Municipality of
Dutton Dunwich

Asset Management Plan

2023

The preparation of this project was carried out with assistance from the Government of Canada and the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them."

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1.0 Introduction

The 2023 Asset Management Plan (AMP) provides an update to the Municipality of Dutton Dunwich's (Municipality) 2014 AMP, in alignment with *Ontario Regulation (O. Reg.) 588/17: Asset Management Planning for Municipal Infrastructure*, and as amended by *O.Reg. 193/21*.

The AMP documents the Municipality's assets and strategies based on known information at the time of writing the report and presents a snapshot in time. Assets will continue to deteriorate, and investments will be required to improve the condition and extend the useful life of the infrastructure in order to meet the "fit for purpose" measure of the assets in the delivery of services.

The AMP is intended to be a medium to long-term focused document for the Municipality to use during decision-making processes, including budgeting, and to assist in strategic planning.

1.1 Asset Management Overview

Asset management is a process of making the best possible decisions regarding the creation, maintenance, renewal, rehabilitation, disposal, expansion, and procurement of infrastructure assets. The objective of asset management is to maximize the benefits of the assets, minimize risk and provide satisfactory levels of service to the public in a sustainable manner. It considers risks related to the lifecycle of the assets and requires a multi-disciplinary team of planning, finance, engineering, technology, maintenance, and operations.

Asset management considers the full lifecycle of the infrastructure, not just the initial cost for designing and constructing the asset, but the operations and maintenance each and every year.

Asset management is an integrated approach that municipalities can use to make informed decisions about their infrastructure. At its core, asset management is about delivering services to communities in a sustainable way. The essential questions for asset management, as described in the *InfraGuide: Managing Infrastructure Assets (October 2005),* are:

1. What do you have and where is it?
2. What is it worth?
3. What is its condition and expected remaining service life?
4. What is the level of service expectation, and what needs to be done?
5. When do you need to do it?
6. How much will it cost and what is the acceptable level of risk(s)?
7. How do you ensure long-term affordability?

These seven essential questions align to four phases of asset management: asset inventory, condition, levels of service (LOS) and analysis and strategy development. These questions align with *O.Reg. 588/17* and ISO55000.

1.2 Scope of the AMP

The AMP is a tool for managing the full lifecycle of physical assets that support the delivery of the Municipality's services that meet the required levels of service. It provides a long-term perspective to support decision making regarding repairs, rehabilitation and replacement of the assets and managing risks.

As defined by *O.Reg. 588/17*, the core assets owned by the Municipality and included in the AMP are:

- Roads (Chapter 2)
- Bridges and Culverts (Chapter 3)
- Water (Chapter 4)
- Wastewater (Chapter 5)
- Stormwater (Chapter 6)

The non-core assets owned by the Municipality and included in the AMP are:

- Buildings and Facilities (Chapter 7)
- Fleet and Equipment (Chapter 8)
- Sidewalks (Chapter 9)

1.2.1 Regulatory Alignment

The 2023 AMP is an update to the 2014 AMP which requires alignment with the new regulation, *O. Reg. 588/17,* and as amended by *O.Reg. 193/21*. The regulation requires the following four phases of compliance:

1. By July 2019: Municipalities to have a strategic asset management policy.
2. By July 2023: All core assets to be covered in the asset management plan with current Level of Service (LOS). Core assets include water, wastewater, stormwater, roads and bridges/culverts.
3. By July 2024: All assets owned by the municipality to be covered in the AMP. Non-core assets include buildings, fleet, and equipment as well as green infrastructure assets.
4. By July 2025: Municipalities will have approved proposed LOS and the lifecycle management and financial strategy for 10-year period to achieve the proposed LOS.

This AMP includes current LOS for core and non-core assets owned by the Municipality which meets phase 3 compliance; and proposed (target) levels of service for core and non-core assets, lifecycle management, and financial strategy for 10-year period to achieve the proposed LOS to meet Phase 4 compliance. Future updates will also need to include green infrastructure assets (i.e., natural assets) owned by the Municipality and further assessment on infrastructure vulnerability to the impacts of climate change.

1.3 State of Local Infrastructure

Each section of the State of Local Infrastructure sets out the following information:

- A summary of the assets in the category
- The replacement cost of the assets in the category
- The average age of the assets in the category, determined by assessing the average age of the components of the assets
- The information available on the condition of the assets in the category, and
- A description of the Municipality's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate.

1.3.1 Asset Replacement Costs

The current replacement cost for the Municipality's infrastructure assets is $556,508,000 (in 2023 dollars). The distribution of this replacement cost by asset category is shown in **Figure 1-1**.

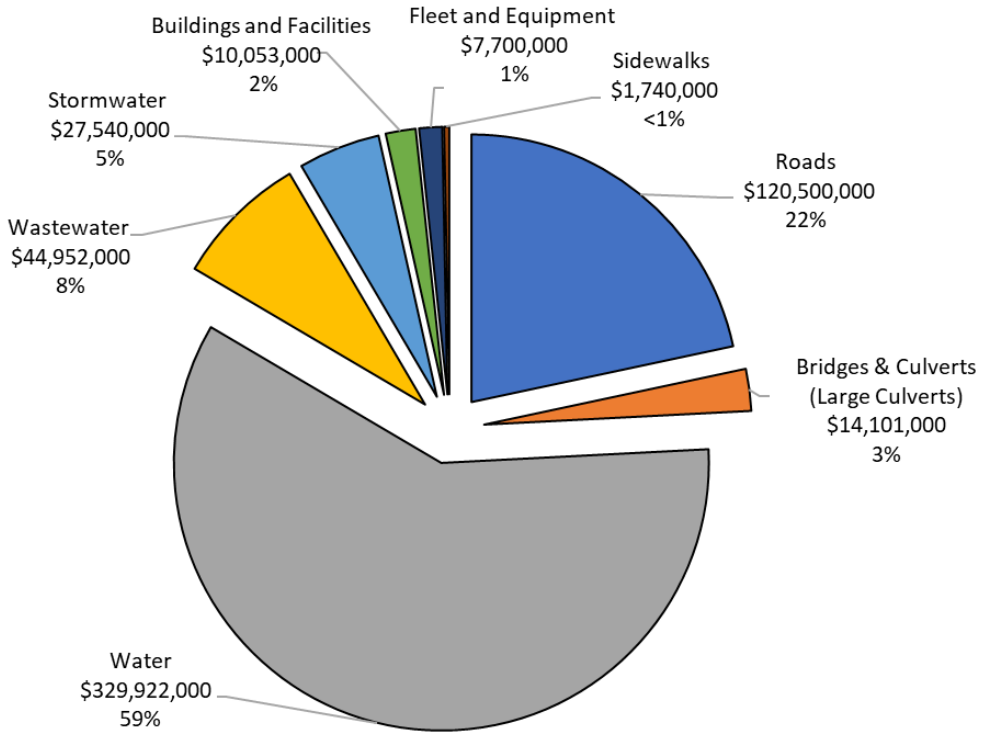


Figure 1-1: Asset Replacement Cost Distribution

Water and wastewater assets make up 67% of the overall replacement costs, with roads and bridges accounting for 25%, stormwater 5%, and buildings and facilities, fleet and equipment, and sidewalks all accounting for 3%.

1.3.2 Condition Ratings

The distribution of available condition ratings for the Municipality's infrastructure assets can be found below in **Figure 1-2**.

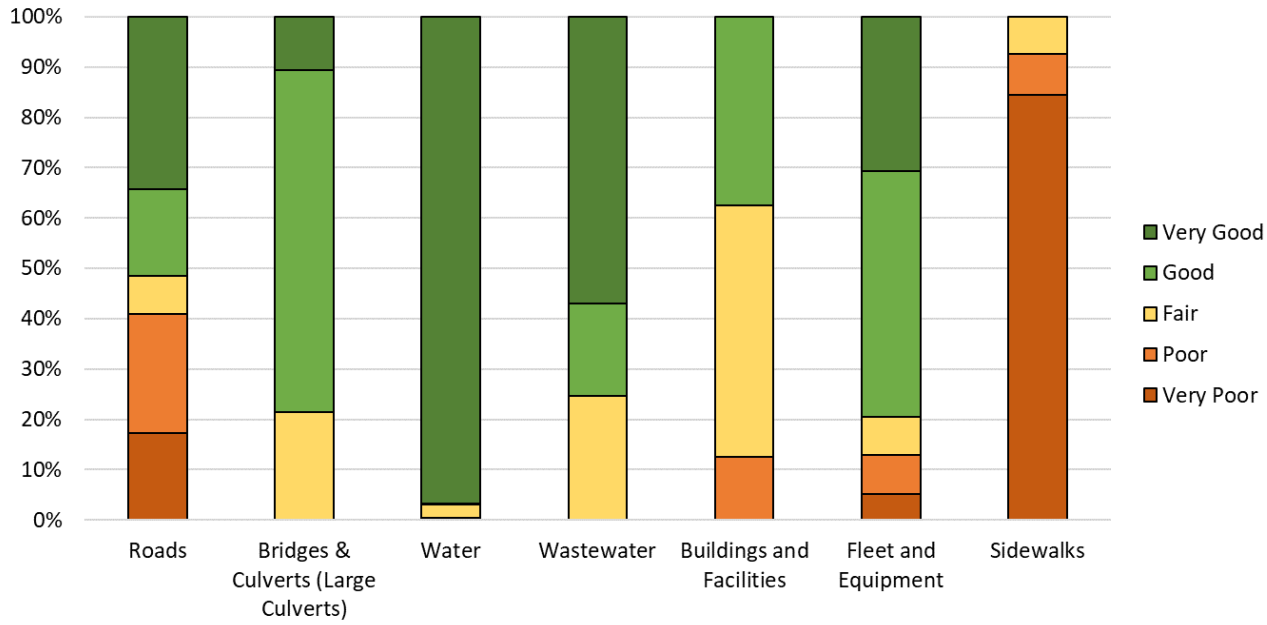


Figure 1-2: Asset Condition Ratings

The detailed condition rating and method for calculating each condition rating is available within each corresponding chapter.

1.4 Levels of Service

The current and proposed Levels of Service (LOS) are described in terms of technical metrics and qualitative descriptions for each asset type. These measures are prescribed for core assets within O. Reg. 588/17. For non-core assets it is up to the Municipality to establish LOS parameters and measures.

LOS are presented in **Figure 1-3** and defined as follows:

- **Community LOS**: LOS that the organization provides to the community, intended to be customer-focused, providing a qualitative description of scope and quality, and

- **Technical LOS**: LOS that the asset is capable of providing to the Municipality which is further measured by the performance of the asset, providing technical metrics that support the delivery of LOS.

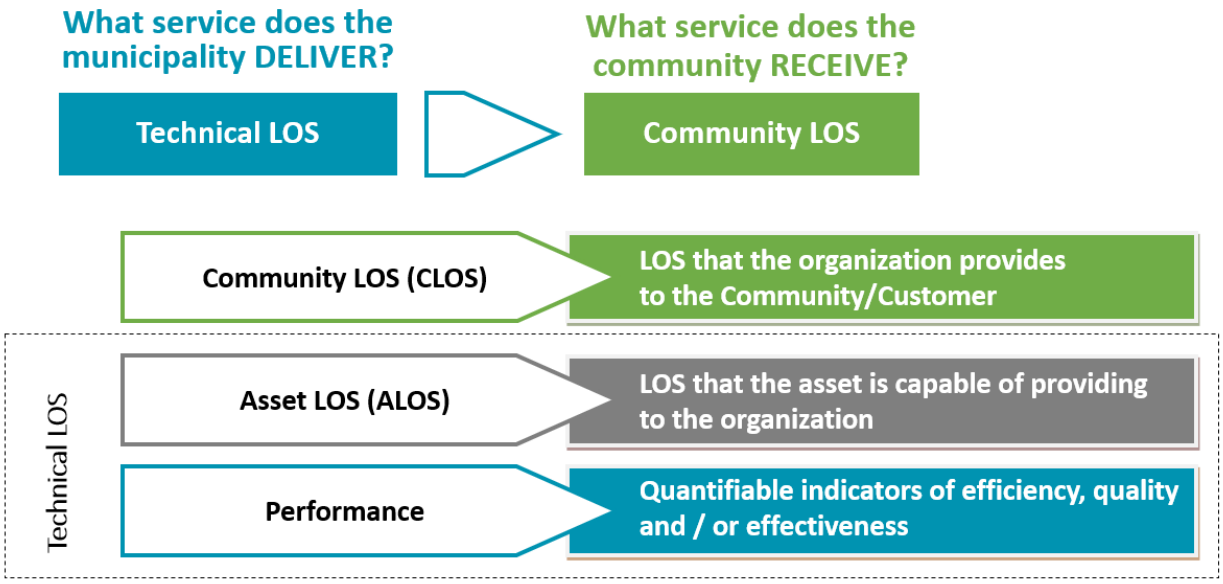


Figure 1-3: Levels of Service (Community LOS, Technical LOS and Performance)

1.4.1 Levels of Service Workshop

A Levels of Service workshop was held with senior staff from the Municipality, representing the departments of Public Works, Parks and Recreation and Finance/Treasury. The workshop was held virtually on June 2, 2022.

The intention of the workshop was to engage with staff and gather qualitative information regarding identification of current levels of service and how levels of service could change in the future. The current services provided, usage of services, performance measures and the community's expectation in terms of current level of service were discussed.

1.4.2 Proposed LOS

The proposed Levels of Service (LOS) is an established target for the Municipality's LOS, set to guide the Municipality in their current and future asset management. Proposed Levels of Service are a requirement for compliance with O. Reg. 588/17. The Proposed LOS established within this report relates to the target to be achieved in 10 years, the year 2033.

To establish the proposed LOS, three scenarios can generally be considered, each using a different level of investment to the infrastructure, and the corresponding impact it will have on the level of service being provided. These scenarios include the following:

- No change in funding – LOS would decrease over time
- Increase in funding – LOS would be maintained over time

- Greater increase in funding – LOS would increase over time (increase would vary depending on funding increase)

The current Levels of Service being provided by the Municipality are generally found to be sufficient. Accordingly, the proposed Levels of Service targets for 2033 will be to maintain the established LOS values from 2023.

