition receive a score of 1 and those in very poor condition receive a score of 4. This approach allows condition data to be translated into a consistent measure of failure risk across all asset types.

#### 1.4.2.2.2. Scoring Consequence of Failure (CoF)

The Consequence of Failure (CoF) for stormwater infrastructure is evaluated using for key criteria: public safety, service disruption, environmental impact, and financial impact. These dimensions help determine the severity of impact if an asset were to fail, guiding prioritization in maintenance and capital planning decisions. Due to limitations in available asset-level data, such as detailed failure records, flood modeling, and diameters, the assessment incorporates factors summarized below to support CoF scores.

- **Safety**: Assesses the risk of injury or harm to people from failures like sinkholes, flooded roads, or exposed infrastructure. Assets in high-traffic or populated areas carry greater safety risk.
- **Service Disruption**: Evaluates how asset failure affects stormwater drainage and flood prevention. Critical assets like trunk mains or ponds have higher consequences due to broader service impacts.
- **Financial impact:** Reflects repair costs and associated damages. Deep, large, or hard to access assets typically result in higher financial consequences.
- **Environmental impact**: Considers the risk of potential for pollution, erosion, or habitat damage. Assets near water bodies or sensitive areas pose higher environmental risks if they fail.

Once each asset type was scored across the four CoF categories, an average was calculated to produce a single CoF score per asset. For example, drainage channels had category score of 2 (for safety), 3 (for service disruption), 2 (for financial impact) and 3 (for environmental) resulting in an average CoF of 2.5, which rounded up to 3. This average serves as a concise representation of the asset’s overall criticality and can be used in conjunction with condition-based Probability of Failure (PoF) scores to determine total risk. Location, diameter, and accessibility are additional parameters typically considered in the CoF criteria; however, due to incomplete data, they were not fully evaluated in this analysis. Overall, the CoF is developed based on the most readily available data.

#### 1.4.2.2.3. Risk Matrix

A risk-based prioritization matrix was developed by calculating a risk score for each asset using a combination of PoF and CoF. PoF was determined based on asset condition using a standardized 1- 4 scale. CoF was assessed using multiple weighted criteria, including safety, service disruption, financial impact, and environmental impact, each scored from 1 to 4 and averaged to represent overall consequences. Once Risk score was calculated, it was used to extract and aggregate the replacement value of assets falling within each risk level. This enabled the development of a color-coded 4×4 risk matrix, where the total replacement cost exposure is visualized by risk category. Each cell in the matrix represents a unique risk score calculated as PoF×CoF, with color-coding to highlight priority levels.

- **Green (Low Risk):** Minimal consequence and/or low likelihood of failure.
- **Yellow (Moderate Risk):** Manageable risk requiring routine monitoring.
- **Orange (High Risk):** Significant risk needing planned intervention.
- **Red (Very High Risk):** Critical assets with high replacement costs and failure impacts; prioritized for renewal.

An estimated risk matrix for the City's stormwater network assets can be seen in the below Figure.

| PoF \ CoF | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 4 | $ 517,190 | $ 1,197,213.37 | | |
| 3 | $ 3,969,470 | $ 5,141,920.69 | $ 15,490,774 | |
| 2 | | $ 13,130,199.84 | $ 126,842,422 | |
| 1 | $ 7,382,828 | $ 9,535,099.05 | $ 40,472,236 | |

**Figure 1.4.4: Replacement Value based Risk Matrix for Stormwater Network**

The matrix helps to visually identify high-value assets with deteriorating conditions which pose a greater risk to service, cost, and compliance. Through this, the matrix supports data driven investment decisions.

### 1.4.5. Lifecycle Activities

Based on current 4×4 risk matrix distribution, the majority of stormwater assets based on replacement cost fall within moderate-risk categories, indicating that while the assets are not in critical condition, or posing an immediate high risk, they still present a meaningful likelihood or consequence of failure that require attention.

**Table 1.4.6: Risk based Lifecycle analysis**

| Color (Risk Zone) | Replacement Cost | Implication |
| --- | --- | --- |
| Green (Low Risk) | $ 103,684,123 | Long-term life expectancy, minimal intervention needed |
| Yellow (Moderate Risk) | $ 133,181,556 | Some risk; monitoring and future intervention is required |
| Orange (High Risk) | $ 15,490,774 | Elevated risk; likely to require renewal soon |
| Red (Very High Risk) | - | Critical risk |

The distribution of assets across moderate and high-risk categories has direct implications for financial planning. To support proactive decision-making, a tailored lifecycle cost analysis must be developed for all assets. The lifecycle activities outlined in the next Tables represent recommended works that should be undertaken to maintain and enhance the performance of the wastewater collection network. These tables also provide estimated costs [42] associated with each activity.

A summary of available lifecycle activities for the stormwater collection network and an estimate of associated costs are provided in below Tables.

[42] The cost estimations presented are approximate and based on 2022 data. As many of the recommended lifecycle activities have not yet been undertaken, the estimates reflect available information at the time of analysis and may be subject to change as more accurate data becomes available.

**Table 1.4.7: Stormwater Network Lifecycle Activities – Minor Maintenance**

| Asset Component | Minor Maintenance Activity Options | Approximate Cost |
|---|---|---|
| Storm Sewer Mains | - Cleaning and Flushing sewers. | - $3.00/m (excl. removal of debris from manholes |
| Storm Sewer Mains | - TV Inspection mains only | - $8/m (incl. cleaning) |

**Table 1.4.8: Stormwater Network Lifecycle Activities – Major Maintenance**

| Asset Component | Major Maintenance Activity Options | Approximate Cost |
|---|---|---|
| Catch Basins, Catch Basin Manholes, and Ditch Inlets | - Vacuum removal of sediment in sumps of storm sewer structures. The frequency varies and dependent on sediment build-up | - $35/structure |
| Storm Sewers | - Traditional Replacement: sewer only (emergency) | - $450 to $1,200 varies by diameter & depth |

**Table 1.4.9: Stormwater Network Lifecycle Activities – Rehabilitation**

| Asset Component | Rehabilitation Activity Options | Approximate Cost |
|---|---|---|
| Storm Sewers | - Trenchless Sewer Lining | - $300 to $800/m varies by diameter |
| Storm Sewers | - Traditional Spot repair of main or leads | - $5,000 to $10,000 (incl. restoration) |
| Manholes | - Sealing Manholes ($2000 per manhole. Varies. Not as common as for sanitary) | - $2,000/manhole |
| Manholes/Catch Basins | - Manhole/Catch Basin F&G, Modulock replacement | - $250/F&G<br>-$300/m depth Modulock |
| Manholes/Catch Basins | - Manhole/Catch Basin benching repair | - $1,000/manhole |

**Table 1.4.10: Stormwater Network Lifecycle Activities – Replacement**

| Asset Component | Replacement Activity Options | Approximate Cost |
|---|---|---|
| Storm Sewers | - Pipe Bursting | - $300 to $400/m varies by diameter. |
| Storm Sewers | - Traditional Replacement: as part of full reconstruction (planned) | - $300 to $850 varies by diameter, depth & soil conditions |
| Manholes | - Manhole replacement alone or in combination with any of above. | - $8,000 to $16,000 varies by size & depth |
| Catch Basins | - Catch Basin replacement alone or in combination with any of above. | - $4,000 to $6,000 varies by size & depth |

There are many risks associated with lifecycle activities of assets. When developing a standard timeframe for when maintenance should occur, the municipality must balance the cost of doing frequent maintenance versus the risks of waiting long periods of time between maintenance activities.

If the City does not perform the above-mentioned lifecycle activities, the stormwater network is at risk of structural compromise that could lead to main breaks, stormwater run-off issues, water contamination issues, etc. This would not only lead to an inconvenience for residents and have a large impact on their daily lives, but it would also result in the City's reputation and reliability being tarnished.

As previously mentioned, performing lifecycle activities (such as repairs, maintenance, etc.) and investing funds on a regular basis is the most cost-effective way to manage an asset throughout its lifecycle. Although the municipality has to put funds into an asset on more occasions, the sum of the funds is less than if the municipality puts funds into the asset one time when the asset has deteriorated to such a level that it is incredibly costly to restore it to a useable condition. Therefore, it is important to perform the lifecycle activities mentioned above on a predetermined, recurring schedule. The costs of performing these lifecycle activities should be considered in terms of staff time and budgetary dollars required. In order to ensure the lifecycle activities are performed at the lowest cost, the City should make note of best practices, issue well-developed RFPs to obtain competitive bids from third-parties, and stay up to date on the current and expected industry trends/standards.

## 1.4.6. Financial Strategy

### 1.4.6.1. Funding vs. Need

The next Figure depicts the current funding vs. need ratio for the stormwater network. The orange bar represents the average annual capital spending required to meet all current and future financial obligations while the green bar represents the average annual operating spending. The blue horizontal line represents the estimated average budgeted spending[43]. It should be noted that operating requirements are generally fully covered by the average operating budget for the stormwater network. The average annual deficit is comprised of capital shortfalls.

The current funding vs. need ratio is approximately 10.6% with an average annual requirement of $4,687,598[44] and average spending of $ 496,078. This gives an annual funding deficit of $ 4,191,519.

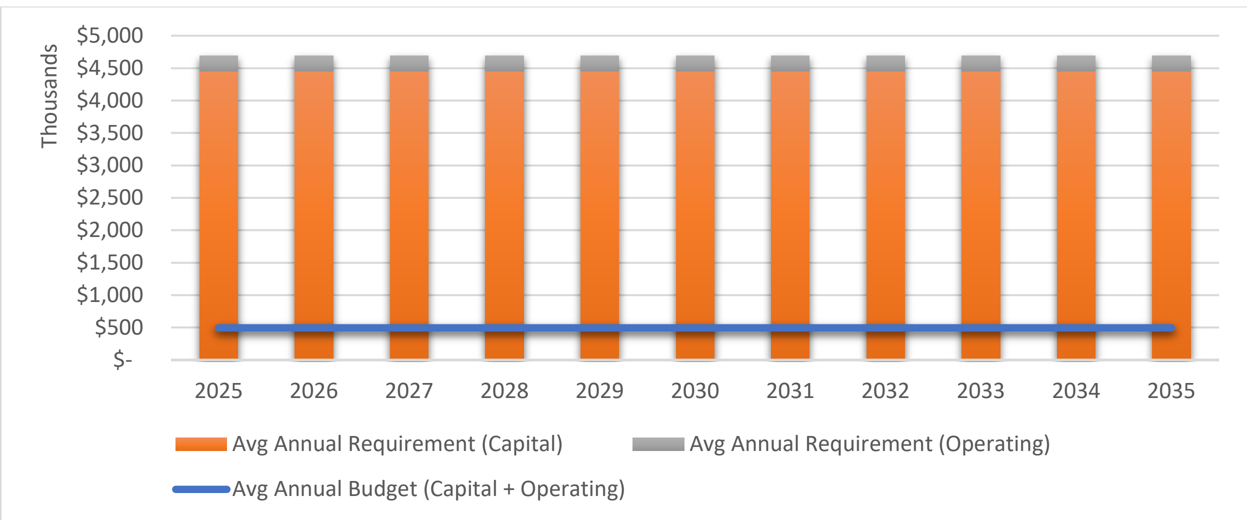



**Figure 1.4.5: Stormwater Network Funding Requirement – Summary**

The next Figure shows the actual annual anticipated requirement[45] as well as the backlog requirement for assets that are at or beyond their estimated useful life.

---

[43] Average budgeted spending includes both capital and operating budget. Based on an average of the five-year capital budget and two-year operating budget.

[44] Average annual requirement (capital) is calculated based on the average of the upcoming 10-year actual anticipated requirement. Where insufficient or unreliable data exists, the average annual requirement (capital) is calculated by taking the CRC for each asset component divided by the years of life remaining (EUL – average age).

[45] Only depicts capital requirement and budget. Does not include operating data.