The Municipality can continue to evaluate the sufficiency of the Levels of Service on an annual basis and can consider adjusting (increasing or decreasing) as required in future to meet customer expectations, best practices, or funding limitations. Based on the current level of service being provided, the Municipality can consider future adjustments to LOS such as:

- Decrease in current LOS for the water assets. Condition of the network is Very Good, which is likely unsustainable given the expected useful life and average age of the network.
- Increase in LOS for roads, including increase of average condition of the network through increased expenditure for implementation of the lifecycle activities.
- Change in LOS for roads, including changing of surface type from gravel to hard surface, or hard surface to gravel. This would alter the lifecycle activities used for road management, and therefore the annual expenditure.
- Establishment and tracking of LOS for the stormwater assets.
- Change in LOS for buildings and facilities, including review of existing facilities and their condition, performance, usage, etc. The review can consider if there are any modifications to existing or proposed facilities that can be made for more efficient or expanded service delivery as required.

1.5 Risk Assessment

In determining the lifecycle activities for each asset category and identifying the priority activities, the risks associated with the options are to be considered. The risk rating for each asset within the asset category generates a risk profile for the entire asset category.

The assets with the highest risk rating help identify the priorities for the municipality.

As part of assessing risk, this methodology considers the factors that increase the likelihood of a hazard occurring (or non-delivery of service) and the consequence. **Figure 1-4** presents a risk “heat map” plotting likelihood and consequence.

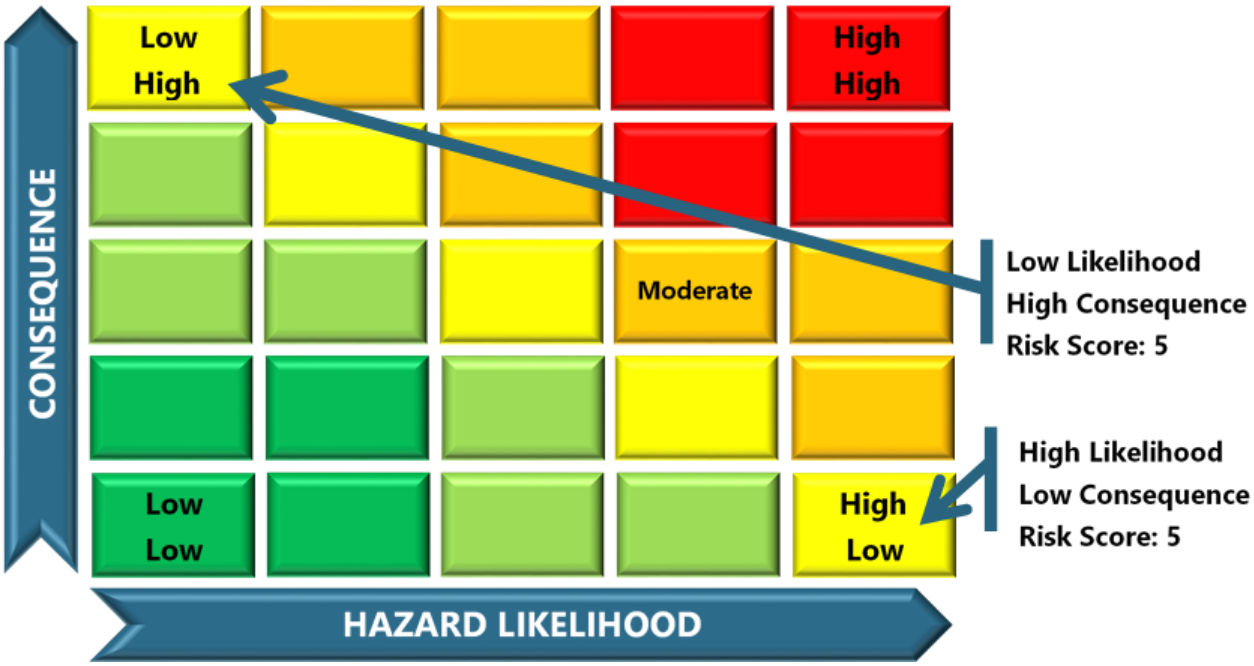


Figure 1-4: Risk Heat Map

A priority rating has been developed based on the calculated risk rating and displayed in **Figure 1-4** in a 5 by 5 matrix. High risks are shown in the red zone (risk rating 17 to 25), Moderate risks are shown in the orange zone (risk ratings of 10 to 16) and Low risks are in the green and yellow zone (risk ratings of 1 to 9).

The approach and methodology to risk assessment is presented in following sections. A risk profile for each asset category is presented in the corresponding asset category chapters.

1.5.1 Risk Methodology Approach

Risk is the likelihood and magnitude of a negative scenario (hazard) occurring that limits the ability of the asset to deliver the service. Risk is the consideration of asset failure and the consequence of the failure.

Risk = Likelihood of Occurrence x Consequence

The consequence considers the severity of the impact, vulnerability of the asset, and exposure to the negative scenario. Applying the methodology of a score of 1 to 5 for the likelihood and the consequence, the maximum risk rating is 25 (high).

1.5.2 Calculation of Likelihood of Occurrence

The factors that contribute to the likelihood of failure include:

- A – Condition of the asset
- B – Performance (reliability)
- C – Vulnerability to climate change

Table 1-1 provides a description of these factors.

Table 1-1: Likelihood Factors

Factors	Low (1)	Moderate (3)	High (5)
A – Condition	Very Good (1)	Good (2); Fair (3)	Poor (4); Very Poor (5)
B – Performance	Always Reliable	Usually Reliable	Not Reliable
C – Climate Change	No or limited impact, quick recovery, or mitigation in place	Limited impact with slower recovery; mitigation plan not in place	Moderate or high impact; no or limited mitigation plan

By separating condition and performance as two separate factors, there is an opportunity to consider assets in Poor condition that may still be performing well, compared to those that are not performing, as well as Good condition assets that may not be reliable. The climate change factor brings into consideration assets that are vulnerable to climate change scenarios such as intense rainfall, increased temperatures, extreme weather, and drought. The climate change rating includes any mitigation activities in the scoring which reduces the risk and lowers the score.

Therefore, the likelihood of failure is (A + B + C)/3 (i.e., the average of the factors, assuming they are equally weighted).

1.5.3 Calculation of Consequence

The question to consider when calculating consequence is: *What increases the impact of non-delivery (or failure of the asset)?*

The factors that contribute to the consequence rating include:

- D – Impact or severity
- E – Importance of the asset in delivering service

Both impact and importance contribute to the consequence and will be multiplied by the likelihood of occurrence. The two ratings are added together for a maximum consequence score of 5. See **Table 1-2** for the description of consequence factors.

Table 1-2: Consequence Factors

Factors	Low	Moderate	High
D – Impact	Low or no impact (0)	Moderate impact (1)	High impact (2)
E – Importance of the asset in delivering service	Low importance (1)	Moderate importance (2)	High importance (3)

A Risk Workshop was held with senior Municipality staff on January 11 and 23, 2023. As part of this workshop, impact ratings were established by considering the following possible areas of consequence and determining an overall rating of high, moderate, or low by taking an average for the impact:

- Safety/Injury
- Financial Loss
- Reputation with Stakeholders
- Environmental Damage
- Loss of Service

The importance ratings were established in consultation with Municipality staff. The most important assets for delivering service were identified, as well as moderate and low importance.

1.5.4 Calculation of Risk

The risk calculation for each of the assets is determined as follows.

Risk= Likelihood of Occurrence X Consequence

Risk = (A + B + C)/3 x (D + E)

Where: A = Condition

B = Performance

C = Climate Change

D = Impact

E = Importance of the asset

1.5.5 Climate Change

In the Risk Workshop, municipal staff considered the following climate change scenarios and identified low, moderate or high vulnerability for each asset category:

- Mean Annual Temperature
- Number of Hot Days (>30°C)
- Heavy Snow Events
- Heavy Rain Events
- Extreme Weather Events
- Occurrence and Magnitude of Flooding

This information was used to inform the assignment of climate change factor (C) in the risk rating calculation for each asset component.

1.5.6 Risk Assessment Limitations and Assumptions

Several key limitations and assumptions were made as part of the risk assessment process, which are summarized below:

- Field condition assessment data was used as available to determine state of infrastructure and risk. In the absence of field condition assessment data, asset age and estimated useful life was used to approximate physical condition.
- Performance of individual assets was assumed as Always Reliable unless otherwise indicated by municipal staff, reviewed reports, or provided asset data.

1.6 Lifecycle Activities

The lifecycle activities include activities that can be undertaken over an asset's useful life. These activities, under *O. Reg. 588/17*, are defined to include constructing, maintaining, renewing, operating and decommissioning of assets and all engineering and design work associated with these activities. Further, *Building Together – Guide for Municipal Asset Management Plans* (Ministry of Infrastructure) categorizes lifecycle activities into the following categories: non-infrastructure solutions, maintenance, renewal/rehabilitation, replacement, disposal, and expansion activities. Lifecycle activities have been identified for each of the asset categories considered within this AMP.

1.7 Asset Management Strategy

The intent of the strategy is to provide guidance for the Municipality in the management of the assets to achieve the goals of the asset management plan. The strategy for each asset type was devised using current practices at the Municipality and recommendations for implementation of new or improved practices that may influence the lifecycle of the asset. The asset management strategy for each asset type includes consideration of the lifecycle activities for that asset type and suggests an overall strategy for the management of the assets over the 10-year timeframe of the AMP.

The asset management strategy for the Municipality assets will employ the lifecycle activities to maximize the useful life and economy of each asset.

The primary indicator used in the development of a lifecycle strategy is the condition of each asset, as it can often be indicative of likelihood of failure of the asset, performance of the asset, and increased risk. The strategy should also consider other factors, such as:

- Importance of the asset
- Asset risk score
- Condition of adjacent sections (linear assets)
- Replacement requirements for adjacent infrastructure

- Expansion or enhancement requirements
- Maintenance frequency and type.

These factors will change throughout the lifecycle of an asset, influenced by age of the asset, usage of the asset, continued development at the Municipality, and changing climate. These factors may impact the lifecycle of an asset, by changing the optimal solution for improving condition and extending the useful life of the asset. Consideration of these factors should be given when devising capital project outlooks and budgeting and updating of the asset management plan.

1.8 Growth

The 2021 Census population of the Municipality was 4,152, which is in the category of "less than 25,000" as established in *O. Reg. 588/17*.

The Municipality of Dutton Dunwich is a part of Elgin County. In reference to the *Official Plan of Elgin County, February 2015.* Elgin County is expected to grow to a population of 54,700 and 55,287 in 2031. This is approximately 16% growth over 20 years.

Growth related assumptions and the potential impact on the lifecycle of the Municipality's assets is presented in **Table 1-3**.

Table 1-3: Growth Related Impacts on Lifecycle of Assets

Asset Category	Growth Impact Assumptions	How Assumptions Relate to Lifecycle of the Assets
Roads	• Increased traffic	• Potential increase in road maintenance costs and capital expenditures
Bridges and Culverts	• Increased usage of bridge crossings by vehicles in the area	• Potential traffic volume delays and mitigation required • Load considerations and regularly scheduled maintenance checks.
Water	• Increased service demands and expansion of network	• Potential increase in capital plan budget to expand network infrastructure and service requirements • Potential increase in operational costs to operate additional pumping and treatment equipment
Wastewater	• Increased service demands and expansion of network • Increased loading on wastewater treatment facility and effluent flow • Increased flow to central collection mains directly upstream of wastewater treatment facility	• Potential increase in capital plan budget due to increase in service network • Potential increase in operational costs due to increase in wastewater treatment volume

Asset Category	Growth Impact Assumptions	How Assumptions Relate to Lifecycle of the Assets
Stormwater	• Increased service demands and expansion of network • Increased storm volumes from urbanization	• Potential increase in capital plan budget due to increase in service network size and capacity
Buildings and Facilities	• Increased facility usage • Changing service demands from aging population	• Increase in capital expenditure for facility development in response to development • Increase in operating costs for facility services and maintenance
Fleet and Equipment	• Increase in service demands - requiring increased operation or capacity at greater distances	• Increased capital costs for purchase of additional assets to meet service needs • Increased operational costs in fleet maintenance and operations consumables
Sidewalks	• Increased pedestrian traffic	• Potential increase in sidewalk maintenance cost • Potential increase in capital expenditure for new development in response to increase in demand

Further, as new residential and commercial development advances within the Municipality, the Municipality will assume ownership of the respective road, water, wastewater, stormwater, and bridge and culvert assets that the developers have installed as part of the required servicing for each development.

1.9 Roadmap with Next Steps

1.9.1 Regulatory Compliance

Annual Report to Council: As required by O. Reg. 588/17, municipalities will report to their Councils at least once per year on the current progress of asset management in the Municipality and any barriers to aligning operations with the AMP.

Full Update of AMP: A full update of the AMP will be required within 5 years.

Enhancements to the AMP: The inclusion of green infrastructure assets (i.e. green assets) owned by the Municipality and assessment of vulnerabilities caused by climate change on the performance of infrastructure. By 2024, establishment of proposed LOS for all assets and a financial strategy to meet the proposed LOS will be required for compliance with the regulation.

1.9.2 Recommendations

Condition Assessments

- Establish a program for regular condition inspections (by professional service providers) to identify the required capital investments for water and stormwater facilities.
- Establish/maintain a condition assessment program for the storm sewers. The recommendation is to use visual inspection facilitated by CCTV or Zoom camera inspection. A typical practice is to undertake assessment of 1/5 to 1/3 of the network annually, such that each pipe gets reviewed in a rotating 3 to 5 year basis.

Performance Data

Expand the collection of performance data to be able to track and report how the assets are performing and to assist the Municipality in establishing targets for proposed LOS.

Financing Strategy

It is recommended that the Municipality reduces its reliance on debt through securing more capital funding through grants and subsidies, tax levy increases, etc.

2.0 Roads

2.1 State of Local Infrastructure – Roads

The Municipality owns and maintains a road network with a total length of 246 km, which includes paved and unpaved road assets. The roads include the following types:

1. Asphalt – Asphalt paved road and shoulder including curb and gutter
2. Tar & Chip – Tar & Chip paved road and shoulder
3. Gravel – Gravel road and shoulder

A summary of the road assets by type is presented in **Table 2-1.**

Table 2-1: Summary of Road Asset by Type

Road Types	Total Length (km)	Replacement Costs ($/m)	Average Age (years)	Expected Useful Life (years)
Asphalt	18.7	$1250/m	28	25
Tar & Chip	30.4	$1250/m	19	10-15
Gravel	196.9	$300/m	20	N/A

2.1.1 Replacement Costs

Replacement costs for all road assets were determined based on recent tender information and product information. The unit replacement costs shown in **Table 2-1** for Asphalt and Tar & Chip surface types include provision for full reconstruction of the road segment, including granular based but excluding adjacent infrastructure (such as drainage works), to estimate the total replacement costs (value) for the road assets.

Note that further in this chapter (Scenario Analysis, **Section 2.7.1**) a higher road reconstruction cost will be used, which accounts for adjacent infrastructure per the Municipality's current road reconstruction strategy.

Using the unit costs provided in **Table 2-1**, the total replacement costs for the Asphalt paved road network is estimated to be $23.4 million, for Tar & Chip paved roads is estimated $38.0 million, and for Gravel roads is estimated to be $59.1 million.

2.1.2 Average Age

The average age of the road network was calculated by road type and averaged by length, as summarized in **Table 2-1.**

2.1.3 Expected Useful Life

The expected useful life values are typical for the road type, and may vary based on road usage, roadside environment, and road design.

2.2 Condition – Roads

Condition of the roads is routinely collected by the Municipality. The most recent condition assessment was undertaken in 2021 which evaluated the condition of the paved road surfaces, which include Asphalt and Tar & Chip road surfaces. The assessment establishes the Pavement Condition Index (PCI) for roadway segments on a scale of 0-100, where 100 represented a road in Excellent condition, and 0 was a Failed asset. A summary of the road condition rating system and total length of road within each condition category is shown in **Table 2-2**.

There are 8.6 km of road network that do not have a PCI rating.

Table 2-2: Road Condition Summary (2021 PCI)

Condition Description	Condition Score Category	Condition Rating	Total Length (m)	Percentage of Network
Excellent	1	85 to 100	13,920	34
Good	2	70 to 85	6,960	17
Fair	3	55 to 70	3,038	8
Poor	4	40 to 55	9,556	24
Very Poor	5	25 to 40	6,694	16
Serious	5	10 to 25	320	1
Failed	5	0 to 10	0	0

Overall, the findings of the 2021 road condition assessment found an overall PCI rating of 0.59 (which corresponds to a value of 3 and descriptor of Fair). The assets were further deteriorated using a model to estimate the current condition, which is estimated to be 0.56 (which corresponds to a value of 3 and descriptor of Fair).

2.3 Current Level of Service – Roads

Levels of service minimum reporting requirements for road assets are outlined in Table 4 of O.Reg. 588/17. **Table 2-3** and **Table 2-4** outline the Municipality's current community and technical LOS for roads.

Table 2-3: Community Level of Service – Roads

Service Attribute	Community Levels of Service (Qualitative Description)	Community LOS
Scope	Description, which may include maps, of the road network in the Municipality and its level of connectivity.	The Municipality has 246 km of paved and unpaved roads. The Municipality is generally connected. The road network is shown in Figure 1 of Appendix A.
Quality	Description or images that illustrate the different levels of road class pavement condition.	Pavement condition was most recently assessed by the Municipality in 2021. The road segment surfaces were visually assessed and provided a condition rating. The rating was assumed to have followed MTO manual guidance.

Table 2-4: Technical Level of Service – Roads

Service Attribute	Technical Levels of Service (Technical Metrics)	Technical LOS
Scope	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the Municipality.	493 lane-kilometers of roadway 294.4 sq. km of land 1.7 lane-kilometers per sq. km. of land. Distinction between classification is not available.
Quality	For paved roads in the Municipality, the average pavement condition index value.	Average Pavement Condition from the 2021 Assessment: Fair (59)
	For unpaved roads in the Municipality, the average surface condition (e.g., Excellent, Good, Fair or Poor).	Roads are re-graded on a regular basis by the Municipality. No current condition ratings available.

2.4 Current Performance – Roads

Asset performance measures were determined in consultation with the Municipality, which provide relevant metrics against which the Municipality can gauge the performance of their assets. The performance measures for roads assets, and their current values are shown in **Table 2-5**.

Table 2-5: Proportion of Lane Kilometers

Asset Performance Measure	Current Value
Roads with load restrictions	This metric is not currently tracked but recommended to be tracked in the future.
Percentage of roads in Fair or Better condition	86% (value from 2023 condition assessment, assuming all Gravel road assets are in Fair condition)

2.5 Risk Assessment – Roads

The risk ratings for the road network follows the risk methodology and approach presented in **Section 1.5** is based on the following:

- Condition: based on surface type as follows:
  - Asphalt and Tar & Chip roads were based on average condition from the 2021 PCI assessment.
  - Gravel road segments were assumed to be in Fair (value of 3) condition.
- Performance: Always Reliable (value of 1) for all assets.
- Climate Change: Assets are vulnerable to climate change (value of 3) for all assets.
- Impact: Moderate (value of 1) impact for all assets.
- Importance: based on width of the road passing over the structure as follows:
  - Low importance (value of 1) for road width of 6 m or less
  - Moderate importance (value of 2) for road width of 6-8 m
  - High importance (value of 3) for road width of 8-9 m

The risk profile for roads is shown in **Figure 2-1.** The risk ratings for the majority of road network is rated as Low, with 4 road segments at a Moderate risk rating. No road segments were rated High risk.

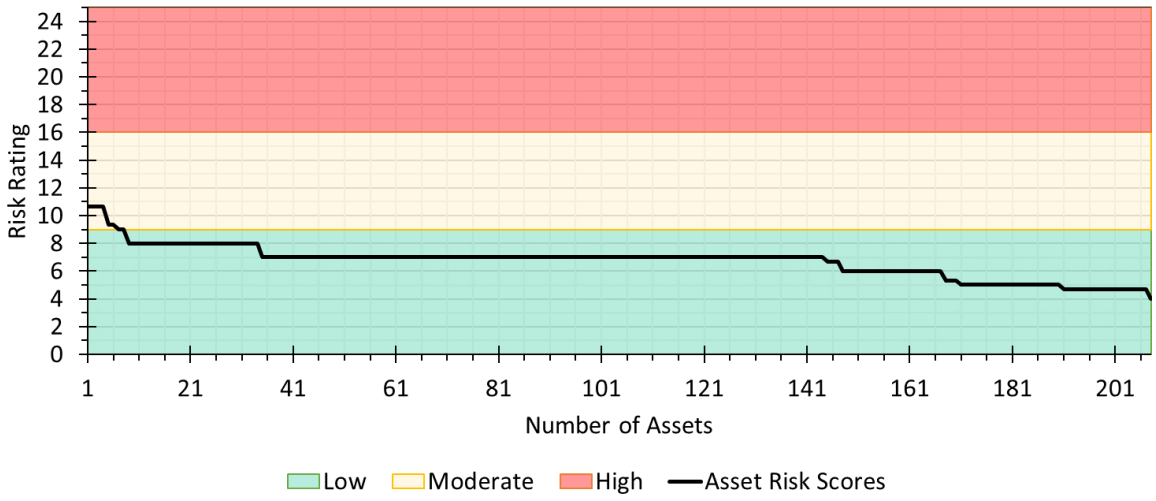


Figure 2-1: Roads Risk Profile

2.6 Lifecycle Activities – Roads

The following section describes the lifecycle activities that can be implemented within the asset management strategy for road assets. The primary lifecycle activities after construction include reconstruction, rehabilitation, maintenance, and disposal. Selection of a lifecycle activity will depend on multiple factors, including works history, condition, surface type and roadside environment.

2.6.1 Construction

The initial lifecycle activity of a road asset is its construction. The road asset should be constructed to adhere to applicable requirements, codes, and design guidelines. Construction of new road assets is recommended to be in line with recommendations as part of growth, master plan, or other municipal strategies. Design of the road asset should consider the level of service expected to be provided by that particular road asset, such as the anticipated speed or volume of traffic. Varying factors in construction include: the road classification, surface type, and roadside environment (e.g., rural, urban).

Construction can also be the replacement of deteriorated assets. At the end of the useful life of an asset, it can be replaced for continuation of service provision. At the time of replacement, design should be undertaken to ensure design requirements are met, and adequate capacity is provided for current and future projections.

2.6.2 Maintenance

Maintenance activities are undertaken on the assets throughout their useful life to maintain their operating condition and performance. There are a variety of maintenance activities available to undertake on road assets, including:

- Ditch improvements (grubbing/clearing)
- Crack sealing

- Microsurfacing
- Surface treatment (single or double)

Maintenance activities can include the full road surface or can be used to address localized repairs on the road surface.

2.6.3 Renewal/Rehabilitation

Renewal or rehabilitation of the road assets can be undertaken when maintenance works are no longer sufficient to address road surface deficiencies. These replace significant parts of the road but provide large improvements to condition and lifespan. These works can include resurfacing.

2.6.4 Decommissioning/Disposal

Disposal activities can include the removal from service of a road segment. These activities can be implemented when a road segment has been determined to be no longer required. A road may be removed from service by removal and disposal of the asset components, or establishment of a barricade to prevent continued usage of the asset. Disposal activities should be conducted such that health and safety protocols are being followed, and spent materials are disposed of at an appropriate or approved facility.

2.7 Asset Management Strategy – Roads

The asset management strategy for the road assets seeks to use the lifecycle activities in a manner that will achieve cost-effective and sustainable management of the road assets. The road assets will deteriorate on a non-linear basis, and the lifecycle activities can be implemented at varying stages within an asset's deterioration.

The condition and usage of the road assets is a key driver in the determination of lifecycle activities to use. The condition was determined in 2021 and should continue to be updated by the Municipality. Condition of the roads can be completed on a scheduled basis wherein the entirety of the network is reviewed in annual portions over a defined duration (example five years). A variety of methods can be implemented for undertaking condition assessment of roads, including visual inspection and street scan technology. A condition rating program can also be implemented that considers the importance or risk of a road segment and prioritizes frequency and timing of condition assessments to higher usage or higher importance roads.

Maintenance works should be undertaken throughout the lifecycle of an asset. Selection of the appropriate maintenance activity will depend on the type of deterioration being experienced on the asset, and the condition of the asset. Some activities, such as crack sealing, are best utilized on a road segment that is generally in "Good" condition. As the road segment continues to deteriorate, maintenance activities may become a less preferred option.

Rehabilitation activities should be undertaken on an asset when it has deteriorated past the point where maintenance activities would be adequate to address condition issues. Selection of the appropriate rehabilitation activity will depend on the road surface material, stage in lifecycle, and severity and type of deterioration.

In general, the current strategy for the road assets at the Municipality is to allow the road asset to degrade near to the end of its expected useful life and reconstruct the road when required. The Municipality combines adjacent linear infrastructure works with the road reconstruction for efficiency in works and costing. This typically includes undertaking drainage (stormwater) works and new sidewalks as part of the road reconstruction works. If condition or performance warrant, wastewater and water lines can be addressed, which should be reviewed on a case-by-case basis as road works are identified.

The Municipality's current program for gravel roads includes application of 450 tonnes of granular material per kilometer on a 5-year rotating schedule, however this has recently been experienced to be insufficient to maintain the current level of service. The Municipality can review its program to determine an appropriate schedule for application of granulars and continue to grade regularly. Localized repairs and maintenance for gravel roads should also be completed where required.

2.7.1 Scenario Analysis

To understand the needs and projected works on the roads assets within a 10-year outlook, reconstruction of the roads was reviewed under varying budget values to understand the impact on overall network condition. Intermittent resurfacing works are not modelled within this analysis. The unit reconstruction costs used within the scenario analysis were provided by the Municipality and are based on recent tender and product costs. As the Municipality's current strategy is to combine road works with drainage and other adjacent works, the unit replacement costs used within the scenario analysis are reflective of the additional asset components (including storm drains, road base, curb and gutter, sidewalk), and have been inflated to account for engineering and contingency. The unit reconstruction cost for asphalt roads is $3,570 per lineal meter, and for tar and chip roads is $400 per lineal meter.

Gravel roads are omitted from analysis, as they are maintained through operations/maintenance and not typically reconstructed.

The budgets analyzed included:

1. Unlimited budget – To determine backlog of works.
2. No budget – To understand the changes in average network condition with no investment.
3. Maintain average condition across network.

A summary of the analysis is outlined in **Table 2-6** below.

Table 2-6: Budget Scenarios Reviewed for Road Asset Projections

	Budget Scenario	Annual Value	Average Annual Investment Over Timeframe	Total Investment Over Timeframe	Average Condition Index (2032)
1	Unlimited	Unlimited	$4,330,074	$43,300,740	0.82
2	No Budget	$ -	$ -	$ -	0.18
3	Maintain Average Condition	$1,850,000	$1,804,961	$18,049,610	0.52

Scenario 1 assumes an unlimited budget available for reconstruction of the road assets. In the first year of the scenario, $11.9 M in reconstruction works were identified, indicating that there is a backlog of repairs required to improve the condition of the assets. The backlog includes any assets that are currently at a condition rating of 0.35 or less.

Scenario 2 models the impact of no spending on road reconstruction during the timeframe. The average condition rating deteriorates to 0.18.

Scenario 3 reviewed the annual investment requirements when targeting the current condition rating of 0.52 over the assessed timeframe. This scenario uses just over $1.8 M in annual expenditure.

In selecting the recommended investment level, the Municipality should consider its current and preferred level of service being provided. The LOS is represented in these scenarios as the average condition of the assets. The current average condition is 0.52, and a best practice recommends maintaining a minimum average condition of 0.60 across the system. If the Municipality's target is to maintain the current LOS, Scenario 3 would be the recommendation, however this would retain the current level of service just below the best practice threshold.