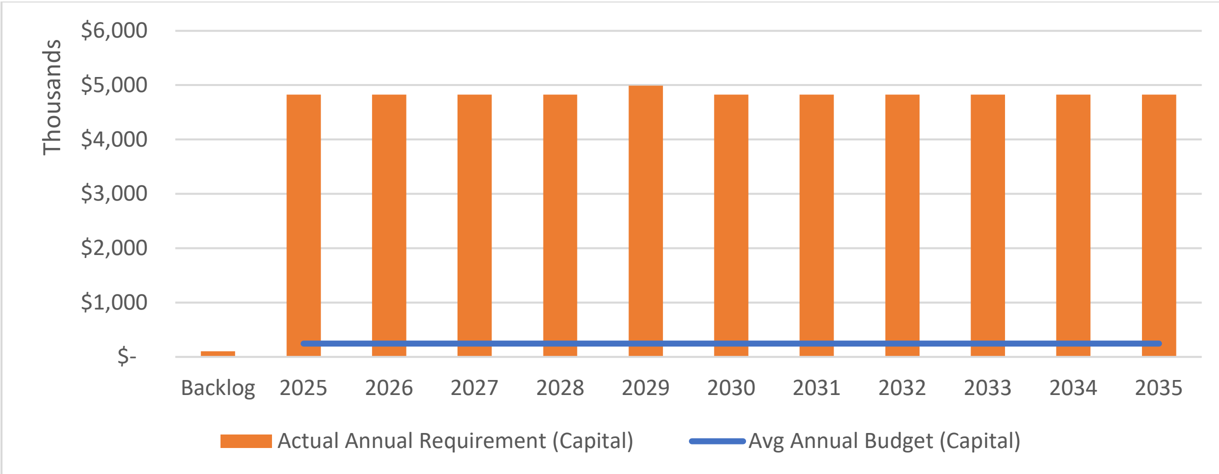



**Figure 1.4.6: Stormwater Network Funding Requirement – Actual Annual Requirement [46]**

## 1.4.7. Improvement Plan and Recommendations

The following recommendations for the next 10-Year are based on the review of current management practices, developed LOS , inventory, valuation and condition analysis. Their achievement is contingent upon the development of a more accurate and informed Level of Service (LOS) framework. Until such a framework is in place, the City's primary strategy remains the maintenance of current service performance levels.

**Table 1.4.11: Asset Management Planning Recommendations – Stormwater Network**

| Focus Area | Identified Gap | Recommendations for improvement |
|---|---|---|
| Improve overall asset condition | - 68% of assets rated fair, poor and very poor condition<br>- Incomplete or outdated asset records<br>- Maintenance is reactive and untracked<br>- No centralized system for inspections and repairs | - Maintain current condition rating<br>- Complete full inventory and condition assessment<br>- Integrate data into GIS and planning tools<br>- Implement CMMS to track and schedule work<br>- Reach 70% proactive maintenance coverage by 2029 |

[46] Although relatively minor, the backlog is comprised of manholes that are at or beyond their EUL; however, asset age data should be supplemented by condition assessments to determine if the asset does need to be renewed.

| | | |
|---|---|---|
| Flood Protection Mapping | - No identified user groups or areas protected by stormwater system<br>- Limited data on service coverage | - Conduct GIS based flood risk mapping and hydraulic modeling<br>- Identify high-risk areas<br>- Target 90% protection coverage by 2027 |
| Watershed Health Monitoring | - Environmental impacts only reviewed at development stage<br>- No active watershed monitoring program | - Launch watershed monitoring (e.g., water quality, habitat impacts)<br>- Integrate findings into stormwater planning by 2027 |
| Community - Based Mitigation | - Sump pump and storm drain disconnection programs exist but have low uptake<br>- Participation and impact not consistently tracked | - Increase program participation to 80% of eligible properties by 2030<br>- Conduct annual performance tracking |
| Resilience to 100 -Year storms | - No data on system capacity under extreme events<br>- Risk areas and capacity constrain unidentified | - Perform system-wide hydraulic modeling<br>- Identify vulnerabilities<br>- Target 70% resilience to 100-year storms by 2032. |
| Resilience to 5-Year storms | - No performance data for frequent (5-year) storm events<br>- Need to assess routine storm capacity | - Model 5-year storm performance<br>- Upgrade system in deficient zones<br>- Achieve 90% resilience to 5-year storms by 2029 |

owen sound
where you *want* to live

# 2025

# Asset Management Plan

# Water Network

## 1.5. Water Network

The City's Water asset components are broken out into 8 asset classes and includes the following:

- **Fire Hydrant**: A hydrant is an appurtenance connected to a watermain, used for firefighting and flushing the water system. It is considered part of the water distribution system.
- **Watermain**: A watermain is a principal pipe in a water distribution system that conveys potable water from treatment plants or reservoirs to service connections and hydrants. It is a core distribution asset.
- **Water Services**: A water service is the connection from the watermain to a building or property, typically including a service pipe, curb stop, and meter. It is part of the customer-side distribution system.
- **Valves**: Valves are mechanical devices installed on watermains to control the flow of water. They are classified as appurtenances and are essential for isolating sections of the system for maintenance.
- **Water Chambers**: (often called valve chambers or meter chambers) are underground structures that house valves, meters, or other control equipment. They are part of the distribution or monitoring infrastructure.
- **Pumping Stations**: are facilities that move water through the system, especially where gravity flow is insufficient. They are part of the supply and distribution infrastructure.
- **Water Meters**: Water meters measure the volume of water used by consumers. They are part of the monitoring and customer service infrastructure, often located within service connections or chambers.
- **Water Treatment Plant (WTP)**: A water treatment plant is a facility where raw water is treated to meet drinking water standards. It includes processes like filtration, disinfection, and chemical treatment. It is a core water asset under O. Reg. 588/17

The Asset Management Plan (AMP) for core assets was previously addressed in the City of Owen Sound's 2022 AMP. This report supports the development of the City's 2025 AMP, focusing on water assets within the Core Assets category.

## 1.5.1. State of Infrastructure

### 1.5.1.1. Water Network

The following information regarding water network asset data is compiled from various incomplete databases, professional expertise, dated inventory maps, and as-built drawings.

#### 1.5.1.1.1. Inventory

The water network that serves the City of Owen Sound consists of various types and diameters of watermains, valves, water chambers, fire hydrants, services, water meters, pumping stations, and a water treatment plant. These components have been identified in the Table below.

**Table 1.5.1: Water Network Inventory**

| Asset Type | Asset Component | Quantity |
|---|---|---|
| **Water Distribution** | Watermain | 156.3 km |
| | Valves | 1,982 units |
| | Valve Chambers | 47 units |
| | Fire Hydrants[47] | 715 units |
| | Services | 7,413 units |
| | Water Meters | 7,372 units |
| | Pumping Stations | 2 units |
| | Water Treatment Plant[48] | 1 unit |

#### 1.5.1.1.2. Current Replacement Cost

The replacement cost for the water distribution network was estimated using current standards, historical tender pricing, and current market replacement values. The estimated replacement value of the water distribution network and associated components, based upon current dollar value (2025) is $486.8 million. The following Table and associated Figure provides a breakdown of the contribution of each of the network components to the overall system value.

[47] Includes flush hydrants

[48] Includes three buildings: main treatment plan and control building, raw water pumping station building, and residual management facility building

**Table 1.5.2: Water Network Replacement Value**

| Asset Type | Asset Component | Quantity | Replacement Value $ (2025) |
|---|---|---|---|
| **Water Network** | Watermain | 156.3 km | $418,377,408 |
| | Valves | 1,982 units | $4,751,316 |
| | Valve Chambers | 47 units | $1,632,845 |
| | Fire Hydrants | 715 units | $6,231,479 |
| | Services | 7,413 units | $21,126,862 |
| | Water Meters | 7,372 units | $3,137,035 |
| | Pumping Stations | 2 units | $11,139,182 |
| | Water Treatment Plant | 1 unit | $20,395,015 |
| | **Total Water Network** | | $486,791,142 |

As can be seen from the below Figure, the City's watermains make up 86% of the water network based on replacement value.

If this total asset value ($486.8 million) is translated to an average value per household assuming 10,140 properties, then the average household would have an investment of approximately $48,007 in water network assets.

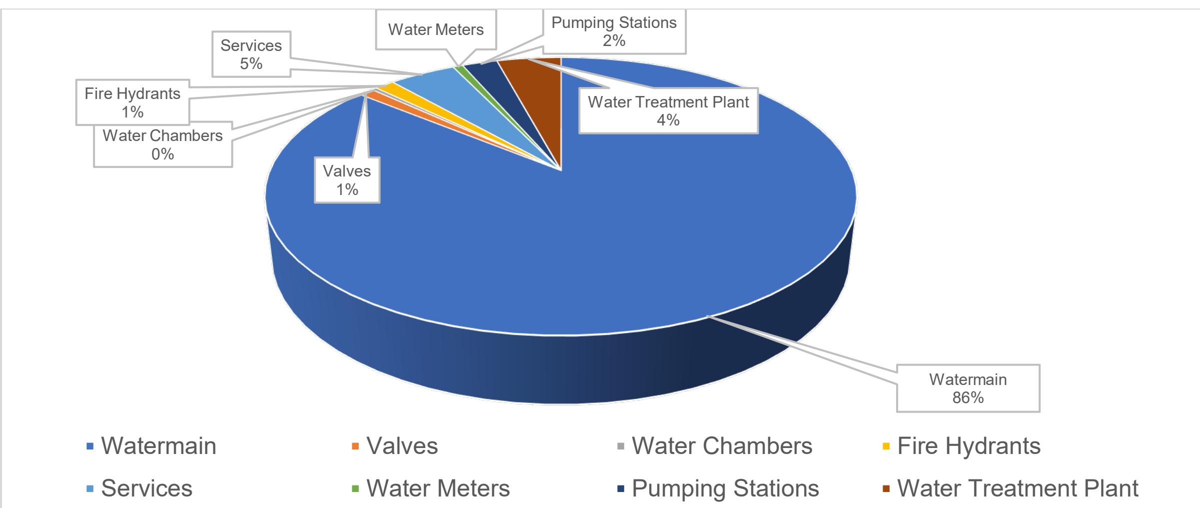



**Figure 1.5.1: Breakdown of Water Network Components by Replacement Value**

### 1.5.1.1.3. Average Age

The generalized values used for the typical expected useful life of the water network assets are summarized in the next Table. It should be recognized that the actual asset life is influenced by many variables such as installation practices, soil conditions, uneven manufacturing quality, local weather conditions, etc., and may be greater than the expected useful life in favourable conditions. City staff will continue to refine the asset's expected useful life as more specific data becomes available.

**Table 1.5.3: Water Network Useful Life and Age**

| Asset Type | Asset Component | Average Estimated Useful Life (EUL) | Average Age | Condition |
|---|---|---|---|---|
| **Water Network** | Watermain | 80 years | 61 years | Poor[49] |
| | Valves | 40 years | 57.7 years | Very Poor |
| | Valve Chambers | 80 years | 35.1 years | Fair |
| | Fire Hydrants | 75 years | 36.1 years | Fair |
| | Services | 75 years | 38.7 years | Fair |
| | Water Meters | 40 years | 33years | Very Poor[50] |
| | Pumping Stations[51] | 65 years[52] | 31years | Fair |
| | Water Treatment Plant (WTP)[53] | 60 years | 39.1 years[54] | Poor |

### 1.5.1.1.4. Condition

Condition of water assets is determined through a mix of hiring third-party consultants to complete assessment reports, staff completing visual inspections, analyzing the material and/or age of asset components, and supplemented by professional judgment.

---

[49] *Although the average age of watermain network is 61 years (76.5% of its expected useful life), inspection results available for some assets indicate a significantly better condition profile. This highlights the importance of inspection-based assessment over age-only evaluations.*

[50] Condition data based on available 2022 records and is not fully complete. While majority of assets were classified as being n fair condition, the database may not reflect current asset performance. An update to the condition assessment is recommended to support accurate planning and risk analysis.

[51] Includes Beattie Street Booster Pumping Station (BPS) and East Hill Booster Pumping Station (BPS)
**Beattie St. BPS**: constructed in 2005 to address low pressure concerns in the SW quadrant of the City. The facility has not undergone any additional upgrades or expansions since its initial construction. The facility consists of four 25 HP pumps.
**East Hill BPS**: constructed in 1960 in order to serve the City's East Hill pressure zone. At the time of construction, the facility consisted of three pumps (two 75 HP pumps and one 60 HP pump with a back-up diesel generator). In 1999, pump number two was removed and replaced with a larger 250 HP pump and several other mechanical, electrical, and structural upgrades were completed at the same time. In 2004, a self-contained stand-by power diesel generator was installed in addition to structural and electrical upgrades to support the new equipment. In 2014, pumps number one and three were replaced with two 200 HP pumps in addition to other facility upgrades.