The Municipality should also consider the current backlog of works relative to the investment scenario. As found through Scenario 1, there is approximately $11.9M in outstanding works on the system. Any investment under this threshold may result in some assets deteriorating to the point of failure during the reviewed timeframe. Risk assessment and continued inspection of the road assets should be conducted to assist in determining the optimal prioritization for works to be undertaken.

Figure 2-2 illustrates the level of investment for Scenario 3 (maintain current average condition index), and the expected impact in average condition index.

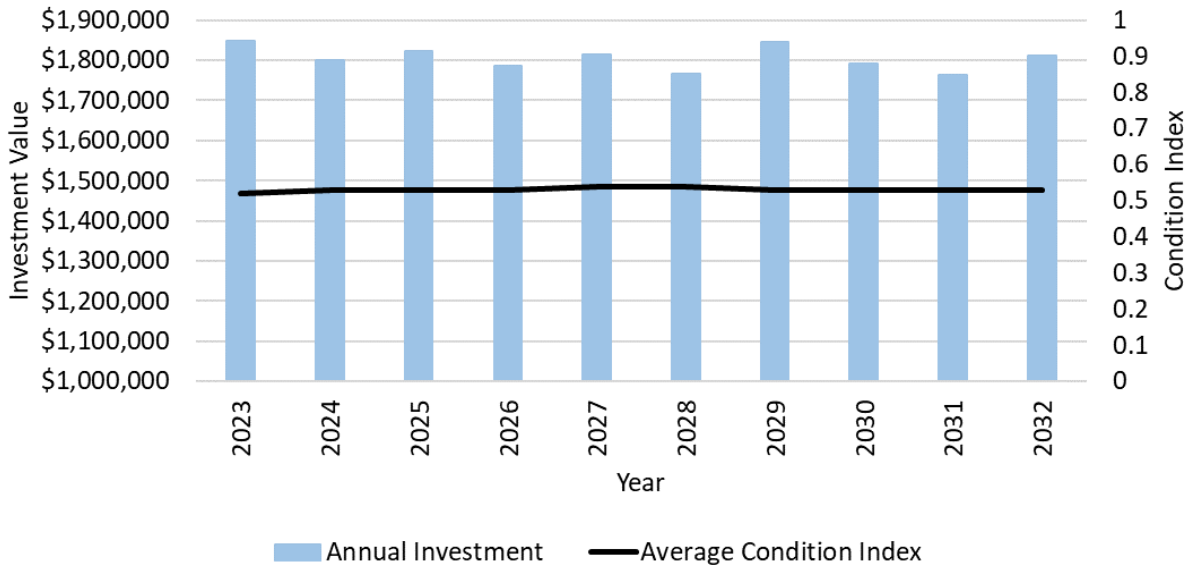


Figure 2-2: Roads Investment and Condition Index to Maintain Current (Scenario 3)

3.0 Bridges and Culverts

3.1 State of Local Infrastructure

The Municipality owns 2 bridges and 26 structural culverts for a total of 28 structures. The summary of types of bridges and culverts and quantity of each is shown in **Table 3-1**.

Table 3-1: Summary of Bridge and Culvert Types

Types of Bridges	Types of Culverts
• Concrete Rigid Frame (1) • Concrete Beams Simply Supported (1)	• C.Plate Steel - Pipe Arch (5) • C.Plate Steel - Round Pipe (1) • Cast in Place Concrete Box (6) • Cast in Place Rigid Frame (10) • Concrete Barrel and C.S.P. (1) • Precast Concete Box (2) • Round C.S.P. (1)

The Ontario Structure Inspection Manual (OSIM) 2008 was used to classify bridges and culverts for consideration. Bridges and structural culverts are defined as structures providing vehicle or pedestrian passage across and obstruction, gap or facility that are greater than or equal to 3 m in span.

3.1.1 Replacement Costs

The replacement costs for the bridges were based on the estimated replacement costs determined by the Municipality as part of their 2008 inventory, inflated to 2023 dollars (inflation used the Bank of Canada inflation rates). The total replacement value for the bridge and structural culverts is estimated to be $14.1 million based on historical costs, inflated to 2023 dollars, as summarized in **Table 3-2**.

Table 3-2: Replacement Cost – Bridges and Culverts

Asset Type	Quantity	Total Replacement Cost (2023)
Bridges	2	$2,221,000
Culverts	26	$11,880,000
Total	**28**	**$14,101,000**

3.1.2 Average Age

The bridge assets were constructed in 2009 and 2019, and therefore have an average age of 9 years.

The age of the culverts was determined using the estimated year of construction for the structures. The Municipality generally tracks the year constructed by decade, and so ages are approximations within a 10-year range per asset. Newer assets have year of construction tracked. The average age of the culvert assets is approximately 68 years.

3.1.3 Expected Useful Life

The expected useful life for bridge and culvert assets ranges from 50 to 80 years, differing by structure type. The expected useful lives are summarized in **Table 3-3.**

Table 3-3: Expected Useful Life of Bridges and Culverts

Structure Type	Expected Useful Life
Concrete Rigid Frame	80
Concrete Beams Simply Supported	80
C.Plate Steel - Pipe Arch	60 - 80
C.Plate Steel - Round Pipe	60
Cast in Place Concrete Box	80
Cast in Place Rigid Frame	80
Concrete Barrel and C.S.P.	50
Precast Concete Box	80
Round C.S.P.	70

With a good maintenance program, i.e. following recommendations from OSIM reports, the useful life of bridges can be extended, by improving the condition of the bridge or structural culvert to meet levels of service and performance.

3.2 Condition – Bridges and Culverts

The Municipality has previously undertaken condition assessment for bridge and structural culvert assets, determined through completion of OSIM inspections, the most recently having been completed in 2020 by Spriet Associates. An OSIM inspection is scheduled for 2023. The OSIM reports rated bridge and culvert component conditions on a scale of 1-5, represented by Very Good, Good, Fair, Poor, and Very Poor. A summary of the average condition description and number of associated structures is shown in **Table 3-4.**

Table 3-4: Summary of Bridge and Culvert Condition

Condition Rating	Bridges	Culverts
Very Good (1)	2	1
Good (2)	0	6
Fair (3)	0	19
Poor (4)	0	0
Very Poor (5)	0	0

3.3 Current Level of Service – Bridges and Culverts

Levels of service for bridges and culverts are outlined in Table 5 of O.Reg. 588/17.
Table 3-5 and **Table 3-6** outline the Municipality's current community and technical levels of service for bridges and culverts.

Table 3-5: Community Levels of Service – Bridges and Culverts

Service Attribute	Community Levels of Service (Qualitative Description)	Community LOS
Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	• Heavy transport vehicles • Motor vehicles • Emergency vehicles • Agricultural vehicles and equipment • Pedestrians
Quality	• Description or images of the condition of bridges and how this would affect use of the bridges. • Description or images of the condition of culverts and how this would affect use of the culverts.	The condition of bridges and culverts are evaluated routinely according to the OSIM requirements. For full descriptions and samples images of bridge and culvert condition classifications refer to the OSIM 2008 and associated field guide. Bridges and structural culverts in good condition typically operate as designed and would not receive any additional restrictions or limitations beyond those designed. Bridges and structural culverts in fair to poor condition may receive load restrictions or be subject to closure as deterioration affects asset capacity to safely and reliably deliver the designed level of service. For photos illustrating the condition of bridge components in each category refer to OSIM 2008 and the associated field guide.

Table 3-6: Technical Levels of Service – Bridges and Culverts

Service Attribute	Technical Levels of Service (Technical Metrics)	Technical LOS
Scope	Percentage of bridges in the Municipality with loading or dimensional restrictions.	None (Municipality has a seasonal period of reduced loads during the spring thaw on the Municipality's road system)
Quality	For bridges in the Municipality, the average bridge condition index value.	Average condition: Excellent (BCI not determined during assessment)
Quality	For structural culverts in the Municipality, the average bridge condition index value.	Average condition: Fair (BCI not determined during assessment)

3.4 Current Performance – Bridges and Culverts

Asset performance measures were determined based on information provided by the Municipality, which provide relevant metrics against which the Municipality can gauge the performance of their assets. The performance measures for bridge and culvert assets and their current values are shown in **Table** 3-7**.**

Table 3-7: Bridge and Culvert Performance Measures

Asset Performance Measures	Current Value
Annual average daily traffic (AADT) counts over bridges to assess usage	This metric is not currently tracked but recommended to be tracked in the future.
Number of bridge or culvert failures/road closures	No structures were noted to have failures or road closures.
Number of structures with load restrictions	No structures were noted to have load restrictions within the 2020 OSIM Reports prepared by Spriet Associates.
Percentage of bridges and culverts in Fair or better condition	9 of the 28 bridges and culverts are in Fair or better condition, resulting in 32% of all bridges and culverts in Fair or better condition.

3.5 Risk Assessment – Bridges and Culverts

The risk assessment for bridge assets will be conducted according to the following assumptions and criteria:

- Condition: Determined based on average condition determined during 2020 OSIM inspection
- Performance: Assumed to be Always Reliable (value of 1) for all assets
- Climate Change: a value of 5 – assets highly vulnerable to flood risks from climate change
- Impact: Moderate (value of 1) impact for all assets

- Importance: Based on width of the road passing over the structure as follows:
  - Low importance (value of 1) for road width of 6 m or less
  - Moderate importance (value of 2) for road width of 6-8 m
  - High importance (value of 3) for road with of 8-9 m

Using the assumptions and parameters listed above, a risk assessment was conducted. The distribution of risk ratings for bridge assets is shown in **Figure 3-1**.

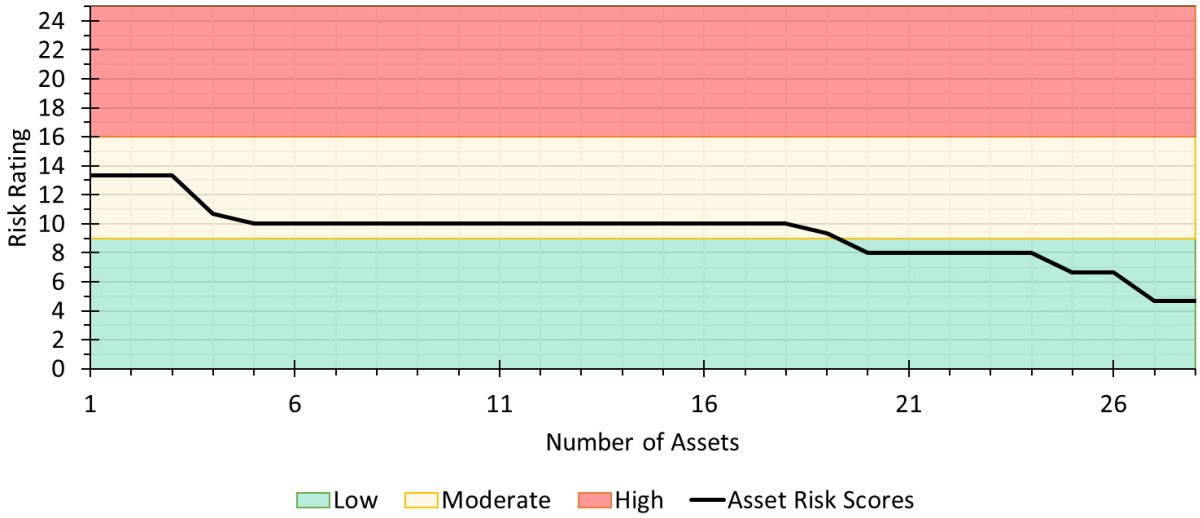


Figure 3-1: Bridges and Culverts Risk Profile

3.6 Lifecycle Activities – Bridges and Culverts

The following section describes the lifecycle activities that can be implemented within the asset management strategy for bridge and culvert assets. Note that bridge assets refer to the entirety of the asset which is made up of bridge deck surface and bridge structure. The primary lifecycle activities include construction, inspections, maintenance and repair, replacement, and disposal.

3.6.1 Construction

The start of an asset's lifecycle is its construction. The bridge or culvert should be constructed to adhere with the requirements of the *O. Reg. 160/02: Standards for Bridges, CSA S6 Canadian Highway Bridge Design Code*, and all other applicable regional codes and requirements for the bridge or culvert and its use. Each bridge or culvert should be designed and constructed to provide the services for which it is intended.

3.6.2 Inspections

Under *O. Reg. 160/02: Standards for Bridges*, the Municipality is required to complete one inspection of all bridges and culverts every two years to identify condition and produce a report outlining the recommended work for a 1 to 10 year period. The inspection uses the Ontario Structural Inspection Manual (OSIM) 2008 and is referred to as the OSIM or Bridge Inspection Report. The Municipality should continue the current biennial OSIM Bridge Inspections along the current schedule, with the most recent inspections having been completed in 2020. The inspections should include all bridges and culverts with a single or combined span greater than 3 m.

3.6.3 Maintenance and Repairs

Bridge and culvert assets are long-lived assets with estimated useful lives between 50 to 80 years. Throughout the lifecycle of these assets the majority of expected needs will be maintenance and repair works.

Routine maintenance works are typically used to prolong the lifespan of assets and include both preventative and reactive activities designed to maintain the asset condition and function.

Preventative activities are implemented to provide a predictive response to deterioration or possible performance issues by managing the contributing factors prior to an event occurring. Reactive maintenance is conducted in response to a condition or performance issue and designed to correct the issue before it causes asset deterioration and possible deficiencies. The scale of maintenance activities varies widely and is dependent on a variety of factors including the age, asset utilization, environment, and design. Maintenance should be completed based on recommendations in biennial OSIM reports and industry best practices. A general summary of bridge and culvert maintenance activities include, but are not limited to:

- Cleaning, washing or flushing
- Railing system maintenance
- Painting of steel bridge components
- Bearing maintenance
- Pest control
- Deck drainage maintenance
- Erosion control
- Scaling of loose concrete and ACR Steel

Repair works are driven by the identification and treatment of deficiencies to prevent the continued deterioration of the deficiency which may cause a reduction in asset condition, performance and LOS delivered. Timing of repairs varies widely as they may be prescheduled based on estimated deterioration, in response to biennial condition reporting, or on an emergency basis. Repairs to bridges vary widely and can be in relation to structural and deck surface components.

3.6.4 Replacement

Replacement of a structure is based on current age, estimated lifespan and recommendations from condition assessments. Replacement can be used when an asset is nearing or has reach the end of its life, repairs are not technically feasible, estimated future repair costs are greater than replacement cost, or increases to capacity or LOS are required. Replacement activities are typically large in scale and involve the issuance of a capital project. Timing of replacement activities must consider the impact on adjacent infrastructure, the impact on near-by asset LOS and replacement or maintenance requirements of connected infrastructure.

3.6.5 Disposal

Disposal activities from bridges and culverts can include the removal from service of a bridge or culvert, through:

- Closure of the bridge from access
- Change in level of service of the bridge to limit access (e.g., vehicular bridge)
- Deconstruction of the bridge or culvert

Disposal activities should be implemented when a bridge or culvert has reached the end of its useful life or has degraded to such a state that it can no longer provide the level of service for which it is intended. Removal of a bridge from service without replacement or decrease in level of service should be undertaken only when it is decided to no longer be required to provide level of service to residents.

Disposal activities should be conducted such that health and safety protocols are being followed, and spent materials are disposed of at appropriate or approved facility.

3.7 Asset Management Strategy – Bridges and Culverts

The asset management strategy for bridges and culverts in the Municipality will employ the lifecycle activities to maximize the useful life of each asset.

The primary indicator used in the development of the lifecycle strategy is the condition of each asset, however, the strategy must also consider other factors, such as:

- Consequence of asset failure
- Asset risk score
- Condition of adjacent assets
- Community growth and capacity requirements

Under **O. Reg. 160/02: Standards for Bridges**, the Municipality is required to complete one inspection of all bridges every two years to identify condition and produce a report outlining the recommended work for a 1- to 10-year period. The inspection uses the Ontario Structural Inspection Manual (OSIM) 2008 and is referred to as the OSIM report. The most recent condition assessment and study was completed in 2019, with reporting currently being completed for the 2021 assessments.

The Municipality current strategy for maintaining the bridges and culverts includes procurement of OSIM reports at the required frequency, and completion of the maintenance, rehabilitation and reconstruction works according to the recommendations from the OSIM reports.

Inspections and OSIM reports will identify works to be done at each of the bridge structures – each of the inspection types should recommend maintenance works, rehabilitation works, and reconstruction where necessary, as well as prioritization of the works and an estimation of the overall condition of the structure. It is therefore assumed that by following the results of the inspections/OSIMs, the Municipality will be following a strategy that prioritizes maintenance works as required to maximize the lifecycle of the bridge assets.

The asset management strategy for bridges is based on maintaining the structures in sufficient condition and performance to allow for continued access to crossings and adequate service delivery. The strategy considers the requirements set out by applicable regulations and builds on those to include the lifecycle activities summarized above.

It is recommended that the Municipality use the OSIM report to identify and forecast lifecycle activities for bridge and structural culvert assets. For detailed recommendations of asset management strategies refer to the most current OSIM inspection report.

3.7.1 Projection of Works

To understand the needs and projected works on the bridges within a 10-year period, a summary of the recommendations from the 2020 OSIM reports (prepared by Spriet Associates) is used. A summary of the annual expenditure for maintenance works or replacement is in **Table 3-8.**

Table 3-8: Summary of Works for Bridges and Culverts

Timeframe	Immediate	1-5 Years	> 5 Years
Replacements – No.	--	1	--
Replacements – Cost	--	$1,200,000	--
Repairs – No.	1	12	--
Repairs – Cost	$100,000	$378,500	--
Safety Reqs – No.	1	9	--
Safety Reqs - Cost	$500	$262,500	--
Total Per Timeframe	***$100,500***	***$1,841,000***	***$ --***

During the 10-year timeframe, the Municipality will require $1,941,500 to maintain the bridge and culvert assets, with the majority of the expenditure incurred in the 1 to 5 year timeframe.

Note that all identified replacements, repairs, and safety requirements were on the culverts. No needs were identified for bridges during the 2020 OSIM inspections for the subsequent 10-year timeframe.

4.0 Water

4.1 State of Local Infrastructure – Water

The Municipality owns and operates a water distribution network. The asset inventory includes linear pipes, appurtenances, and water facilities. A summary of the quantity of assets within the network is provided in **Table 4-1**.

Table 4-1: Water Asset Inventory Summary

Water Asset	Quantity	Unit of Measure
Watermain	283,682	Length (m)
Water Tower	1	Quantity
Water Dispenser	1	Quantity

The analysis within this report related to linear assets is predicated on the assumption that appurtenances included in the system are required componentry that will be replaced in conjunction with the linear components and are expected to have similar lifespans and conditions as the linear components.

4.1.1 Linear Water Assets

The Municipality's water distribution network consists of approximately 284 km of watermain. The material types of the existing watermain construction are summarized in **Table 4-2**.

Table 4-2: Material Types of Watermain

Material Type	Diameter Range (mm)	Total Length (m)	Percentage of System
PVC	50 - 150	222,628	78.5
PVC	150 - 350	55,724	19.6
Asbestos Cement	150	141	0.05
Asbestos Cement	200	5,008	1.8
Ductile Iron	150	181	0.06

4.1.1.1 Replacement Costs

Replacement costs for the linear water network were estimated based on recent tender information and product information. The replacement costs include costs necessary for full reconstruction of a segment, including trench and surface restoration. It is assumed that reconstruction works on the network will be completed using PVC watermain. The reconstruction costs are shown in **Table 4-3**.

Table 4-3: Linear Water Asset Replacement Costs

Diameter (mm)	Replacement Costs ($/m)
< 250	$1,000/m
250 - 400	$2,000/m

Using the units costs provided, the total replacement costs for the linear water network is estimated to be $328.3 million.

4.1.1.2 Average Age and Expected Useful Life

The average age of the linear water assets water network was calculated by pipe material, weighted by length of asset. The average age is summarized in **Table 4-4**.

Table 4-4: Average Age of Linear Water Assets by Pipe Material

Pipe Material	Average Age (years)	Expected Useful Life (years)
PVC	21.9	75
Asbestos Cement	54.2	60
Ductile Iron	32.4	60

As data continues to be available regarding useful life of the watermain construction materials, these values can be reviewed and updated as appropriate.

4.1.2 Water Facility Assets

In addition to the linear water assets, the Municipality's water network also includes facility assets that provide storage services. These facility assets are complex and include multiple components, including electrical, mechanical, structural, instrumentation and control, process, civil, and architectural. **Table 4-5** summarizes the water facility assets.

Table 4-5: Summary of Water Facility Assets

Asset No.	Description	Asset Location	Year of Const	Age	Useful Life	Repl. Cost
B12	Water Tower	McBeth St.	1985	38	50	$1,556,000
B14	Water Dispenser	29234 Pioneer.	1990	33	40	$66,000

4.1.2.1 Replacement Costs

Replacement costs for the water facility assets have been estimated based on the insurance replacement costs provided by the Municipality. These costs have been inflated to represent current (2023) dollars, as shown in **Table 4-5**.

4.1.2.2 Average Age

The age of the facilities was based on the original construction date. The average age is 35 years, determined from **Table 4-5**.

4.1.2.3 Expected Useful Life

The expected useful life of the facilities was provided by the Municipality, as summarized in **Table 4-5**.

4.2 Condition – Water

4.2.1 Linear Water Assets

Condition of the linear water network was determined through a deterioration model, which estimates an asset condition based on the age and construction material of the segment, and its expected useful life. The condition is reported on a condition rating scale of 1-5, where 1 represents an asset in Very Good condition and 5 represents an asset in Very Poor condition. The average condition score for all linear watermain assets by length is estimated to be 1, corresponding to Very Good.

There are 3 remaining segments of watermain that are composed of Asbestos Cement and Ductile Iron, which represent approximately 2% of the network. These remaining segments have a condition lower than the PVC.

4.2.2 Water Facility Assets

The condition of the water facilities was estimated based on the useful life and age of each asset. Comprehensive existing condition of the Municipality's water facility assets is not currently available. It is recommended that a condition assessment be completed of the water facilities (including components of each facility) and incorporated into the next update of the AMP. A summary of the condition is in **Table 4-6**.

Table 4-6: Condition Summary of Water Facility Assets

Asset Number	Description	Year of Const.	Age	Useful Life	% of Useful Life Used	Corresp. Condition
B12	Water Tower	1985	38	50	76%	4
B14	Water Dispenser	1990	33	40	83%	5

4.3 Current Levels of Service – Water

Levels of service for water assets are outlined in Table 1 of the regulation, *O.Reg. 588/17*. **Table 4-7** and **Table 4-8** outline the Municipality's current community and technical levels of service for water assets.

Table 4-7: Community Levels of Service – Water

Service Attribute	Community Levels of Service (Qualitative Description)	Community LOS
Scope	Description, which may include maps, of the user groups or areas of the Municipality that are connected to the municipal water system.	The water distribution system provides water service to properties across the Municipality. The extents of the network are shown in Figure 2 in **Appendix A.**
	Description, which may include maps, of the user groups or areas of the Municipality that have fire flow.	To be determined and reported on by the Municipality.
Reliability	Description of boil water advisories and service interruptions.	The Municipality does not have any documented boil water advisories in 2021 and 2022. There was one water main break in both 2021 and 2022, as well as leaks at property lines in both years.

Table 4-8: Technical Levels of Service – Water

Service Attribute	Technical Levels of Service (Technical Metrics)	Technical LOS
Scope	Percentage of properties connected to the municipal water system.	Currently 2,050 customers being served in the former Village of Dutton, the former Hamlets of Wallacetown, Iona and Iona Station and a large portion of the rural area of the former Township of Dunwich. Percentage is not available.
	Percentage of properties where fire flow is available.	To be determined and reported on by the Municipality.
Reliability	The number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system.	There were no documented boil water advisories in 2021 and 2022.
	The number of connection-days per year due to watermain breaks compared to the total number of properties connected to the municipal water system.	There was one watermain break in both 2021 and 2022. In 2021, the break occurred on October 18th on Currie Rd in the Town of Dutton. In 2022, it occurred on December 31st on King St in Wallacetown. The proper disinfection procedures were followed and documented. There were a few leaks that occurred at property lines in 2021 and 2022.

4.4 Current Performance – Water

Asset performance measures were determined in consultation with the Municipality, which provide relevant metrics against which the Municipality can gauge the performance of their assets. The performance measures for the water network, and their current values are shown in **Table 4-9**.

Table 4-9: Performance Measures – Water

Asset Performance Measure	Current Value
Number of annual non-compliances of the Ontario Drinking-Water System Regulations and Safe Water Drinking Act	There were 0 non-compliances in 2021 and 2022.
Cost efficiency (operating cost to provide service – $/household for water services)	Average operating cost for water for 2021 and 2022 was $731.13 and $1,189.09 respectively, per household connected for water service.
Number of watermain breaks and repair time	There was one watermain break in both 2021 and 2022. The proper disinfection procedures were followed and documented. The repair time was not tracked but recommended to be tracked in the future.
Service interruptions (duration and number of users impacted)	The only documented service interruption is a watermain break in both 2021 and 2022.

4.5 Risk Assessment – Water

The risk ratings for the water assets follows the risk methodology and approach presented in **Section 1.5**. The risk assessment for water linear and facility assets will be conducted according to the assumptions and criteria summarized in **Table 4-10**.

Table 4-10: Water Asset Risk Assessment Assumptions

	Water linear assets	Water facility assets
Condition	Determined based on estimated condition (using deterioration curve)	Based on % of useful life remaining
Performance	Always Reliable (value of 1)	Always Reliable (value of 1)
Climate Change	Moderate (value of 3) for all assets (Limited impact with slower recovery; mitigation plan not in place)	Moderate (value of 3) for all assets (Limited impact with slower recovery; mitigation plan not in place)
Impact	Moderate impact (value of 1)	High impact (value of 2)
Importance	Due to unknown pipe diameters, all assets were assigned an importance of Moderate (value of 2)	Moderate importance (value of 2)

The risk profile for linear water assets is shown in **Figure 4-1.** The risk ratings for all 106 linear water assets are in the Low Risk Range.

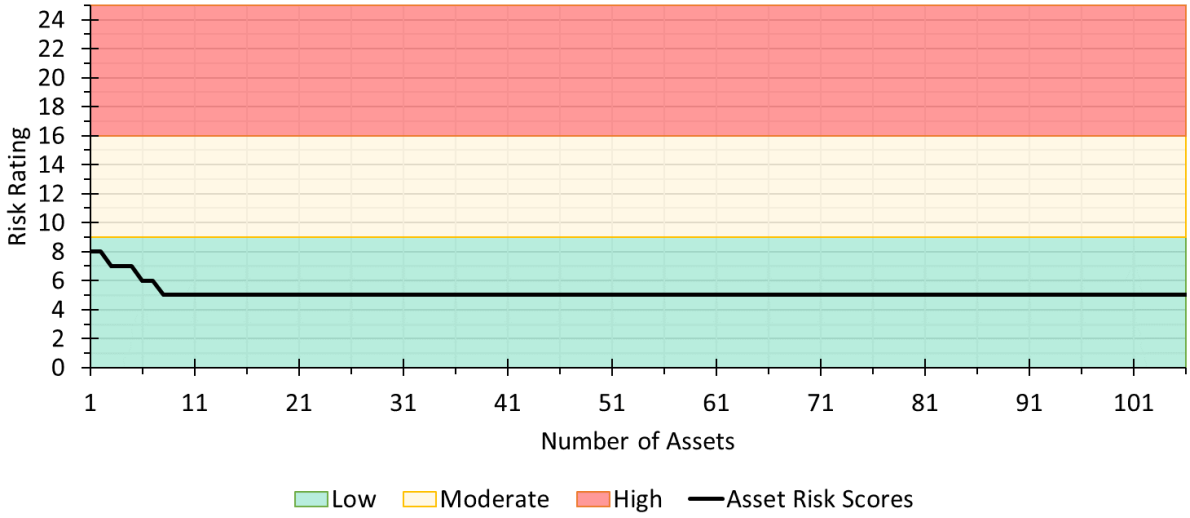


Figure 4-1: Water (Linear) Risk Profile

The risk assessment of the water facilities found both assets to be in the Moderate risk range, with a score of 10.7 for the Water Tower and 12 for the Water Dispenser.