[52] the average EUL and average age from the table above represent the overall averages. Within each pumping station there are various structural, electrical, mechanical, and other components that have an EUL of anywhere from 20 – 65 years and an average age of 7 – 65 years

[53] Originally constructed in 1966. Has been expanded/upgraded in 1980, 2000, 2003, and 2006.
**1980 expansion**: to add additional capacity. Construction of second treatment train, addition of another clear well.
**2000 upgrade**: replace and upgrade generator.
**2003 upgrade**: installation of UV reactors, upgrades to fluoridation system, new coagulant chemical tank and pumps, addition of SCADA system components, installation of new vitalization system, installation of new emergency shower.
**2006 upgrade**: addition of residual management facility (to remove suspended solids from water drained during backwashing operations in the gravity media filters, prior to discharging water into Georgian Bay), expansion to the Chlorine gas room, expansion to the loading dock.

[54] the average age represents the overall average. Within the WTP there are various structural, electrical, mechanical, and other components that have an average age of 7 – 65 years. Average age was calculated through using a weighted average of the age of the original structure and the age of asset components newly implemented through the various updates. Assumption that age is based on 50% of plant being the age of the original construction, 10% being the age of the 1980 update, 15% being the age of the 2003 upgrade, and 25% being the age of the 2006 upgrade based on the magnitude and scale of the upgrades.

The next Table outlines the condition of each component in the water distribution network based on current replacement cost.

**Table 1.5.4: Water Network Condition by Replacement Value**

| Asset Type | Asset Component | Good $ | Fair $ | Poor & Very Poor $ |
|---|---|---|---|---|
| **Water Network** | Watermain[55] | 319,990,768 | 26,885,302 | 71,501,338 |
| | Valves | 11,439 | 1,155,812 | 3,584,065 |
| | Valve Chambers | 264,268 | 1,157,281 | 211,297 |
| | Fire Hydrants | 1,558,980 | 3,869,196 | 803,303 |
| | Services | 4,402,235 | 7,096,928 | 9,627,699 |
| | Water Meters | 450,000 | 2,437,035 | 250,000 |
| | Pumping Stations | 5,440,833 | 5,686,241 | 12,107 |
| | Water Treatment Plant | 5,309,721 | 12,938,033 | 2,147,260 |
| | **Total Water Distribution Network** | 337,428,244 | 61,225,828 | 88,137,068 |

The next Figure demonstrates that about 69% of the water network is in good condition, representing approximately $337.4 million; however, about 18% of the water network is in poor condition, representing approximately $88.1 million.

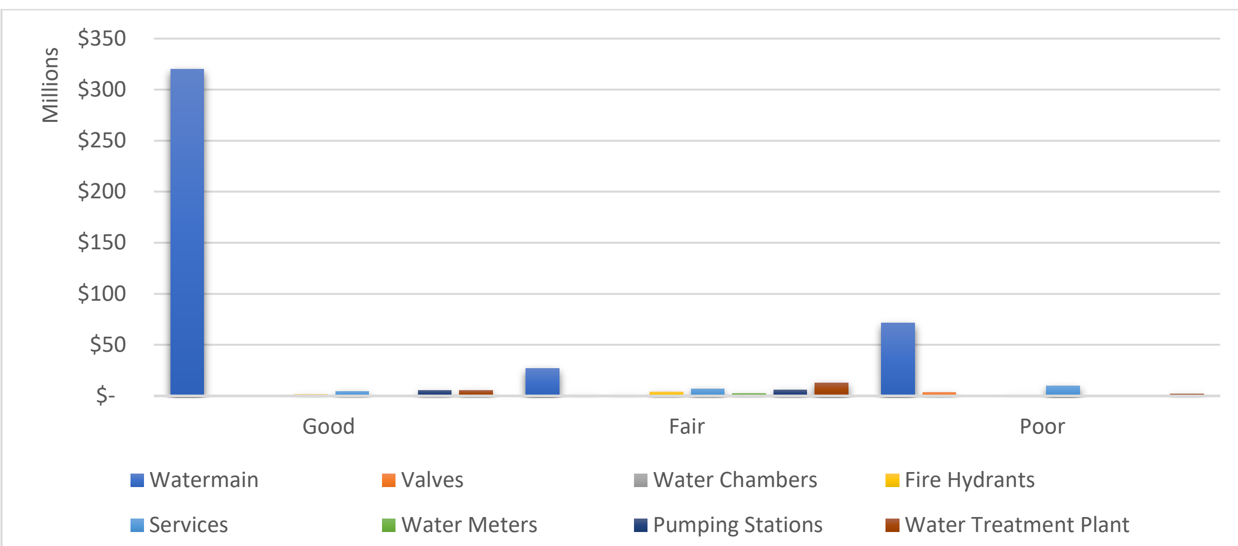



**Figure 1.5.2: Breakdown of Water Network Component Conditions by Replacement Value**

55 Inspection data were available for most watermains; therefore, the condition analysis is based on both inspection results and the age of the infrastructure.

### 1.5.2. Level of Service (LOS)

This document outlines both the Customer (qualitative) and Technical (quantitative) Levels of Service for the municipal water system. It reflects the City's commitment to protecting public health, property, and the environment while meeting or exceeding legislative standards.

## 1.5.2.1. Scope

The next Figure provides an overview of the City’s municipal water system.

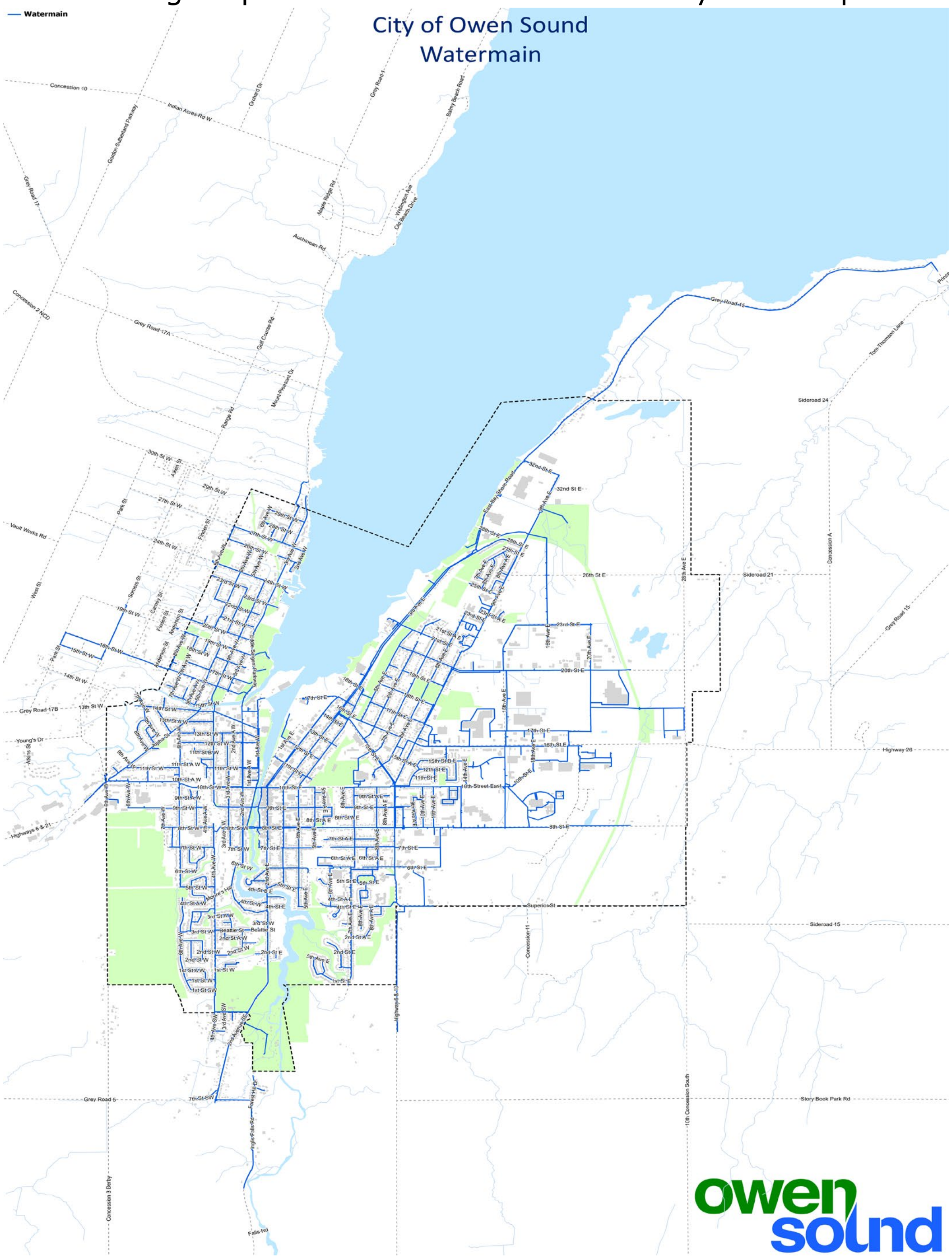



**Figure 1.5.3: Overview of the City’s Water Network**

### 1.5.2.2. Community Levels of Service (Qualitative Descriptions)

#### 1.5.2.2.1. Service Area Coverage

The City of Owen Sound Provides municipal water service to approximately 7,372 properties, including about 7,000 residential and 372 commercial connections. This accounts for 99.9% of all properties in the City. The remaining 11 properties that are not connected to the system are located in rural or difficult to service areas, primarily in the southeast area of the City.

#### 1.5.2.2.2. Fire Flow Availability

All properties that are connected to the municipal water system are also provided with fire protection services. Hydrant spacing typically adheres to a 90-metre interval standard with a few exceptions. As a result, 99.9% of City properties benefit from accessible fire flow capabilities, which significantly enhances community safety and fire response effectiveness.

#### 1.5.2.2.3. Reliability

The City of Owen Sound experiences very few boil water advisories. When one has occurred, it has been out of an abundance of precaution. The following is an excerpt taken from a 2018 precautionary boil water advisory and provides a general description of the event:

> *"The City of Owen Sound has issued a precautionary boil water advisory for a portion of the City water system in a small area in the south end near Greenwood Cemetery. This boil water advisory is being issued because of adverse bacteriological test results in the distribution system.*
>
> *Persons in the affected area will be receiving a door-to-door notice. If you are in the affected area, please boil all water used for drinking, preparing food, beverages, ice cubes, washing fruits and vegetables or brushing teeth. Infant formulas should be prepared using boiled tap water, at all times. It's not necessary to boil tap water used for other household purposes, such as showering, laundry, bathing or washing dishes. Water should be brought to a rolling boil for 2 minutes.*
>
> *Adequate chlorine residual has been confirmed in the distribution system. Samples to confirm bacteriological water quality have been taken and sample results should be received by Friday, September 21st. The City will advise affected residents when this advisory is lifted."*

#### 1.5.2.2.4. Watermain Breaks

Other service interruptions experienced by the City are watermain breaks. These are more frequent than boil water advisories, with an average of 20 watermain breaks occurring each year[56]. Watermain breaks may be caused by sudden changes in the temperature, excess pressure on pipes, or aging equipment, among other things. The following is an excerpt taken from a watermain break notice and provides a general description of the event:

> *"Alpha Street will be closed from 9th Avenue West (Nicol's Gully) to 11th Street West effective immediately for an emergency watermain break repair. There may be interruptions to water services in the area."*

All explanations of Customer Level of Service (LOS) have been summarized in the next Table.

### 1.5.2.3. Technical Levels of Service (Quantitative Metrics)

The municipality's water system demonstrates a high level of technical performance across key indicators, reflecting strong infrastructure coverage and reliability. Currently 99.9% of all properties are connected to the municipal water system, meeting nearly full network coverage. Similarly, 99.9% of properties have access to fire flow, indicating a robust fire protection service supported by well-distributed hydrant infrastructure.

In terms of water quality and operational reliability, the system maintains zero connection - days under boil water advisories, highlighting effective water safety management and minimal public health disruptions.