4.6 Lifecycle Activities – Water

The following section describes the lifecycle activities that can be implemented within the asset management strategy for water assets. The water assets include linear and facility assets, lifecycle activities for each presented separately.

4.6.1 Linear Water Assets

Construction

Construction of new assets is recommended to be in line with recommendations as part of growth, master plan, or other municipal strategies. The design of the new assets should be consistent with jurisdictional design requirements, including provincial design guidelines and local requirements. New construction of assets will occur where no previous water servicing is available. The risk associated with new construction includes the high cost of brand new assets relative to ability to recoup costs through user rates or development charges.

Construction can also be the replacement of deteriorated assets. At the end of the useful life of an asset, it can be replaced for continuation of service provision. At the time of replacement, design should be undertaken to ensure design requirements are met, and adequate capacity is provided for current and growth usage projections.

Maintenance

Maintenance activities are undertaken on the assets throughout their useful life to maintain their operating condition and performance. Maintenance works includes routine maintenance (flushing, cleaning), and minor repairs to assets (localized pipe repair, appurtenance repair). There exists the risk that a maintenance activity may be implemented that does not adequately mitigate a performance or condition issue, and additional costs are then required for further repair or replacement.

Renewal Activities

Renewal of the watermain assets can include pipe lining (structural, semi-structural or non-structural lining). A lining can be used where the condition has deteriorated, however structurally the pipe segment is still sound. A lining can extend the useful life of an asset and improve performance.
Risks associated with these renewal activities include the improper installation of the renewal works or continued/advanced deterioration of the original watermain such that the renewal works do not perform as expected.

Operating

Operating activities for the watermain assets include those activities that do not directly deal with the physical state of the watermains, but work to extend the asset's useful life. The operating activities can include non-infrastructure policies, and monitoring/ inspection of the assets. Condition assessment of watermain pipes is challenging to achieve. It is recommended that reactive maintenance works (watermain repairs, etc.) be reviewed and tracked such that they can provide additional information to the Municipality regarding condition of the pipe segments (beyond the theoretical condition determined through age of pipe and deterioration rate). Operating activities can be used throughout the useful life of an asset.

Decommissioning

Decommissioning of the watermain assets includes abandonment or replacement of the asset at the end of its useful life. Removal of the expended asset can provide additional space for new underground assets to be constructed within a right-of-way.

4.6.2 Water Facility Assets

The lifecycle activities for the water facility assets will be generally consistent with those expected for general municipal buildings.

As the water building assets are specialized for treatment and distribution services, there are additional factors that must be considered:

- Water distribution facilities are highly regulated. Any and all lifecycle activities undertaken must be done in compliance with codes and regulations.
- Expansion of existing facilities may be required for additional water distribution capacity as a result of growth. Expansion activities may encompass multiple lifecycle stages, such as construction for additional infrastructure required, and renewal for expansion of existing infrastructure (such as increased storage requirements).

4.7 Asset Management Strategy – Water

4.7.1 Linear Water Assets

The Municipality of Dutton Dunwich has an existing 5-year plan for the linear water assets which identifies prioritized replacement and new construction works, and considers previously completed water distribution network modelling. The plan was developed expected residential growth and servicing needs at the Municipality. The plan also prioritizes replacement of watermain to eliminate older materials from the network, such as ductile iron pipe. The Municipality will continue to address works on the water network according to this plan as it reflects the needs on the system. The Municipality should continue to review the plan and the allocated budget to confirm sufficient funding is available.

The condition of an asset, a major factor in the asset management strategy, should be established to assist in decision making. Due to the difficulty in undertaking visual inspection of a watermain, the Municipality should monitor the expected condition of the pipes, based on the age and tracking of maintenance activities completed for each segment.

When the condition of the asset has degraded such that an intervention is required, it is recommended that maintenance be reviewed as the first opportunity to extend the useful life. Maintenance works can include localized repair work or relining of a pipe segment. Because of the non-intrusive nature of conducting relining, it can be done on an individual pipe segment at a time, or to localized repairs.

When the condition of the asset has degraded such that maintenance is no longer an appropriate activity, the segment can and should be reconstructed. The Municipality should follow best practices and local design guidelines when designing the reconstruction works. Assets at the end of their useful life should be abandoned in place or removed.

A summary of the watermain strategy by condition range and expected lifecycle activity is provided in **Table 4-11**.

Table 4-11: Average Condition of Linear Watermain Assets

Condition Range	Lifecycle Activity Category	Lifecycle Activity
1.0 to 0.60	Maintenance	Maintenance Works (cleaning, flushing) Small pipe section repairs
0.60 to 0.35	Rehabilitation	Localized repairs Structural relining
0.35 to 0	Reconstruction	Pipe replacement or abandonment

Current best practices suggest that that reconstruction and new construction works on the assets will be done using PVC material for all pipe diameters.

4.7.1.1 Scenario Analysis

The Municipality has developed a 5-year plan, with works identified for years 2024-2029. The projects identified within the 5-year plan are based off increase in residential growth, and development of the Dutton Business Park property, and recommendations were informed by a water study completed in 2020. The recommendations within the plan are included in **Table 4-12**.

Table 4-12: Water Projections from Municipal 5-Year Plan

Year	Projects Identified
2024	• Replacement (and upsizing) of watermain on Shackleton Line • Replacement of water meters (continuation of existing program)
2025	• Replacement of watermain on Jordan St (including services) • Replacement of water meters (continuation of existing program if not completed in 2024) • Replacement of water truck fleet asset • Internal inspection of water tower
2026	• Cleaning of water tower (if recommended from internal inspection) • Replacement of watermain on Margaret St (including services)
2027	• Installation of watermain on Willey Road
2028	• Remaining works carried over (not completed) from 2027
2028- 2029	• Replacement of water truck fleet asset • Replacement of watermain on Currie Road

The Municipality has not yet estimated expenditures for the proposed works.

In addition to the 5-year plan developed by the Municipality, analysis was completed to understand the needs and projected works on the water assets within a 10-year outlook, to provide an estimation of budget required to maintain the water linear assets. Replacement activities were reviewed under varying budget values to understand the impact on overall asset condition. This model is based only on the condition of assets and does not consider strategic replacement of watermains. The budgets analyzed include:

1. Unlimited budget – To determine backlog of works.
2. No budget – To understand the changes in average network condition with no investment.
3. Maintain average current condition index for linear assets at end of 10-year timeframe.
   Note: The current condition is 0.97. This scenario was not run, this will be discussed further in the section below.

A summary of the analysis is outlined in **Table 4-13**.

Table 4-13: Budgets Reviewed for Water Asset Projections

	Budget Scenario	Annual Value	Total Investment Over Timeframe	Average Condition Index (2032)
1	Unlimited	Unlimited	$8,012,800	0.94
2	No Budget	$0	$0	0.93
3	Maintain current average condition	N/A	N/A	N/A

Note: as only one project was incurred during the unlimited scenario, the average annual investment over timeframe was omitted.

The budget values considered in the scenarios are maximum investment per year.
The current condition of the water assets is 0.97 on a scale of 0 to 1 where 1 represents an asset in perfect condition. This Very Good condition can be attributed to the age of the existing watermains and the long expected useful life of PVC.

Scenario 1 assumes an unlimited budget, and incurred just one replacement works within the timeframe, which is the replacement of the Pioneer Supply Line, recommended by the model to occur in 2030 with a cost of just over $8 M. This section of watermain is constructed of Asbestos Cement, and its replacement is consistent with the Municipality's strategy to replace these material types within their network.

Scenario 2 modelled the condition of the network with no investment over the timeframe. Due to the long expected useful life of the assets and their age, the condition with no investment deteriorates to only 0.93, or Very Good.

During analysis a third scenario was considered which would determine the funding requirement for maintaining the current average condition. Due to the high current average condition and the threshold for replacement of the assets, the results of this scenario would be consistent with the Unlimited (Scenario 1). Due to the very good condition of the assets, the Municipality can continue to utilize the assets without significant intervention and continue to provide a high level of service to the users.

4.7.1.2 Expenditure Based on Reinvestment

An alternative for estimating the annual expenditure for assets is through estimation using the recommended reinvestment rate and the replacement value of the assets. As there are limited present needs on the water assets the Municipality can consider reinvestment values to contribute to reserves on an annual basis to build up sufficient funding to address future water network needs. The 2016 infrastructure report card suggests a reinvestment rate of 1.0 to 1.5% annually for potable water (linear). The current replacement cost for all the water linear assets is $328,281,000, which suggests the reinvestment rates noted in **Table 4-14.**

Table 4-14: Reinvestment Rate for Linear Water Assets

Reinvestment Rate	Reinvestment Value
1.0%	$3,282,810
1.5%	$4,924,215

4.7.2 Water Facility Assets

The asset management strategy for water facility assets seeks to maximize the useful life and economy of each asset, using the lifecycle activities.

The primary drivers of lifecycle activities for these assets are the condition and service delivery requirements. The Municipality's water facility assets are complex, the componentry for which are expected to have differing rates of degradation and expected useful lives. As such, lifecycle activities will be required to be implemented at varied frequency and timelines.

The expected useful life of the asset components should be used to approximate the timing and frequency of lifecycle activities; however, this should be refined by undertaking detailed condition assessment of the buildings for an understanding of the actual condition of the assets.

The Municipality current completes an internal inspection of the water tower on a 5-year schedule, with the most recent inspection having been completed in 2020. The internal inspection is completed by a third-party consultant.

A maintenance schedule and forecast of asset improvements should be based on condition information.

Routine maintenance schedules are assumed to be in place currently and are recommended to continue assuming that they are currently providing sufficient level of maintenance.

Management of the water facility assets should also include climate change considerations, in new construction, maintenance or renewal lifecycle activities. Assessment should be undertaken to understand vulnerability of the facility assets to a changing climate, which will inform lifecycle activity requirements, and potential changes to the way lifecycle activities are undertaken.

Works should also be undertaken as required to maintain the capacity to meet regulations and user requirements.

The current level of service being provided in water service delivery is generally a high average condition of the assets (resulting in low service interruptions and boil water advisories). To maintain these LOS values, the Municipality's strategy should continue to maintain the condition of the water facility assets and provide upgrades and replacements according to projections to retain the required capacity.

4.7.2.1 Projection of Works

The projection of works for the water facility assets considers the estimated replacement date based on the expected useful life, year of construction, and replacement cost of the assets. The year of replacement was determined assuming a linear deterioration of the assets, for their expected useful life beginning in the year of construction. Based on this approach, the following replacements for the water facility assets are incurred in the upcoming 10-year timeframe (in 2023$)

- Replacement of the Water Dispenser in 2030 - $74,000
- Replacement of the Water Tower in 2035 - $1,749,000

It is recommended that a program for regular condition inspections by professional service providers be implemented to provide additional detail and guide the planned capital investment into building asset investment. The Municipality has completed an internal inspection of the water tower in 2020 and intends to complete another on a 5-year schedule with the next scheduled for 2025.

4.7.2.2 Expenditure Based on Reinvestment

An alternative for estimating the annual expenditure for assets is through estimation using the recommended reinvestment rate and the replacement value of the assets. The 2016 infrastructure report card suggests a reinvestment rate of 1.7-2.5% annually for buildings and facilities. The current replacement cost for all the water facility assets is $1,823,000, which suggests the reinvestment rates noted in **Table 4-15**.

Table 4-15: Reinvestment Rate for Water Facilities

Reinvestment Rate	Reinvestment Value
1.7%	$31,000
2.5%	$45,600

5.0 Wastewater

5.1 State of Local Infrastructure – Wastewater

The Municipality owns and operates a wastewater collection and treatment system, containing linear mains, and facilities for wastewater treatment and collection. A summary of the quantity of assets within the network is provided in **Table 5-1**.

Table 5-1: Wastewater Asset Inventory Summary

Water Asset	Quantity	Unit of Measure
Forcemain	5,850	Length (m)
Sanitary Sewer	12,765	Length (m)
Sewage Treatment Plant	1	Quantity
Pumping Station	7	Quantity

The analysis of linear wastewater assets within this report will be limited to the pipe assets only, omitting appurtenances such as maintenance holes, etc. This is predicated on the assumption that all other elements included in the system are required componentry that will be replaced in conjunction with the linear components and are expected to have similar expected useful lives and conditions as the linear components.

5.1.1 Linear Wastewater Assets

The material types of the existing wastewater gravity sewers and forcemain construction are summarized in **Table 5-2**.

Table 5-2: Material Types of Wastewater Mains

Material Type	Diameter Size Range (mm)	Total Length (m)	Percentage of System	Average Age (years)	Useful Life (years)
Asbestos Cement	100-250	7,927	42.8	50.7	60
HDPE Forcemain	100-150	4,928	26.6	11.9	75
PVC	100-300	4,679	25.3	10.9	75
PVC Forcemain	150	905	4.9	52	75
Reinforced Concrete Pipe (RCP)	900	90	0.5	10	75

5.1.1.1 Replacement Costs

Replacement costs for the linear wastewater network were determined based on recent tender information and product information. The replacement costs include provision for full reconstruction of a segment, including trench and surface restoration. It is assumed that reconstruction works will be completed using PVC material for pipes that are 400 mm in diameter or less, and concrete material for pipes that are larger than 400 mm diameter. The reconstruction costs are shown in **Table 5-3**.

Table 5-3: Linear Wastewater Asset Replacement Costs

Replacement Pipe Material	Diameter	Replacement Costs ($/m)
PVC	< 250 mm	$1,950/m
PVC	250 mm – 400 mm	$3,200/m
Asbestos Cement	> 400 mm	$4,200/m

Using the unit costs provided in **Table 5-3**, the total replacement costs for the linear wastewater network is estimated to be $38.8 million.