The impact of watermain breaks remains low, with approximately 20[57] breaks per year and 0.27%[58] of connection-days affected. This suggests that while aging infrastructure presents challenges, well-established response protocols and overall system resilience help minimize service downtime.

All explanations of Customer and Technical Level of Service (LOS) have been summarized in the next Table.

---

[56] The data is based on 2020-2022 reporting period. As of the publication of this report, compliance data for 2023 and 2024 is not yet fully verified. This value is therefore considered provisional and will be updated once more recent data becomes available.

[57] Most main breaks are resolved in 1 days or less, therefore total number of days is the same as total number of main breaks

[58] Calculated as: 20/7372

**Table 1.5.5: Customer and Technical LOS for Water Network**

| Customer Level of Service (Qualitative) | | | |
|---|---|---|---|
| **Attribute** | **Performance Measure** | **Current Performance[59]** | **Target LOS[60]** |
| Accessibility/service coverage | Service area coverage | 7,372 of 7383 properties connected (99.9%); only 11 rural/unserved properties in Southeast (SE) of the City area | 100% of eligible properties connected. |
| Emergency readiness/fire protection | Fire flow availability | All 7372 connected properties have fire flow protection; hydrant spacing typically 90 m | 100% of connected properties; hydrants within 90-100 m spacing |
| Public health risk/communication | Service reliability – boil water advisories | Boil water advisories are extremely rare and mostly precautionary. The last major advisory was in 2018. The City has effective public notification procedures. | No avoidable advisories, 100%complience with public communication protocols |
| Reliability | Service reliability - Watermain Breaks | Approx. 20 WM breaks/year; often due to aging infrastructure or temperature changes; service interruptions may occur. | Fewer than 15 breaks per year per 100 km of pipe (industry benchmark); minimal service disruption |
| Water quality | Reduce number of annual water quality complaints | 24 complaints/year | Maintain current average |
| Pressure measurement/service reliability | Reduce number of annual water pressure complaints | 7 complaints/year | Maintain current average |

[59] The data is based on 2022 reporting period. As of the publication of this report, compliance data for 2023 and 2024 is not yet fully verified. This value is therefore considered provisional and will be updated once more recent data becomes available.

[60] Target Levels of Service (LOS) are intended to guide planning and investment decisions; however, they must be refined using the most current and accurate data. Until such refinements are made, the City's primary strategy remains the maintenance of existing LOS to ensure service continuity and stability.

| Technical Level of Service (Quantitative) | | | |
|---|---|---|---|
| **Attribute** | **Performance Measure** | **Current Performance** | **Target LOS** |
| Network coverage | % of properties connected to the water system | 99.9% of properties are connected | Maintain current coverage |
| Emergency response | % of properties with fire flow | 99.9% | Maintain current coverage |
| Service quality/health impact | Connection-days under boil water advisory | 0%[61] | Within target level |
| Operation disruption | Connection – days due to WM breaks | 0.27% | ≤ 0.1%; focus on reducing through asset renewal and preventive maintenance |
| Efficiency/ Non-Revenue Water | Reduce annual volume of unconnected water ($m^3$) | 3,050,622m$^3$ of unconnected (non-revenue or lost) water annually. | Year-over-year reduction (e.g., 10% decrease over 5 years) |
| Asset condition/ infrastructure health | Improve overall physical condition of municipal water assets | 69% of assets are in good condition | Maintain current condition |

## 1.5.3. Asset Management Strategy

### 1.5.3.1. Overview

An asset management strategy is a set of planned actions that will enable the asset to provide the agreed upon levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost.

61 $\frac{\text{days} \times \text{affected properties}}{Total\ properties}$

### 1.5.3.2. Risk Management

Risk management is essential to maintaining reliable, safe, and sustainable water networks. It helps ensure that potential service disruptions, environmental impacts, and financial losses are identified early and addressed before they escalate.

#### 1.5.3.2.1. Scoring Probability of Failure (PoF)

The Probability of Failure (PoF) represents the likelihood that a water asset will fail based on its current physical condition. PoF is assigned using a standardized 4-point scale, where assets in good condition receive a score of 1 and those in very poor condition receive a score of 4. This approach allows condition data to be translated into a consistent measure of failure risk across all asset types.

#### 1.5.3.2.2. Scoring Consequence of Failure (CoF)

To understand the potential service impact of each wastewater asset type, a Consequence of Failure (CoF) framework has been developed. This framework evaluates each asset class across four critical service impact categories:

- **Safety**: Failures may cause contamination or pressure loss, posing health risks, especially near critical users such as hospitals, schools, or care facilities.
- **Service Disruption**: The likelihood and severity of interruptions can affect households, businesses, or essential services, depending on asset location and function.
- **Financial impact:** The direct and indirect costs associated with failure, including emergency repairs and damages.
- **Environmental impact**: Failure can cause flooding, environmental harm, and public dissatisfaction, especially in urban or sensitive areas.

Once each asset type was scored across the four CoF categories, an average was calculated to produce a single CoF score per asset. For example, Valves had category scores of 2 (for safety), 3 (for service disruption), 2 (for financial impact) and 1 (for environmental) resulting in an average CoF of 2. Location, diameter and accessibility are some other parameters that are usually considered in CoF criteria. For watermains, the diameter of the pipes has been considered for CoF development. Also, water treatment plant received the maximum possible CoF average of 4 indicating the high criticality. This average serves as a concise representation of the asset's overall criticality and can be used in conjunction with condition-based Probability of Failure (PoF) scores to determine total risk. Location, diameter, and accessibility are additional parameters typically considered in the CoF criteria. Overall, the CoF is developed based on the most readily available data.

#### 1.5.3.2.3. Risk Matrix

A risk-based prioritization matrix was developed by calculating a risk score for each asset using a combination of PoF and CoF. PoF was determined based on asset condition using a standardized 1- 4 scale. CoF was assessed using multiple weighted criteria, including safety, service disruption, financial impact, and environmental impact, each scored from 1 to 4 and averaged to represent overall consequences. Once Risk score was calculated, it was used to extract and aggregate the replacement value of assets falling within each risk level. This enabled the development of a color-coded 4×4 risk matrix, where the total replacement cost exposure is visualized by risk category. Each cell in the matrix represents a unique risk score calculated as PoF×CoF, with color-coding to highlight priority levels.

- **Green (Low Risk):** Minimal consequence and/or low likelihood of failure.
- **Yellow (Moderate Risk):** Manageable risk requiring routine monitoring.
- **Orange (High Risk):** Significant risk needing planned intervention.
- **Red (Very High Risk):** Critical assets with high replacement costs and failure impacts; prioritized for renewal.

An estimated risk matrix for the City's water network assets can be seen in the Figure below.

| PoF | | | | |
|---|---|---|---|---|
| 4 | $ 13,536,985 | $ 3,795,062.55 | | |
| 3 | $ 58,214,353 | $ 10,431,301.20 | | $ 2,159,367 |
| 2 | $ 29,322,337 | $ 13,279,217.09 | | $ 18,624,274 |
| 1 | $ 5,130,255 | $ 246,706,063.41 | $ 61,283,706 | $ 24,308,220 |
| | 1 | 2 | 3 | 4 |

CoF

**Figure 1.5.4: Replacement Value based Risk Matrix for Water Network[62]**

The matrix helps to visually identify high-value assets with deteriorating conditions which pose a greater risk to service, cost, and compliance. Through this, the matrix supports data driven investment decisions.

## 1.5.4. Lifecycle Activities

The lifecycle activities outlined in Tables below represent recommended works that should be undertaken to maintain and enhance the performance of the water distribution network. These tables also provide estimated costs [63] associated with each activity.

**Table 1.5.6: Water Network Lifecycle Activities – Minor Maintenance**

| Asset Component | Minor Maintenance Activity Options | Approximate Cost |
|---|---|---|
| Hydrants (Fire Fighting and Flush Types) | Provide visual inspection for damage, tampering, vandalism, missing parts, need for paint | $5/hydrant |
| | Check for adequate water pressure and flow rates (may only be required on an as- needed basis if a change in use is proposed or problems are noted). | $75/hour (as required) |
| | Check for operation, exercise valves, flush lead/barrel, verify that barrel has drained. Where the hydrant services a 'dead end' | $40/hydrant/visit |

[62] All information are based on available data.
[63] The cost estimations presented are approximate and based on 2022 data. As many of the recommended lifecycle activities have not yet been undertaken, the estimates reflect available information at the time of analysis and may be subject to change as more accurate data becomes available.

| | | |
|---|---|---|
| | flushing should occur to clear the volume of water main with potentially stale water. | |
| Hydrants (Winter Maintenance) | Clear snow from access to fire hydrants.<br>Install and remove fire hydrant markers with the change in seasons<br>If valves are not non-freezing, there will be extra maintenance. | $25/hydrant (twice/yr)<br>$5/hydrant marker/visit (twice/yr) |
| Main Line Valves | Check valves for operation and exercise (Valve Maintenance Program). | - $100/valve |
| PRVs & other Specialty Valves | Provide visual inspection for signs of wear, corrosion, build-up or any abnormal conditions | - $100/chamber (twice/yr) |

**Table 1.5.7: Water Network Lifecycle Activities – Major Maintenance**

| Asset Component | Major Maintenance Activity Options | Approximate Cost |
|---|---|---|
| Main Line Valves | - Check valves for operation and exercise (Valve Maintenance Program). | - $100/valve |
| Mains and/or Services | - Traditional Replacement: water only (emergency) | - $550 to $1,300 per metre (varies by diameter & depth) |
| PRVs & other Specialty Valves | - Check valves (including isolation valves) for operation and exercise.<br>- Each valve on the system should be disassembled and inspected annually, diaphragm and discs to be replaced if they show any signs of wear. Manufacturer's recommendations for regular maintenance details should be referenced. | - $10/chamber<br>- $500/chamber |
| Water Meters | - Water Meter maintenance activities undertaken by Water Distribution Coordinator. | - $150 per meter |

**Table 1.5.8: Water Network Lifecycle Activities – Rehabilitation**

| Asset Component | Rehabilitation Activity Options | Approximate Cost |
|---|---|---|
| Mains | - Trenchless Lining | - $500/metre (varies on diameter, must replace valves, fire hydrant leads, & services) |
| Mains/ Services | - Spot repair of Main or Services | - $5,000 to $25,000 (incl. restoration) |
| Main Line Valves | - Significant repair or replacement of valves coming out of Valve Maintenance Program. | - $5,000 to $25,000 varies on size, depth & extent of repair (incl. restoration) |
| Trunk Line Valves in Chambers | - Maintenance needs specific to trunk valves. | - $2,000 to $3,000 more for extensive rebuilds. |
| Hydrants | - Hydrant Repair | - $100 to $200 more for extensive rebuilds. |
| Hydrants | - Hydrant Painting | - $80/hydrant<br>- $20/hydrant for touch-up |
| Anodes | - Replace every 25 years to protect City’s ductile iron trunk water mains. | - $250/anode (incl. restoration) |

**Table 1.5.9: Water Network Lifecycle Activities – Replacement**

| Asset Component | Replacement Activity Options | Approximate Cost |
|---|---|---|
| Mains and/or Services | - Traditional Replacement as part of full reconstruction (planned) | - $400 to $1,000 per metre (varies by diameter, depth & soil conditions) |
| PRVs & other Specialty Valves | - Replace Valves and/or Chambers | - $10,000/valve<br>- $50,000/chamber |
| Hydrants | - Hydrant Replacement | - $7,000/hydrant (incl. restoration) |
| Water Meters | - Replacement of meters with upgraded units. | - $175/meter |

There are many risks associated with lifecycle activities of assets. When developing a standard timeframe for when maintenance should occur, the municipality must balance the cost of doing frequent maintenance versus the risks of waiting long periods of time between maintenance activities.

If the City does not perform the above-mentioned lifecycle activities, the water network is at risk of structural compromise that could lead to main breaks, water contamination issues, pipe freezing, the need for boil water advisories, etc. This would not only lead to an inconvenience for residents and have a large impact on their daily lives, but it would also result in the City's reputation and reliability being tarnished.

As previously mentioned, performing lifecycle activities (such as repairs, maintenance, etc.) and investing funds on a regular basis is the most cost-effective way to manage an asset throughout its lifecycle. Although the municipality has to put funds into an asset on more occasions, the sum of the funds is less than if the municipality puts funds into the asset one time when the asset has deteriorated to such a level that it is incredibly costly to restore it to a useable condition. Therefore, it is important to perform the lifecycle activities mentioned above on a predetermined, recurring schedule. The costs of performing these lifecycle activities should be considered in terms of staff time and budgetary dollars required. In order to ensure the lifecycle activities are performed at the lowest cost, the City should make note of best practices, issue well-developed RFPs to obtain competitive bids from third-parties and stay up to date on the current and expected industry trends/standards.

## 1.5.5. Financial Strategy

### 1.5.5.1. Funding vs. Need

In the next Figure, the funding deficit for the water network is shown. The orange bar represents the average annual capital spending required to meet all current and future financial obligations while the green bar represents the average annual operating spending. The blue horizontal line represents the estimated average budgeted spending[64]. It should be noted that in general, operating requirements for the water network are fully covered based on the average annual operating budget. The average annual deficit is comprised of capital shortfalls.

The total average annual funding deficit for the water network is $17,993,232. The average annual requirement is 24,130,914[65] and current average spending is $6,137,682, giving a funding vs. need ratio of approximately 25.4%.

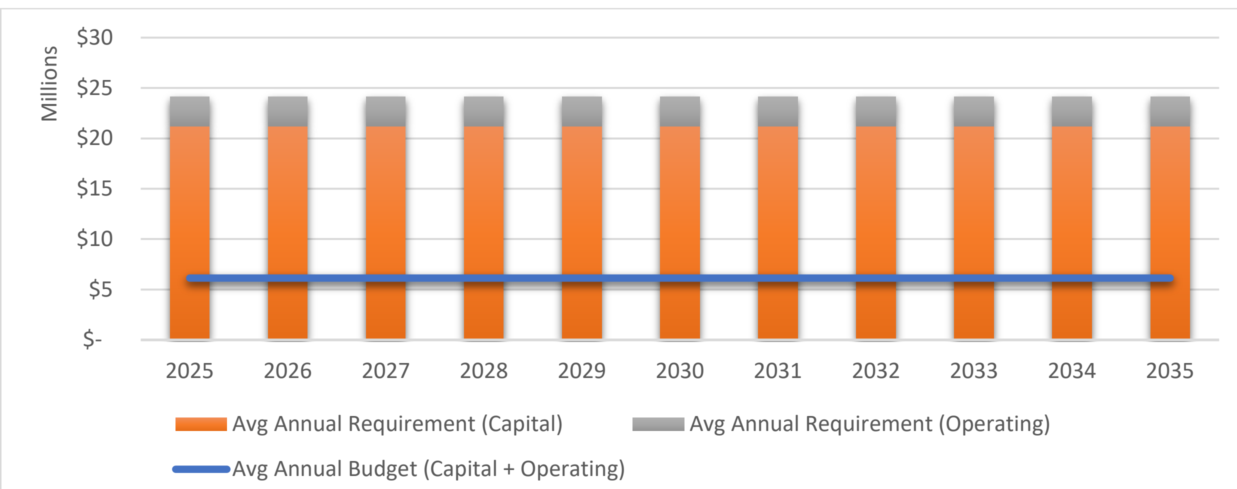



**Figure 1.5.5: Water Network Funding Requirement - Summary**

[64] Average budgeted spending includes both capital and operating budget. Based on an average of the five-year capital budget and two-year operating budget.
[65] Average annual requirement (capital) is calculated based on the average of the upcoming 10-year actual anticipated requirement. Where insufficient or unreliable data exists, the average annual requirement (capital) is calculated by taking the CRC for each asset component divided by the years of life remaining (EUL – average age).

The below Figure shows the actual annual anticipated requirement[66] as well as the backlog[67] requirement for assets that are at or beyond their estimated useful life.

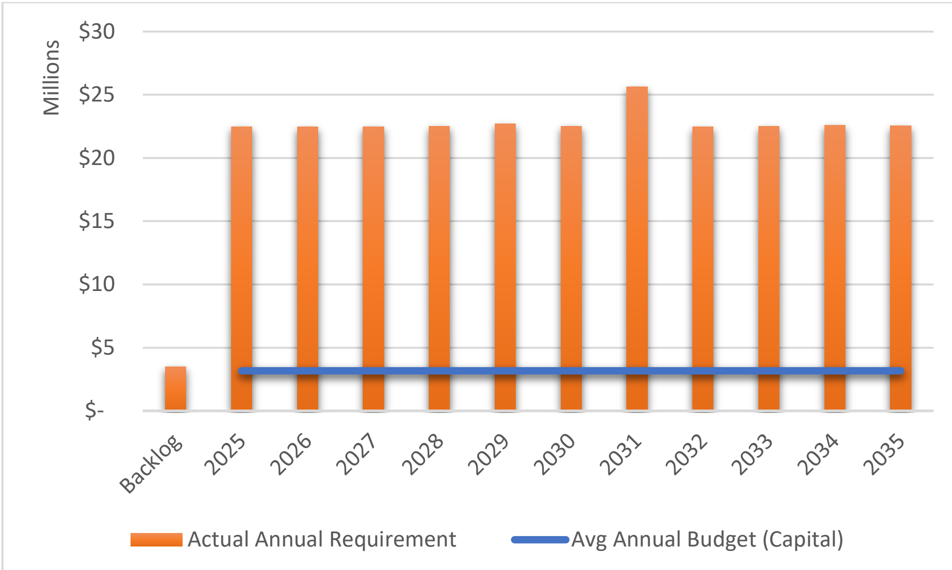



**Figure 1.5.6: Water Network Funding Requirement – Actual Annual Requirement**

Although relatively small, most of the backlog is comprised of valve chambers that are at or beyond their EUL; however, asset age data should be supplemented by condition assessments to determine if the asset does need to be renewed.

## 1.5.6. Improvement Plan and Recommendations

The following recommendations for the next 10-Year are based on the review of current management practices, developed LOS, inventory, valuation and condition analysis. Their achievement is contingent upon the development of a more accurate and informed Level of Service (LOS) framework. Until such a framework is in place, the City's primary strategy remains the maintenance of current service performance levels.

---

[66] Only depicts capital requirement and budget. Does not include operating data.
67 Although relatively small, most of the backlog is comprised of valve chambers that are at or beyond their EUL; however, asset age data should be supplemented by condition assessments to determine if the asset does need to be renewed.

**Table 1.5.10: Asset Management Planning Recommendations – Water Network**

| Items | Current LOS | Target LOS | Recommendations |
|---|---|---|---|
| Improve overall asset condition | 69% of assets rated good | Maintain current condition | -Develop Prioritized renewal plan based on risk and condition scoring. For example, target pipes over 50 years old or those with multiple breaks for scheduled replacement.<br>-Implement regular inspections, and a scoring system integrated with GIS mapping to correlate asset condition ratings.<br>-Develop a comprehensive lifecycle management plan to ensure component quality and extend the useful life where possible.<br>-Seek out potential funding resources and allocate targeted capital funding to address assets in poor/very poor categories. Increase annual rehabilitation budget to ensure sufficient funding to increase renewal rate and close the condition gap.<br>- Coordinate bundle renewal projects with other utility work, such as road resurfacing or sewer upgrades, to enhance cost-efficiency and minimize delays.<br>-Implement trenchless rehabilitation methods (e.g., CIPP lining) to extend asset life with less disruption and lower cost than full replacement.<br>-monitor asset performance using smart water technologies, like using pressure, flow, or acoustic sensors to detect early failure in aging pipes.<br>-Apply Deterioration Modeling to predict future condition decline; Forecast when today's fair pipes will become poor and intervene earlier.<br>- Conduct planned inspections using CCTV, condition scoring, and valve/hydrant inspections. |
| Increase percentage of properties | 99.9% | 100% of eligible | -Maintain current service level |

| | | | |
|---|---|---|---|
| connected to the municipal water system | | properties connected | |
| Ensure full fire flow coverage for all properties connected to the municipal water network | 99.9% of connected properties have fire flow; hydrants spaced is 90 m | 100% | -Upgrade undersized watermains and ensure compliant hydrant distribution |
| Maintain zero connection-days under boil water advisories in the municipal network | 0% (vary rare; last major event in 2018) | 0 % avoidable advisories | -Maintain treatment quality and clear emergency response procedures |
| Reduce connection-days affected by watermain breaks in the municipal network | 0.27%, approx. 20 breaks per year | Maintain current average | -replace aging infrastructure; prioritize renewal of watermains based on age, material and historical failure.<br>-implement predictive maintenance strategies; introduce acoustic or pressure monitoring sensors for real-time leak detection and early failure warning. |
| Increase pace of Service Restoration time after failure | Moderate, occasional delays due to isolation or access | Maintain average downtime | -Improve valve condition and operability as most valves are in poor or very poor condition<br>-update isolation maps<br>-increase redundancy and crew readiness |
| Increase customer satisfaction | Generally low complaint rate | Maintain average satisfaction rate | -improve communication during service issues<br>-increase visibility of planned work by providing advance notice for planned disruptions<br>- Flush dead-ends and monitor chlorine residuals regularly to maintain high water quality |

| | | | |
|---|---|---|---|
| Lower asset risk profile | Some high – risk pipes identified | Majority of assets rated low to moderate risk | -Apply risk-based planning and targeted capital investment |

owen sound
where you *want* to live

# 2025

# Asset Management Plan

# Wastewater Network

## 1.6. Wastewater Network

The City's Wastewater asset components are broken out into 6 asset classes and include the following:

- **Wastewater Collection Pipe or Sanitary Sewer Main**: Underground pipes that transport wastewater from homes and businesses to treatment facilities or other conveyance systems.
- **Sanitary Sewer Manhole**: Vertical access points to sewer systems, used for inspection, maintenance, and ventilation.
- **Wastewater Services**: Encompasses all infrastructure involved in the collection, transmission, treatment, and disposal of wastewater.
- **Wastewater Force Main**: Pressurized pipes that carry wastewater from pump stations to discharge points, typically uphill or over long distances.
- **Wastewater Pumping Station**: Facilities that use pumps to move wastewater through the system when gravity flow is not feasible.
- **Wastewater Treatment Plant/Station (WWTP)**: Facilities that treat wastewater to remove contaminants before releasing it into the environment.

The Asset Management Plan (AMP) for core assets was previously addressed in the City of Owen Sound's 2022 AMP. This report supports the development of the City's 2025 AMP, focusing on wastewater assets within the Core Assets category.

### 1.6.1. State of Infrastructure

#### 1.6.1.1. Wastewater

The following information regarding wastewater network asset data is compiled from various incomplete databases, professional expertise, dated inventory maps, 3-D imaging, and as-built drawings.

##### 1.6.1.1.1. Inventory

The wastewater network that serves the City of Owen Sound consists of various types and diameters of sanitary collection pipes, manholes, force mains, wastewater services, pump stations, and a wastewater treatment plant. These components have been identified in the Table below.

**Table 1.6.1: Wastewater Network Inventory**

| Asset Type | Asset Component | Quantity |
|---|---|---|
| **Wastewater Network** | Collection Pipes | 118.2 km |
| | Manholes | 1,636 units |
| | Force Main | 3.6 km |
| | Wastewater Services | 7,000 units |
| | Pump Stations | 8 units |
| | Wastewater Treatment Plant | 1 unit |

### 1.6.1.1.2. Current Replacement Cost

The replacement cost for the wastewater network was estimated using current standards, historical tender pricing, and current market replacement values. The estimated replacement value of the wastewater network and associated components, based upon current dollar value (2025) is $ 429 million. The following Table and associated Figure provides a breakdown of the contribution of each of the network components to the overall system value.

**Table 1.6.2: Wastewater Network Replacement Value**

| Asset Type | Asset Component | Quantity | Replacement Value $ (2025) |
|---|---|---|---|
| **Wastewater Network** | Collection Pipes | 118.2 km | 284,588,550 |
| | Manholes | 1,636 units | 19,386,547 |
| | Force Mains | 3.6 km | 2,062,493 |
| | Wastewater Services | 7,000 units | 13,175,548 |
| | Pump Stations | 8 units | 15,685,176 |
| | Wastewater Treatment Plant (WWTP) | 1 unit | 94,111,054 |
| | **Total Wastewater Network** | | 429,009,367 |

As can be seen from the Figure below, the City's sanitary collection pipes make up over 66% of the wastewater network based on replacement value.