5.1.1.2 Average Age

The average age of the linear wastewater assets was calculated by pipe material, weighted by length of asset. The average age is summarized in **Table 5-2.**

5.1.1.3 Expected Useful Life

The expected useful life of the linear water assets is used to estimate the replacement schedule as summarized in **Table 5-2**.

As data continues to be available regarding useful life of the wastewater sewer construction materials, these values can be reviewed and updated as appropriate.

5.1.2 Wastewater Facility Assets

In addition to the linear wastewater assets, the Municipality's wastewater network also includes facility assets that provide transmission and treatment services. These facility assets are complex and include multiple components, including electrical, mechanical, structural, instrumentation and control, process, civil and architectural. The wastewater facilities are summarized in **Table 5-4**.

Table 5-4: Summary of Wastewater Facility Assets

Asset No.	Description	Asset Location	Year of Const	Age	Useful Life	Repl. Cost
B15	Sewage Treatment Plant	301 Shackleton	1992	31	50	$4,235,000
P1	Pumping Station No. 1 - From Shackleton to Leitch	Shackleton – Leitch	1972	51	80	$355,000
P2	Pumping Station No. 2 - From Mary to Currie STS	Mary – Currie STS	1972	51	80	$213,000
P3	Pumping Station No. 3 - From Currie to John	Currie – John	1975	48	80	$213,000
P4	Pumping Station No. 4 - From Main to Strathcona	Main – Strathcona	2012	11	80	$213,000
P5	Pumping Station No. 5 - From Lila to Brown Drain	Lila Street – Brown Drain	2007	16	80	$213,000
P6	Pumping Station No. 6 - Currie Rd North	Caledonia II sewer	2008	15	80	$355,000
P7	Pumping Station – Service Centre	Service Centre	2010	13	80	$355,000

5.1.2.1 Average Age

The age of the facilities was based on the original construction date. The average age is 30 years, as shown in **Table 5-4**.

5.1.2.2 Expected Useful Life

The expected useful life of the facilities was provided by the Municipality, and includes 80 years for pumping stations, and 50 for the treatment plant, as summarized in **Table 5-4**.

5.1.2.3 Replacement Costs

Replacement costs for the wastewater facility assets have been estimated based on the insurance replacement cost, and estimated replacement costs provided by the Municipality. These costs have been inflated to represent current (2023) dollars, as shown in **Table 5-4**.

5.2 Condition – Wastewater

Condition of the wastewater assets was estimated based on age of the asset relative to its expected useful life, where the age was determined using the year of construction, and a condition rating from a scale of 1 to 5 of Very Good (1) was assumed at the date of construction.

5.2.1 Linear Wastewater Assets

The estimated condition is reported on a condition rating scale of 1 to 5, where 1 represents an asset in Very Good condition. The average estimated condition of all linear wastewater assets (by length) is 3, corresponding to a condition of Fair. This is an estimate based on the age of the wastewater assets, the actual condition of the assets may differ.

Actual condition data for the linear wastewater assets can be determined in field using visual camera inspection. It is recommended that a condition assessment be completed of the wastewater linear assets and incorporated into the next update of the AMP.

5.2.2 Wastewater Facility Assets

The condition of the wastewater facilities was estimated based on the useful life and age of each asset. Comprehensive existing condition of the Municipality's wastewater facility assets is not currently available. It is recommended that a condition assessment be completed of the wastewater facilities (including components of each facility) and incorporated into the next update of the AMP. A summary of the condition is in **Table 5-5**.

Table 5-5: Summary of Wastewater Facility Asset Conditions

Asset No.	Description	Year of Const	Age	Useful Life	% of Useful Life Used	Corresp Condition
B15	Sewage Treatment Plant	1992	31	50	62%	4
P1	Pumping Station No. 1 - From Shackleton to Leitch	1972	51	80	64%	4
P2	Pumping Station No. 2 - From Mary to Currie STS	1972	51	80	64%	4
P3	Pumping Station No. 3 - From Currie to John	1975	48	80	60%	3
P4	Pumping Station No. 4 - From Main to Strathcona	2012	11	80	14%	1
P5	Pumping Station No. 5 - From Lila to Brown Drain	2007	16	80	20%	1
P6	Pumping Station No. 6 - Currie Rd North	2008	15	80	19%	1
P7	Pumping Station - Service Centre	2010	13	80	16%	1

5.3 Current Levels of Service – Wastewater

Levels of service for wastewater assets are outlined in Table 2 of the regulation, *O.Reg. 588/17*.

Table 5-6 to **Table 5-9** outline the Municipality's current community and technical levels of service for wastewater assets.

Table 5-6: Community Levels of Service – Wastewater

Service Attribute	Community Levels of Service (Qualitative Description)	Community LOS
Scope	Description, which may include maps, of the user groups or areas of the Municipality that are connected to the municipal wastewater system.	The Municipality provides wastewater collection and treatment services for properties, primarily located in the urban. A map showing the areas connected to the wastewater system is in Figures 3a-d in **Appendix A**.
Reliability	Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes.	There are no known combined sewers in the Municipality.
Reliability	Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches.	There are no known combined sewers in the Municipality.
Reliability	Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes.	Stormwater has the potential to enter into the municipal wastewater system through multiple points of entry, including: • Direct connections from properties, including roof leaders, sump pumps, etc. • Inflow and infiltration within manholes and damaged pipes and joints
Reliability	Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described above.	Resiliency in the sanitary sewer system, in the event that inflow of stormwater occurs, is created through: • Prohibition of discharging of stormwater into the wastewater system • Designing wastewater infrastructure to provide minimum sizing and criteria as per current standards
Reliability	Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system.	The Municipality reports annually on performance of the wastewater treatment system, including description of the effluent discharged from the sewage treatment plants. Table 5-7 describes the volume of effluent flow from 2021-2022, as noted within 'The Corporation of the Municipality of Dutton Dunwich Annual Reports' for 2021 and 2022. The quality parameters of the effluent are also tracked and are summarized in Table 5-8. The source of the table is from The Corporation of the Municipality of Dutton Dunwich Annual Reports for 2021 and 2022.

Table 5-7: Annual Effluent Flow 2021-2022

Year	Annual Effluent Flow (m^3)
2021	183,430
2022	169,661

Table 5-8: Wastewater Effluent Quality

Effluent Parameter	ECA Concentration Objectives	2021		2022	
		Monthly Average Results Range	Number of Objective Exceedances (weekly)	Monthly Average Results Range	Number of Objective Exceedances (weekly)
CBOD5 (mg/L)	5.0 (May – Oct) 10.0 (Nov – April)	2.0 – 4.3	0	2.0 – 4.3	0
Total Suspended Solids (mg/L)	5.0 (May – Oct) 10.0 (Nov – April)	3.0 – 7.6	2	2.2 – 12.3	6
Total Phosphorus (mg/L)	0.3 (May – Oct) 0.8 (Nov – April)	0.19 – 0.43	6	0.23 – 0.39	20
E. coli	100 cfu / mL	1.0 – 11.0 cfu /100mL	0	1.0 – 11.2 cfu /100mL	0
Total Ammonia Nitrogen (mg/L)	2.0 (May – Oct) 4.4 (Nov – April)	0.1 – 0.175 (Ammonia Concentrations)	0	0.105 – 2.32 (Ammonia Concentrations)	0
Dissolved Oxygen (single sample)	> 5.0 mg/L	8.3 - 11.9	0	7.51 – 10.1	0
pH	6.5 - 8.5	7.0 - 7.4	0	7.1 - 7.7	0

Table 5-9: Technical Levels of Service – Wastewater

Service Attribute	Technical Levels of Service (Technical Metrics)	Technical LOS
Scope	Percentage of properties connected to the municipal wastewater system.	Percentage is not available.
Reliability	The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system.	There are no known combined sewers in the Municipality.
	The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system.	The Municipality received 2 complaints of sewer backups on September 13th, 2021, and no complaints in 2022. In comparison to the total number of properties connected to the municipal wastewater system, this is equivalent to 1 connection-day per year due to wastewater backups.
	The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system.	There were no effluent limit exceedances for 2021 or 2022.

5.4 Current Performance – Wastewater

Asset performance measures were determined based on consultation with the Municipality, which provide relevant metrics against which the Municipality can gauge the performance of their assets. The performance measures for the wastewater network, and their current values are shown in **Table 5-10**.

Table 5-10: Performance Measures – Wastewater

Asset Performance Measure	Current Value
Number of customers that have experienced a service interruption in the last year	No customers experienced a service disruption in 2022.
Percentage of wastewater flows that meet environmental objectives when discharged	100% (no effluent limit exceedances or abnormal discharges noted for 2021 or 2022)

In addition, the Municipality can consider selection and tracking of other relevant indicators, including the following:

- Cost efficiency (operating cost to provide wastewater services were $532,253 for 2021 and $1,239,535 in 2022 - per unit costs can be determined by the amount of customers connected to the wastewater system)

5.5 Risk Assessment – Wastewater

The risk ratings for the wastewater assets follows the risk methodology and approach presented in **Section 1.5**. The risk assessment for wastewater linear and facility assets will be conducted according to the assumptions and criteria summarized in **Table 5-11**.

Table 5-11: Wastewater Asset Risk Assessment Assumptions

	Wastewater linear assets	Wastewater facility assets
Condition	Determined based on estimated condition (using deterioration curve)	Based on % of useful life remaining
Performance	Always Reliable (value of 1)	Always Reliable (value of 1)
Climate Change	Moderate (value of 3) for all assets (Limited impact with slower recovery; mitigation plan not in place)	Moderate (value of 3) for all assets (Limited impact with slower recovery; mitigation plan not in place)
Impact	Moderate impact (value of 1)	High impact (value of 2)
Importance	High importance (value of 3) attributed to assets of 400 mm diameter or larger Moderate importance (value of 2) attributed to all other assets	High importance (value of 3) for Sewage Treatment Plant Moderate importance (value of 2) for all other assets

The risk profile for linear wastewater assets is shown in **Figure 5-1** and for wastewater facilities in **Figure 5-2**.

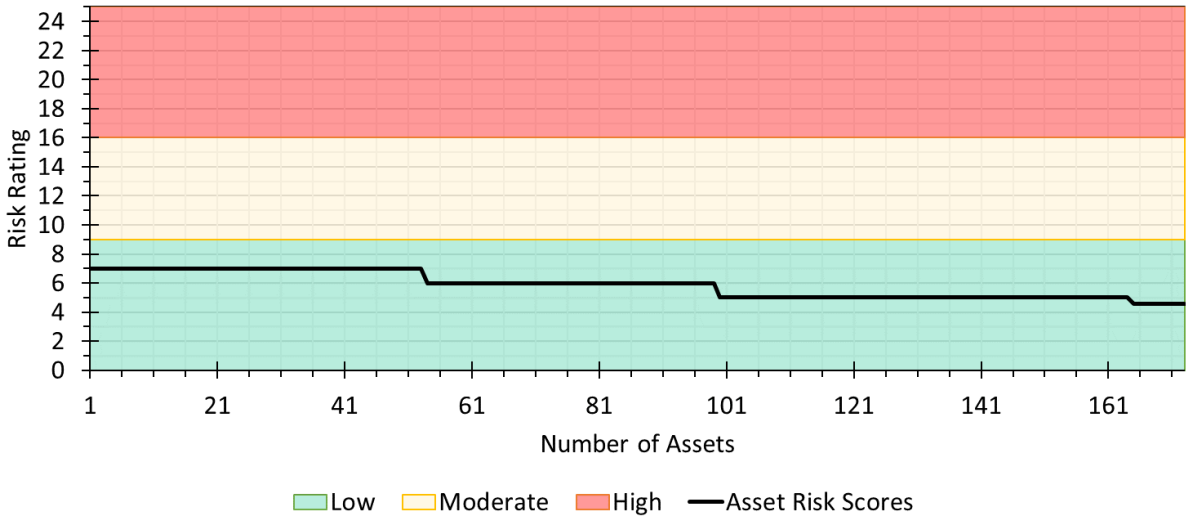


Figure 5-1: Wastewater – Linear Risk Profile

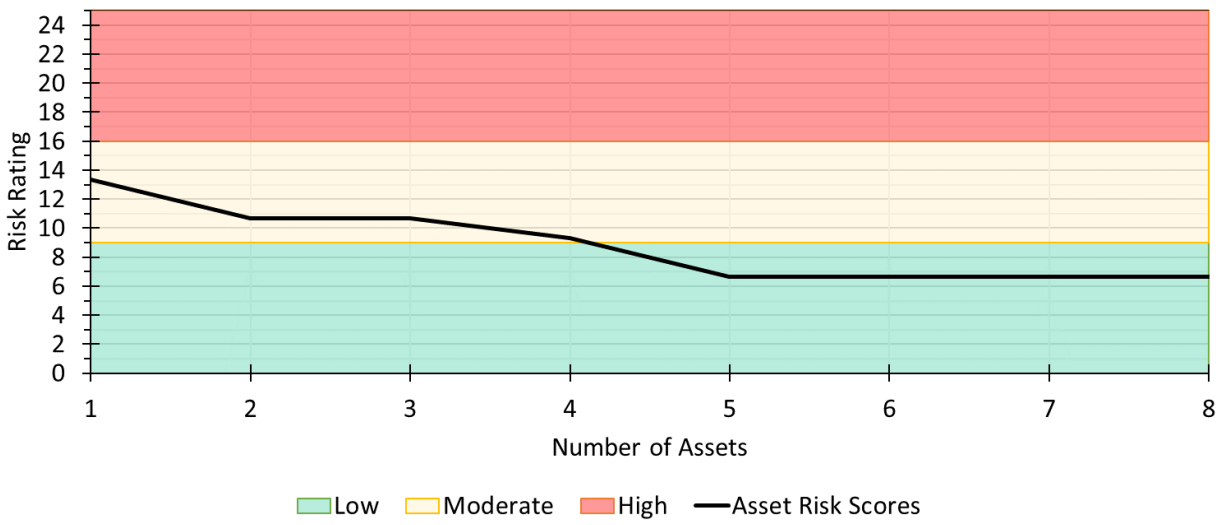


Figure 5-2: Wastewater – Facility Risk Profile

5.6 Lifecycle Activities – Wastewater

The following section describes the lifecycle activities that can be implemented within the asset management strategy for wastewater assets. The wastewater assets include linear and facility assets, lifecycle activities for each presented separately.