If this total asset value ($429 Million) is translated to an average value per household assuming 10,140 dwellings, then the average household would have an investment of approximately $42,309 in wastewater network assets.

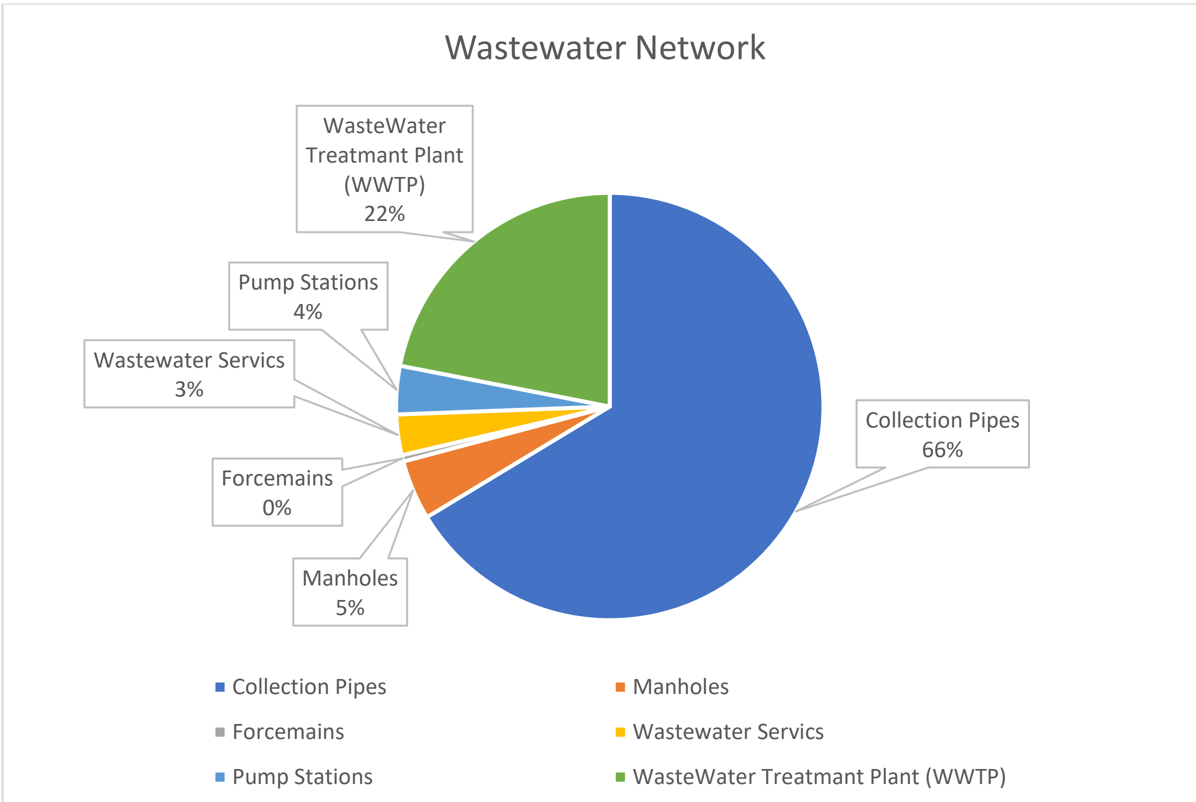



**Figure 1.6.1: Breakdown of Wastewater Network Components by Replacement Value**

#### 1.6.1.1.3. Average Age

The generalized values used for the typical expected useful life of the wastewater network assets are summarized in the Table below. It should be recognized that the actual asset life is influenced by many variables such as installation practices, soil conditions, uneven manufacturing quality, local weather conditions, etc., and may be greater than the expected useful life in favourable conditions. City staff will continue to refine the asset's expected useful life as more specific data becomes available.

**Table 1.6.3: Wastewater Network Useful Life**

| Asset Type | Asset Component | Average Estimated Useful Life (EUL) | Average Age | Condition |
|---|---|---|---|---|
| **Wastewater Network** | Collection Pipes | 80 years | 57.3 years | Poor[68] |
| | Manholes | 80 years | 60.2 years | Poor |
| | Force Mains | 80 years | 48.8 years | Fair |
| | Wastewater Services | 80 years | 30.7 years | Good |
| | Pump Stations | 35 years | 36.6 years[69] | Very Poor |
| | Wastewater Treatment Plant (WWTP) | 60 years | 21 years[70] | Good |

#### 1.6.1.1.4. Condition

The condition of wastewater assets is determined through a mix of hiring third-party consultants to complete assessment reports, staff completing visual inspections, analyzing the material and/or age of asset components, and supplemented by professional judgment.

The Table below outlines the condition of each component in the wastewater network based on the current replacement cost.

**Table 1.6.4: Wastewater Network Condition by Replacement Value**

| Asset Type | Asset Component | Good $ | Fair $ | Poor & Very Poor $ |
|---|---|---|---|---|
| **Wastewater Distribution** | Collection Pipes | 7,327,962 | 137,996,858 | 139,263,730 |
| | Manholes | 531,231 | 6,441,987 | 12,413,328 |
| | Force Mains | 612,761 | 69,850 | 1,371,977 |
| | Wastewater Services | 13,175,548 | - | - |
| | Pump Stations | 3,921,294 | - | 11,763,882 |
| | Wastewater Treatment Plant (WWTP) | 42,349,974 | 42,349,974 | 9,411,105 |
| | **Total Wastewater Distribution Network** | 67,918,770 | 186,858,669 | 174,224,023 |

[68] Based on available inspection data for some assets and age-based assessment, the condition is more accurately categorized as fair, though nearing the threshold to Poor.
[69] Pump station ages range from 1 to 48 years old. One of the older pump stations was built in 1962 but underwent a major internal upgrade in 2005; 1962 has been used as its in-service date, although a lot of the components are much newer. Additionally, one of the middle-aged pump stations is set for renewal later in 2022; however, that has not been considered in the average age calculation above.
[70] Originally constructed in 1962. The plant has undergone several substantial upgrades over the last several decades, with the most recent (and notable) upgrade completed in 2017. This latest upgrade allows for additional biological treatment, filtration, and disinfection of wastewater before it is discharged back into the Bay. Due to the magnitude of the 2017 update, about 60% of the WWTP can be considered essentially a new facility from this date, with 35% being considered "new" from 1990, and 5% being considered "new" from 1962. Therefore, the average age was calculated as (2025-2017) * 0.60 + (2025-1990) * 0.35 + (2025-1962) * 0.05.

The Figure below demonstrates that about 60% of the wastewater network is in good and fair condition, representing approximately $254.8 million; however, about 41% of the wastewater network is in poor and very poor condition, representing approximately $174.2 million.

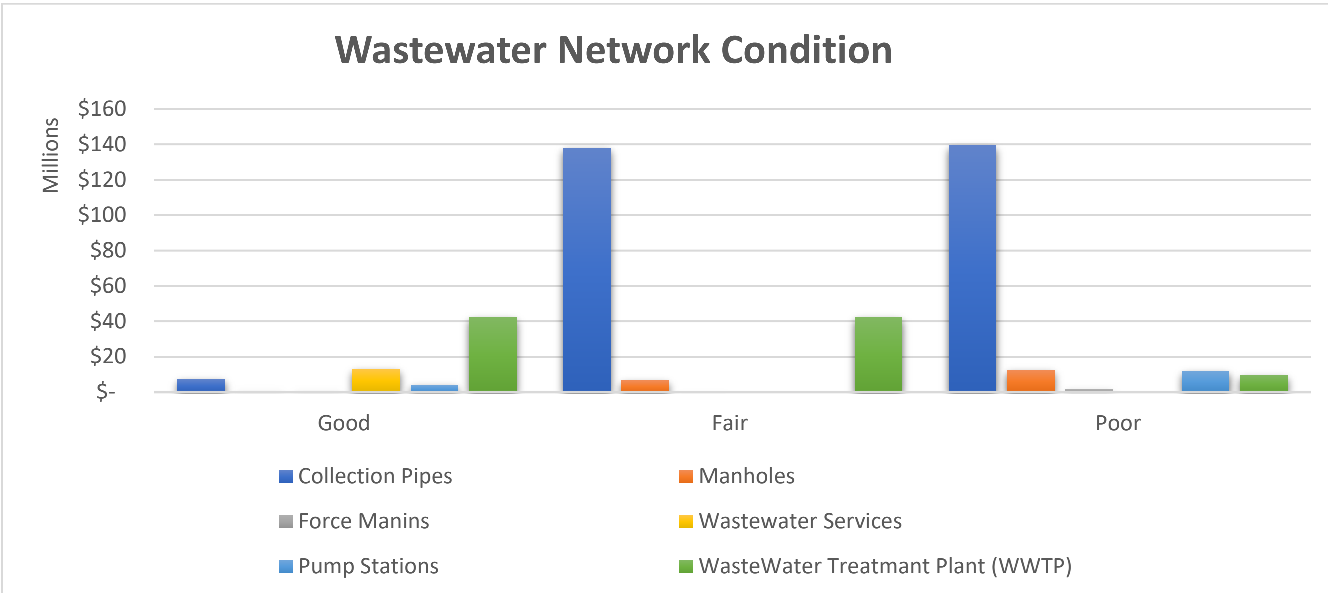



**Figure 1.6.2: Breakdown of Wastewater Network Component Conditions by Replacement Value**

## 1.6.2. Level of Service (LOS)

This document outlines both the Customer (qualitative) and Technical (quantitative) Levels of Service for the municipal wastewater system. It reflects the City's commitment to protecting public health, property, and the environment while meeting or exceeding legislative standards.

### 1.6.2.1. Scope

All properties within City limits are serviced with City sewers (wastewater system) except 36 locations which are rural (Southeast area of the City) or where service is not feasible.

The below Figure provides an overview of the City's sanitary sewer (wastewater) system.

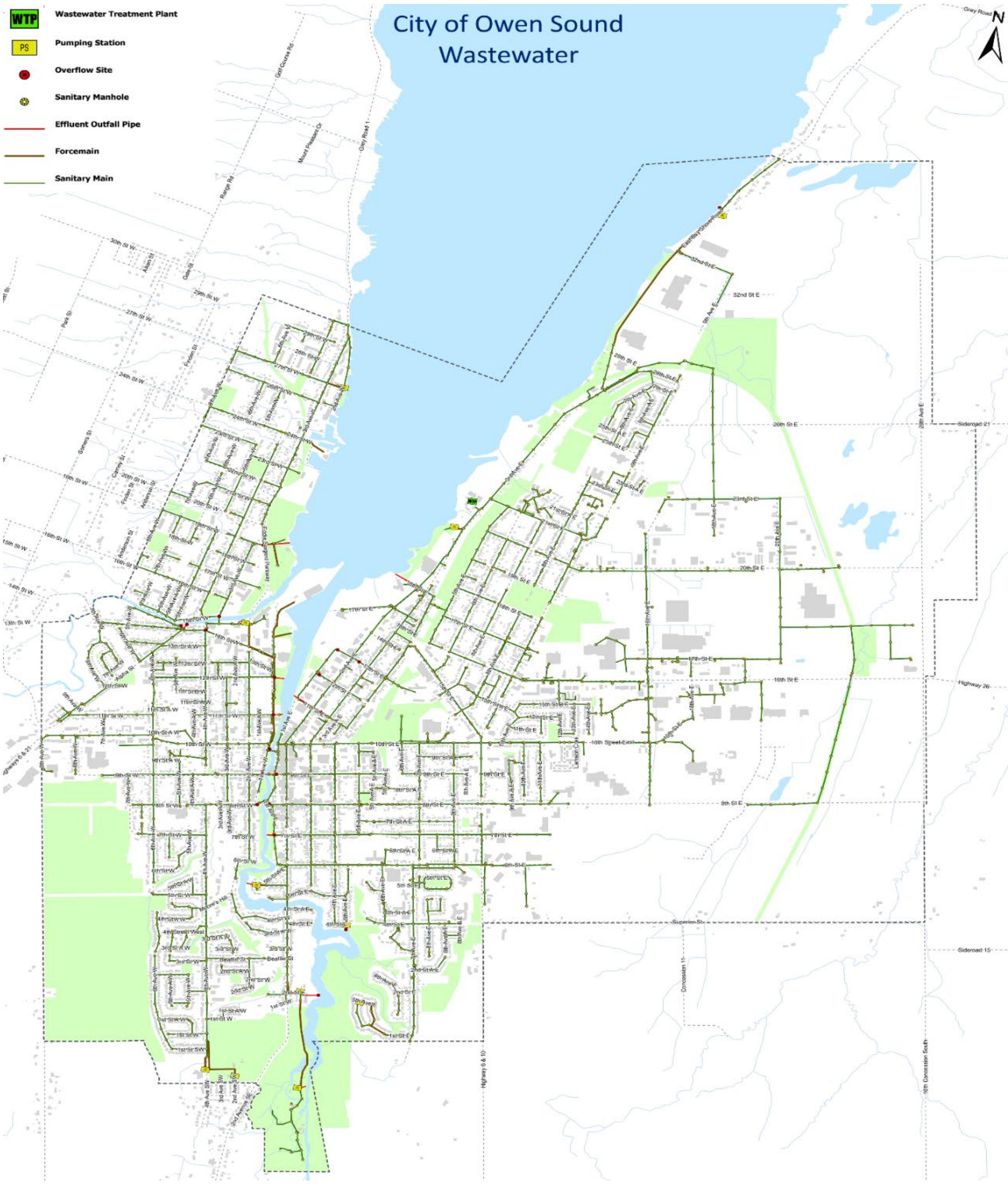



**Figure 1.6.3: Overview of the City's Wastewater Network[71]**

[71] This is an image for illustrative purposes.

#### 1.6.2.2. Community Levels of Service (Qualitative Descriptions)

The design of combined sewers within the municipal wastewater system incorporates overflow structures to prevent backups into homes during storm events. These structures are strategically placed at various locations, particularly where trunk sewers on the east and west sides of the City receive flows from branch sewers. This design ensures that when wet weather flows exceed sewer capacity, the overflow is directed to receiving waters, thereby safeguarding residential areas.

Overflows in combined sewers can occur in habitable areas or beaches, with the Pottawatami River, Sydenham River, and Owen Sound Bay being potential recipients of these overflows. Typically, five overflow events occur annually, with an average volume of 11,000 cubic meters. These events highlight the need for ongoing monitoring and management to protect these vulnerable areas.

Stormwater infiltration into sanitary sewers is another concern, as it can lead to sewage backups into homes. While sewage rarely overflows into streets, backups into homes can occur due to stormwater sources on private property during wet weather. Additionally, sanitary sewers can become surcharged during such conditions, exacerbating the issue.

To mitigate these risks, the design of sanitary sewers includes resilience measures. Overflow locations at trunk sewer connection points provide relief to the system, preventing backups into homes. This proactive approach ensures that the system remains robust and capable of handling increased flows during adverse weather conditions.

Effluent discharged from sewage treatment plants is subject to stringent provincial Environmental Compliance Approval (ECA) requirements. The wastewater treatment plant (WWTP) employs Biological Aerated Filter (BAF) technology for secondary treatment, ensuring compliance with standards for Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Phosphorous, and Ammonia. This technology plays a crucial role in maintaining high effluent quality and protecting the environment.

All explanations of Customer Level of Service has been summarized in Table 5, together with Technical Level of Service explanations.

#### 1.6.2.3. Technical Levels of Service (Quantitative Metrics)

The municipal wastewater system boasts a high connectivity rate, with 99.5% of properties linked to the system, which underscores the city's commitment to ensuring widespread access to essential wastewater services.

The municipal wastewater system experiences an average of five events per year where combined sewer flow exceeds system capacity. Given the total number of properties connected to the system (7,347), this represents a mere 0.07% of properties affected by such events.

Wastewater backups, though infrequent, do occur. On average, there are six backups per year from the public side of the lateral, each lasting approximately two days. This results in 12 connection-days per year where a wastewater backup is in effect, affecting 0.2% of the connected properties.

Effluent violations due to wastewater discharge are exceptionally rare, with only one violation recorded in the past three years. This translates to an average of 0.33 violations per year, impacting just 0.005% of the connected properties. Such low figures reflect the city's effective management and adherence to regulatory standards.

The city's wastewater network is dedicated to preserving the existing collection system with the overarching goal of protecting public safety, health, property, and the natural environment. This commitment is aligned with legislative requirements for wastewater quality, which support sustainable community growth and economic development. The current performance is rated as good, with continuous efforts to improve.

Quantitatively, 62% of the wastewater network is in fair, good or excellent condition. The wastewater treatment plant (WWTP) consistently meets approval for effluent quality every month, with zero bypass incidents reported annually. Additionally, the city receives an average of three sanitary complaints per year, indicating a generally satisfactory level of service.

All explanations of Customer and Technical Level of Service (LOS) has been summarized in the next Table:

**Table 1.6.5: Customer and Technical LOS for Wastewater Network**

| Customer Level of Service (Qualitative) | | | |
|---|---|---|---|
| **Attribute** | **Performance Measure** | **Current Performance [72]** | **Target LOS[73]** |
| Reliability | Description of overflow design in combined sewers | Trunk sewers with overflow structures on east/west sides to prevent backups during wet weather | Maintain or enhance overflow management infrastructure to further reduce overflow risk |
| Reliability | Frequency and volume of combined sewer overflows in habitable/beach areas | 5 events/year; 11,000 m³/year average overflow into rivers or Owen Sound Bay | Maintain current average |
| Reliability | Description of how stormwater enters sanitary sewers and causes backups | Rare overflows into streets; backups may occur in homes due to private property sources or surcharged sanitary sewers | Eliminate street overflows; implement I&I[74] reduction program for private property sources. |
| Reliability | Resilience measures in sanitary sewer design to avoid backups | Overflow relief provided at trunk connection points to protect homes | Expand resilience features across more connection points and critical areas. |
| Environmental Compliance | Description of effluent from wastewater treatment plants | Secondary treatment using BAF; meets BOD, TSS, Phosphorous, Ammonia standards under ECA | Maintain full compliance and explore opportunities for enhanced nutrient removal. |

[72] The data is based on 2022 reporting period. As of the publication of this report, compliance data for 2023 and 2024 is not yet fully verified. This value is therefore considered provisional and will be updated once more recent data becomes available.

[73] Target Levels of Service (LOS) are intended to guide planning and investment decisions; however, they must be refined using the most current and accurate data. Until such refinements are made, the City’s primary strategy remains the maintenance of existing LOS to ensure service continuity and stability.

[74] Inflow and Infiltration (I&I) refers to unintended stormwater or groundwater entering the sanitary sewer system through direct connections (inflow) or through cracks and defects in pipes and manholes (infiltration), increasing risk of system overflows and backups.

| | | | |
|---|---|---|---|
| General Service Commitment | To preserve the existing wastewater collection system with the goal of protecting public safety, health, property, and the natural environment while meeting or exceeding all legislative requirements for wastewater quality that will enable sustainable community growth and economic development. | Fair to good, with continuous improvement focus | Achieve a Good overall service rating by enhancing system reliability, ensuring sustained compliance with health, environmental and legislative standards. |
| Customer Service | Number of sanitary complaints received annually | 3 complaints/year | Maintain average complaints |
| **Technical Level of Service (Quantitative)** | | | |
| **Attribute** | **Performance Measure** | **Current Performance** | **Target LOS** |
| Accessibility | % of properties connected to the wastewater system | 99.5% of properties are connected | 99.9% |
| Reliability | Events per year where combined sewer flow exceeds system capacity | 5 events/year → 0.07% of 7,347 connected properties | Maintain current average |
| Reliability | Connection-days per year with wastewater backups | 6 events × 2 days = 12 connection-days/year → 0.2% | Maintaine current average |
| Environmental Compliance | Effluent violations per year compared to properties connected | 0.333 violations/year [75]→ 0.005% of connections | 0 Violations/year |
| Condition | % of wastewater network in fair/ good/excellent condition | 60% | Maintain current average |
| Treatment Performance | Number of months per year effluent meets environmental approvals | 12 months/year | Maintain 12 month/year |
| Emergency Incidents | Total number of bypass incidents | 0 | Maintain 0 |

[75] The effluent violation data is based on 2020-2022 reporting period, during which one violation occurred. This results in average of 0.33 violations per year, or approximately 0.005% of connected properties. As of the publication of this report, compliance data for 2023 and 2024 is not yet fully verified. This value is therefore considered provisional and will be updated once more recent data becomes available.

### 1.6.3. Asset Management Strategy

#### 1.6.3.1. Overview

An asset management strategy is a set of planned actions that will enable the asset to provide the agreed upon levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost.

#### 1.6.3.2. Risk Management

Risk management is essential to maintaining reliable, safe, and sustainable wastewater services. It helps ensure that potential service disruptions, environmental impacts, and financial losses are identified early and addressed before they escalate.

##### 1.6.3.2.1. Scoring Probability of Failure (PoF)

The Probability of Failure (PoF) represents the likelihood that a wastewater asset will fail based on its current physical condition. PoF is assigned using a standardized 4-point scale, where assets in good condition receive a score of 1 and those in very poor condition receive a score of 4. This approach allows condition data to be translated into a consistent measure of failure risk across all asset types.

##### 1.6.3.2.2. Scoring Consequence of Failure (CoF)

To understand the potential service impact of each wastewater asset type, a Consequence of Failure (CoF) framework has been developed. This framework evaluates each asset class across four critical service impact categories:

- **Safety**: The degree to which asset failure could endanger public or work health
- **Service Disruption**: The likelihood and severity of interruptions to wastewater collection or treatment.
- **Financial impact:** The direct and indirect costs associated with failure, including emergency repairs and damages.
- **Environmental impact**: The risk of untreated wastewater discharge into the environment due to system failure.

Once each asset type was scored across the four CoF categories, an average was calculated to produce a single CoF score per asset. For example, collection pipes had category scores of 2 (for safety), 3 (for service disruption), 3 (for financial impact) and 3 (for environmental) out of 4, resulting in an average CoF of 2.75 out of 4, which rounded up to 3 out of 4. Location, diameter and accessibility are some other parameters that are usually considered in CoF criteria. Also, the wastewater treatment plant received the maximum possible CoF average of 4, indicating the high criticality of the asset. This average serves as a concise representation of the asset's overall criticality and can be used in conjunction with condition-based Probability of Failure (PoF) scores to determine total risk. Overall, the CoF is developed based on the most readily available data.

#### 1.6.3.2.3. Risk Matrix

A risk-based prioritization matrix was developed by calculating a risk score for each asset using a combination of PoF and CoF. PoF was determined based on asset condition using a standardized 1- 4 scale. CoF was assessed using multiple weighted criteria, including safety, service disruption, financial impact, and environmental impact, each scored from 1 to 4 and averaged to represent overall consequences. Once the risk score was calculated, it was used to extract and aggregate the replacement value of assets falling within each risk level. This enabled the development of a colour-coded 4×4 risk matrix, where the total replacement cost exposure is visualized by risk category. Each cell in the matrix represents a unique risk score calculated as PoF×CoF, with color-coding to highlight priority levels.

- **Green (Low Risk):** Minimal consequence and/or low likelihood of failure.
- **Yellow (Moderate Risk):** Manageable risk requiring routine monitoring.
- **Orange (High Risk):** Significant risk needing planned intervention.
- **Red (Very High Risk):** Critical assets with high replacement costs and failure impacts; prioritized for renewal.

An estimated risk matrix for the City's wastewater network assets can be seen in the next Figure.

| PoF \ CoF | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 4 | $ 5,082,727 | | $ 128,010,829 | |
| 3 | $ 7,330,602 | | $ 11,252,901 | $ 22,546,964 |
| 2 | $ 6,441,987 | | $ 137,996,858 | $ 42,427,730 |
| 1 | $ 13,706,779 | | $ 4,635,286 | $ 49,576,704 |

**Figure 1.6.4: Replacement Value based Risk Matrix for Wastewater Network**

The matrix helps to visually identify high-value assets with deteriorating conditions which pose a greater risk to service, cost, and compliance. Through the visualized information, the matrix supports data driven investment decisions.

## 1.6.4. Lifecycle Activities

Based on the current 4×4 risk matrix distribution, the majority of wastewater assets based on replacement cost fall within moderate and high-risk categories, indicating growing vulnerabilities that could affect service delivery, environmental compliance, and financial performance if not addressed.

**Table 1.6.6: Risk based Lifecycle analysis**

| Color (Risk Zone) | Replacement Cost | Implication |
|---|---|---|
| Green (Low Risk) | $ 86,774,085 | Long-term life expectancy, minimal intervention needed |
| Yellow (Moderate Risk) | $ 180,424,588 | Some risk; monitoring and future intervention is required |
| Orange (High Risk) | $ 161,810,695 | Elevated risk; likely to require renewal soon |
| Red (Very High Risk) | - | Critical risk |

The distribution of assets across moderate and high-risk categories has direct implications for financial planning. To support proactive decision-making, a tailored lifecycle cost analysis must be developed for all assets. The lifecycle activities outlined in Tables below represent recommended works that should be undertaken to maintain and enhance the performance of the wastewater collection network. These tables also provide estimated costs [76] associated with each activity.

**Table 1.6.7: Wastewater Network Lifecycle Activities – Minor Maintenance**

| Asset Component | Minor Maintenance Activity Options | Approximate Cost |
|---|---|---|
| Sewer Mains and Manholes | - Cleaning and Flushing sewers | - $6.00/m (excl. removal of debris from manholes) |
| Sewer Mains and Laterals | - TV Inspection (incl. cleaning) mains only and/or laterals | - $8/m for mains<br>-$250/lateral |

**Table 1.6.8: Wastewater Network Lifecycle Activities – Major Maintenance**

| Asset Component | Major Maintenance Activity Options | Approximate Cost |
|---|---|---|
| Sewer Mains | - Cleaning with cutters to remove calcite and other debris, flushing debris | - $4.50/m |
| Sewer Mains and/or Laterals | - Traditional replacement: sewer only (emergency) | - $450 to $1,200/m (varies by diameter & depth) |

**Table 1.6.9: Wastewater Network Lifecycle Activities – Rehabilitation**

| Asset Component | Rehabilitation Activity Options | Approximate Cost |
|---|---|---|
| Sewer Mains | - Trenchless sewer lining | - $300 to $800/m (varies by diameter) |
| Sewer Mains/Laterals | - Trenchless spot repair of main or lateral | - $5,000 to $25,000 per location |
| Sewer Mains/Laterals | - Traditional spot repair of main or lateral | - $5,000 to $25,000 (incl. restoration |
| Manholes | - Sealing manholes | - $2,000/manhole |

[76] The cost estimations presented are approximate and based on 2022 data. As many of the recommended lifecycle activities have not yet been undertaken, the estimates reflect available information at the time of analysis and may be subject to change as more accurate data becomes available.

| | | |
|---|---|---|
| Manholes | - Manhole F&G, Modulock replacement | - $250/F&G<br>-$300/m depth modulock |
| Manholes | - Manhole benching repair | - $1,000/manhole |

**Table 1.6.10: Wastewater Network Lifecycle Activities – Replacement**

| Asset Component | Replacement Activity Options | Approximate Cost |
|---|---|---|
| Sewer Mains | - Pipe Bursting | - $300 to $400/m (varies by diameter) |
| Sewer Mains and Laterals | - Traditional replacement: as part of full reconstruction (planned) | - $300 to $850/m (varies by diameter, depth & soil conditions) |
| Laterals | - Pipe bursting | - $2,000/lateral |
| Manholes | - Manhole replacement alone or in combination with any of above. | - $8,000 to $16,000 varies by size & depth |

There are many risks associated with lifecycle activities of assets. When developing a standard timeframe for when maintenance should occur, the municipality must balance the cost of doing frequent maintenance versus the risks of waiting long periods of time between maintenance activities.

If the City does not perform the above-mentioned lifecycle activities, the wastewater network is at risk of structural compromise that could lead to main breaks, wastewater run-off issues, water contamination issues, sewer backup issues, etc. This would not only lead to an inconvenience for residents and have a large impact on their daily lives, but it would also result in the City's reputation and reliability being tarnished.

As previously mentioned, performing lifecycle activities (such as repairs, maintenance, etc.) and investing funds on a regular basis is the most cost-effective way to manage an asset throughout its lifecycle. Although the municipality has to put funds into an asset on more occasions, the sum of the funds is less than if the municipality puts funds into the asset one time when the asset has deteriorated to such a level that it is incredibly costly to restore it to a useable condition. Therefore, it is important to perform the lifecycle activities mentioned above on a predetermined, recurring schedule. The costs of performing these lifecycle activities should be considered in terms of staff time and budgetary dollars required. In order to ensure the lifecycle activities are performed at the lowest cost, the City should make note of best practices, issue well-developed RFPs to obtain competitive bids from third-parties, and stay up to date on the current and expected industry trends/standards.

### 1.6.5. Financial Strategy

#### 1.6.5.1. Funding vs. Need

The Figure below graphs the funding deficit for the wastewater network. The orange bar represents the average annual capital spending required to meet all current and future financial obligations while the green bar represents the average annual operating spending. The blue horizontal line represents the estimated average budgeted spending[77]. It should be noted that in general, operating requirements for the wastewater network are mostly funded. The average annual deficit is comprised of mostly, capital shortfalls.

The total average annual funding deficit for the wastewater network is $9,145,017. The average annual requirement is $13,961,441[78] and current average spending is $ 4,816,424, giving a funding vs. need ratio of approximately 34.5%.

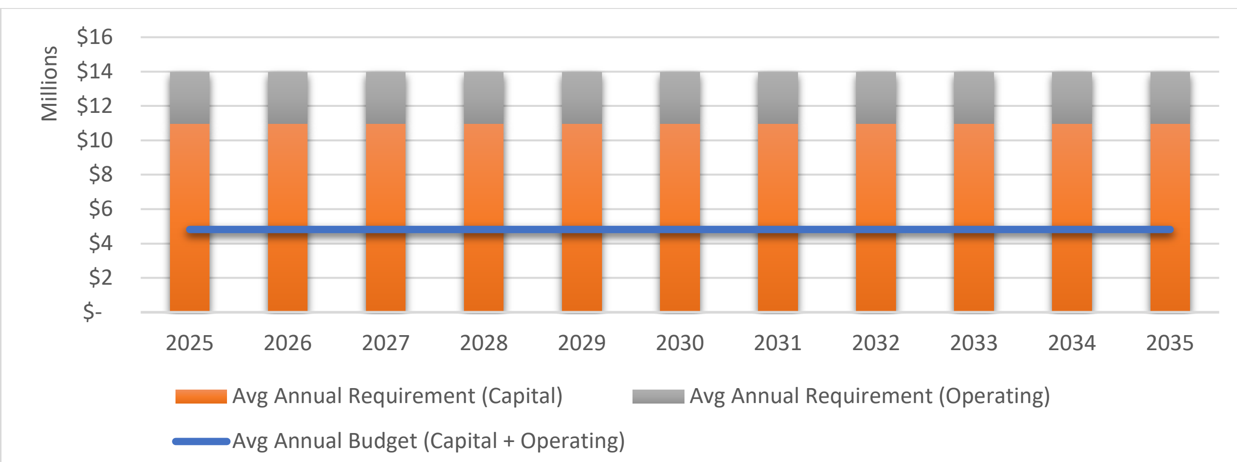



**Figure 1.6.5: Wastewater Network Funding Requirement – Summary**

[77] Average budgeted spending includes both capital and operating budget. Based on an average of the five-year capital budget and two-year operating budget.

[78] Average annual requirement (capital) is calculated based on the average of the upcoming 10-year actual anticipated requirement. Where insufficient or unreliable data exists, the average annual requirement (capital) is calculated by taking the CRC for each asset component divided by the years of life remaining (EUL – average age).

The next Figure shows the actual annual anticipated requirement[79] as well as the backlog requirement for assets that are at or beyond their estimated useful life.

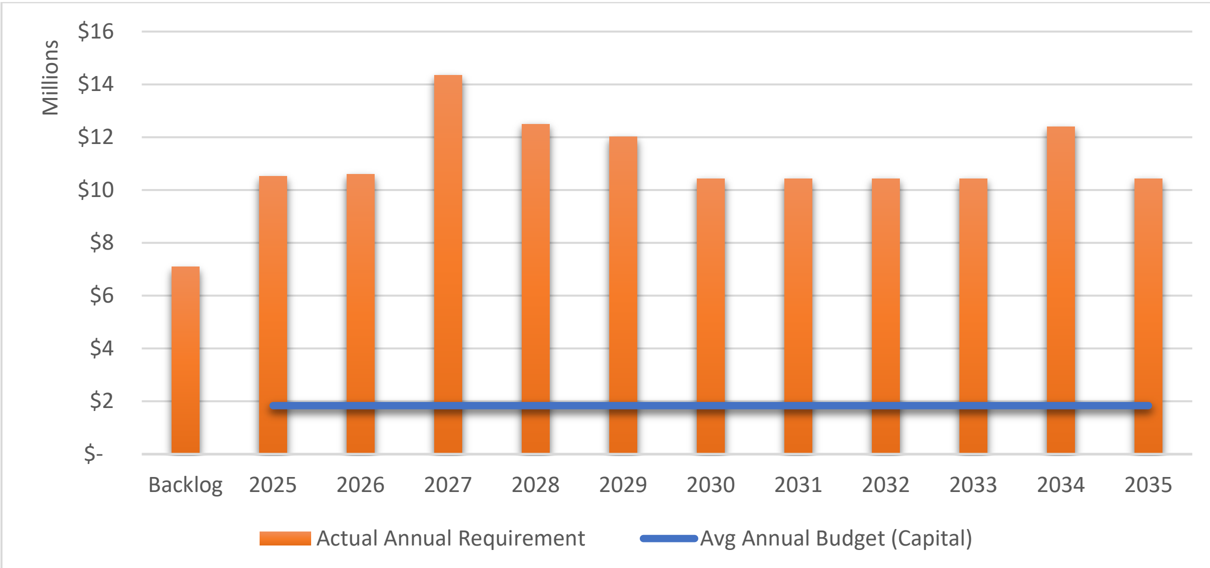



**Figure 1.6.6: Wastewater Network Funding Requirement – Actual Annual Requirement**

## 1.6.6. Improvement Plan and Recommendations

The following recommendations for the next 10-Year are based on the review of current management practices, developed LOS , inventory, valuation and condition analysis. Their achievement is contingent upon the development of a more accurate and informed Level of Service (LOS) framework. Until such a framework is in place, the City's primary strategy remains the maintenance of current service performance levels.

[79] Only depicts capital requirement and budget. Does not include operating data.

**Table 1.6.11: Asset Management Planning Recommendations – Wastewater Network**

| Items | Current LOS | Target LOS | Recommendations |
|---|---|---|---|
| Improve overall asset condition | 60% of assets rated fair or good | Maintain current condition | -Develop prioritized renewal plan based on risk and condition scoring<br>-Implement regular inspections, and a scoring system integrated with GIS mapping to correlate asset condition ratings.<br>-Develop a comprehensive lifecycle management plan to ensure component quality and extend the useful life where possible.<br>-Seek out potential funding resources, and allocate targeted capital funding to address assets in poor/very poor categories.<br>-Increase frequency and scope of condition assessments (e.g., CCTV,…)<br>-Implement trenchless rehabilitation methods (e.g., CIPP lining)<br>-Establish an annual rehabilitation target (e.g., 3-5% of system length) |
| Reduce combined sewer overflows | 5 events/year, 11,000 m³/year overflow | Maintain current average | -Implement I&I reduction in upstream sewers<br>-Progressively separate combined sewer areas |
| Reduce connection-days of backups | 12 connection-days/year → 0.2% | Maintain current average | -Prioritize problem zones identified by historical backup data<br>-Address private side connections and foundation drains<br>-Expand contingency planning for surcharged areas |
| Eliminate effluent violations | 1 violation over 3 years | 0 violations/year | -Increase operational monitoring and process control at treatment plant<br>-Upgrade aging components<br>-Conduct regular operator training and compliance audits |