5.6.1 Linear Wastewater Assets

In the lifecycle of a linear wastewater asset, there are multiple activities that can be taken, depending on the asset attributes. The expected lifecycle activities recommended to be used are as follows.

Construction

Construction of new assets is recommended to be in line with recommendations as part of growth, master plan, or other municipal strategies. The design of the new assets should be consistent with jurisdictional design requirements, including provincial design guidelines and local requirements. New construction of assets will occur where no previous sanitary servicing is available. The risk associated with new construction includes the high cost of brand-new assets relative to ability to recoup costs through user rates or development charges.

Construction can also be the replacement of deteriorated assets. At the end of the useful life of an asset, it can be replaced for continuation of service provision. At the time of replacement, design should be undertaken to ensure design requirements are met, and adequate capacity is provided for current and future requirements.

Maintenance

Maintenance activities are undertaken on the assets throughout their useful life to maintain their operating condition and performance. Maintenance works includes routine maintenance (flushing, cleaning), and minor repairs to assets. There exists the risk that a maintenance activity may be implemented that does not adequately mitigate a performance or condition issue, and additional costs are then required for further repair or replacement.

Renewal

Renewal of the sanitary sewer assets can include structural or non-structural lining. A lining can be used where the condition has deteriorated, however structurally the pipe segment is still sound. A lining can extend the useful life of an asset and improve performance. Risks associated with lining of a pipe include the improper installation of the pipe or continued deterioration of the original pipe such that the lining does not perform as expected.

Operating

Operating activities for the wastewater network include those activities that do not directly deal with the physical state of the pipe but work to extend the assets useful life. The operating activities can include non-infrastructure policies, and monitoring/inspection of the assets. The inspection of sanitary sewer assets can be undertaken through a condition assessment program, recommended to be visual inspection through CCTV or zoom camera means. Usage of the zoom camera technology has the risk of insufficient visual detail to make appropriate activity decisions.

Decommissioning

Decommissioning activities of the wastewater assets includes abandonment and rerouting or replacement of the asset at the end of its useful life. While typically assets are abandoned in place, the removal of the expended asset can provide additional space for new underground assets to be constructed.

5.6.2 Wastewater Facility Assets

The lifecycle activities for the facility (building) assets will be generally consistent with those expected for buildings, including:

Construction

Beginning of an asset's lifecycle. To be constructed to adhere to applicable standards and codes.

Maintenance

Types of maintenance include preventative, reactive and major maintenance. These activities are to be done on a routine basis to retain good condition and performance of the assets, and in response to issue or fault in a component or building asset. Maintenance activities will be undertake throughout the lifecycle of the asset.

Renewal

Addition to or update of existing building component(s) to achieve modernization, compliance with updated codes and requirements, and/or to suit changes to services provided.

Decommissioning/Disposal

Removal from service of a building asset or component. Disposal can be through decommissioning or sale. Activities should comply with applicable health, safety and environmental protocols.

As the sanitary sewer building assets are specialized for treatment and collection services, there are additional factors that must be considered:

- Wastewater treatment and collection facilities are highly regulated. Any and all lifecycle activities undertaken must be done in compliance with codes and regulations.
- Expansion of existing facilities may be required for additional wastewater treatment and collection capacity as a result of growth. Expansion activities may encompass multiple lifecycle stages, such as construction for additional infrastructure required, and renewal for expansion of existing infrastructure such as the treatment facility.

5.7 Asset Management Strategy – Wastewater

5.7.1 Linear Wastewater Assets

The asset management strategy for the wastewater assets in the Municipality will employ the lifecycle activities to maximize the useful life and economy of each asset.

The condition of an asset, a major factor in the asset management strategy, should be established to assist in decision making. It is recommended that the Municipality establish/maintain a condition assessment program for the wastewater assets. The recommendation is to use visual inspection facilitated by CCTV or Zoom camera inspection. A typical practice is to undertake assessment of 1/5 to 1/3 of the network annually, such that each pipe gets reviewed in a rotating 3 to 5 year basis.

When the condition of the asset has degraded such that an intervention is required, it is recommended that maintenance be reviewed as the first opportunity to extend the useful life. Maintenance works can include localized repair work or relining of a pipe segment. Because of the non-intrusive nature of conducting relining, it can be done on an individual pipe segment at a time, or to complete localized repairs.

When the condition of the asset has degraded such that maintenance is no longer an appropriate activity, the segment can and should be reconstructed. The Municipality should follow best practices and local design guidelines when designing the reconstruction works. Assets at the end of their useful life should be abandoned in place or removed.

A summary of the wastewater asset condition and associated lifecycle activity is provided in **Table 5-12**.

Table 5-12: Average Condition of Linear Wastewater Assets

Condition Range	Lifecycle Activity Category	Lifecycle Activity
1.0 to 0.60	Maintenance	• Maintenance Works (cleaning, flushing) • Maintenance hole repairs • Small pipe section repairs • CCTV as required
0.60 to 0.35	Rehabilitation	• Localized repairs • Spare Parts Inventory • Structural relining • CCTV as required
0.35 to 0	Reconstruction	• Pipe replacement or abandonment

Current best practices suggest that that reconstruction and new construction works on the assets will be done using PVC material for pipes that are 400 mm in diameter or less, and concrete material for sizes larger than 400 mm diameter.

5.7.1.1 Scenario Analysis

To understand the needs and projected works on the linear wastewater assets within a 10-year outlook, replacement activities were reviewed under varying budget values to understand the impact on overall asset condition. The budgets analyzed include:

1. Unlimited budget – To determine backlog of works
2. No budget – To understand the changes in average network condition with no investment
3. Maintain average current condition index for linear assets at end of timeframe
4. Target PI of 0.60

A summary of the analysis is outlined in **Table 5-13** below.

Table 5-13: Scenario Results for Linear Wastewater Asset Projections

	Budget Scenario	Annual Value	Average Annual Investment Over Timeframe	Total Investment Over Timeframe	Average Condition Index (2032)
1	Unlimited	Unlimited	$1,562,487	$15,624,876	0.96
2	No Budget	$0	$0	$0	0.43
3	Maintain average current condition	$400,000	$396,637	$3,966,370	0.53
4	Goal PI of 0.60	$525,000	$517,301	$5,173,005	0.59

The budget values considered in the scenarios are maximum investment per year.

Scenario 1 assumes an unlimited budget available for reconstruction of the linear wastewater assets. In the first year of the scenario, $15.6M in reconstruction works were identified, indicating that there is a backlog of repairs required to improve the condition of the assets. The backlog includes any assets that are currently at a condition rating of 0.35 or less.

Scenario 2 models the impact of no spending on wastewater reconstruction during the 10-year timeframe. The average condition rating deteriorates to 0.43.

Scenario 3 reviewed the annual investment requirements when targeting the current condition rating of 0.53 over the assessed timeframe. This scenario uses just under $400,000 in annual expenditure.

Scenario 4 reviewed the investment level to increase the average condition index to 0.6 (Fair to Good), based on industry best practices as a consideration for the Municipality. The average condition reached at the end of the timeframe is 0.59, with an average annual expenditure of just over $517,000, an increase of over $100,000 annually from Scenario 3. increases the annual investment value by $400,000 from the value recommended in the 2014 AMP.

In selecting the recommended investment level, the Municipality should consider its current and preferred level of service being provided. The LOS is represented in these scenarios as the average condition of the assets. The current average condition is 0.53, and a best practice recommends maintaining a minimum average condition of 0.60 across the system. If the Municipality's target is to maintain the current LOS, Scenario 3 would be the recommendation, however if the Municipality was seeking an increase in average condition, a higher annual expenditure (such as Scenario 4) could be selected.

The Municipality should also consider the current backlog of works relative to the investment scenario. The unlimited scenario identifies a $15.6 million backlog of works currently outstanding on the system. While the other scenarios present annual expenditures that are more affordable for the Municipality, it may be insufficient to address all required lifecycle activities, thereby risking degradation of some assets to the point of failure. Risk assessment and visual inspection of the pipes should be conducted to assist in determining the optimal prioritization for works to be undertaken, as well as other factors such as sewer separation needs, and growth considerations.

Figure 5-3 illustrates the level of investment for Scenario 3 (maintain current average condition index), and the expected impact in average condition index.

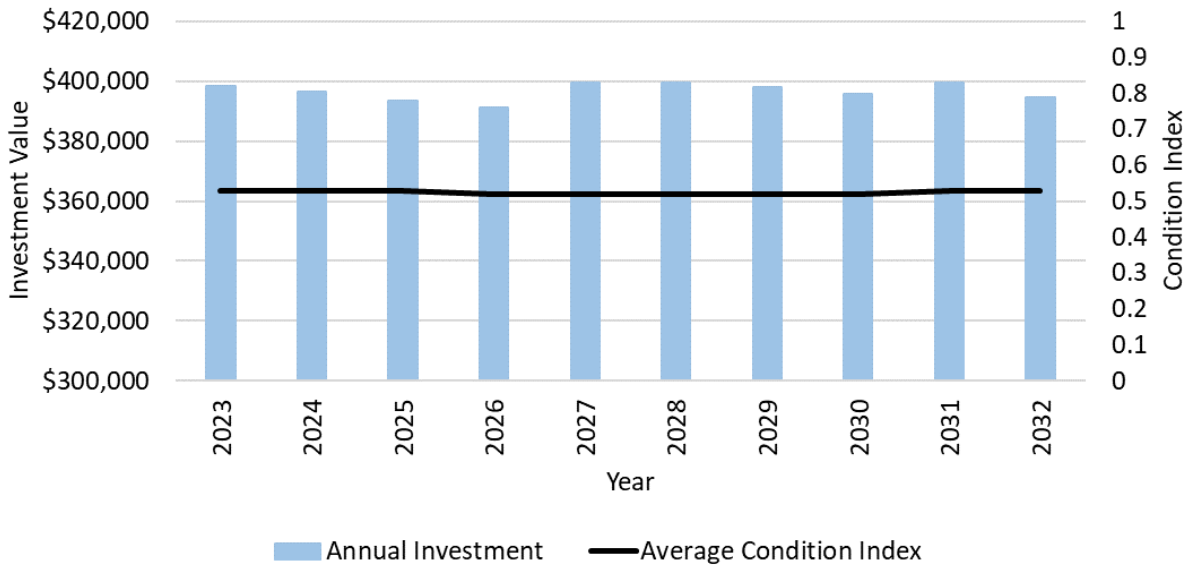


Figure 5-3: Linear Wastewater Investment and Condition Index to Maintain Current (Scenario 3)

5.7.2 Wastewater Facility Assets

The asset management strategy for wastewater facility assets seeks to maximize the useful life and economy of each asset, using the lifecycle activities.

The primary drivers of lifecycle activities for these assets are the condition and service delivery requirements. The Municipality's wastewater facility assets are complex, the componentry for which are expected to have differing rates of degradation and expected useful lives. As such, lifecycle activities will be required to be implemented at varied frequency and timelines.

The expected useful life of the asset components should be used to approximate the timing and frequency of lifecycle activities; however, this should be refined by undertaking detailed condition assessment of the buildings at regular intervals for an understanding of the actual condition of the assets. A maintenance schedule and forecast of asset improvements should be based on this detailed review, which should be updated at a frequency suitable to the Municipality, suggested to be every five years.

If it is not possible to complete the condition assessment of all buildings in the near term, priority buildings for the condition assessment program are suggested to be identified by the presented risk assessment, condition, and performance measures. Buildings with high risk or poor condition/performance components should be prioritized in the condition assessment program.

Routine maintenance schedules are assumed to be in place currently and are recommended to continue assuming that they are currently providing sufficient level of maintenance.

Management of building assets should also include climate change considerations, in new construction, maintenance or renewal lifecycle activities.

Assessment should be undertaken to understand vulnerability of building assets to a changing climate, which will inform lifecycle activity requirements, and potential changes to the way lifecycle activities are undertaken.

Works should also be undertaken as required to maintain the treatment efficiency and capacity to meet regulations and user requirements.

The current level of service being provided in wastewater service delivery is generally a high average condition of the assets (resulting in low quantity of complaints or issues), and treatment quality within the C of A limits. To maintain these LOS values, the Municipality's strategy should continue to maintain the condition of the wastewater building assets and provide upgrades and replacements according to projections to retain quality and quantity of treatment capacity.

5.7.2.1 Projection of Works

The projection of works for the wastewater facility assets considers the estimated replacement date based on the expected useful life, year of construction, and replacement cost of the assets. The year of replacement was determined assuming a linear deterioration of the assets, for their expected useful life beginning in the year of construction. Based on this approach, there are no expected works required within the upcoming 10-year timeframe.

It is recommended that a program for regular condition inspections by professional service providers be implemented to provide additional detail and guide the planned capital investment into building asset investment.

5.7.2.2 Expenditure Based on Reinvestment

An alternative for estimating the annual expenditure for assets is through estimation using the recommended reinvestment rate and the replacement value of the assets. The 2016 infrastructure report card suggests a reinvestment rate of 1.7-2.5% annually for buildings and facilities. The current replacement cost for all the wastewater facility assets is $6,930,000, which suggests the reinvestment rates noted in **Table 5-14**.

Table 5-14: Reinvestment Rate for Wastewater Facilities

Reinvestment Rate	Reinvestment Value
1.7%	$117,900
2.5%	$173,300

It is recommended that the Municipality consider maintaining a budget based on the reinvestment value to allow for building of reserves to assist in future expenditures.

6.0 Stormwater

6.1 State of Local Infrastructure – Stormwater

The Municipality owns and operates a stormwater network which consists of the following assets:

- Lineal storm sewer – total quantity of 11,039 meters
- Stormwater management ponds – wet pond at Nancy/Lila Street and dry pond at Nancy Street

The analysis of linear stormwater assets within this report will be limited to the pipe assets only, omitting appurtenances such as maintenance holes, catchbasins, etc. This is predicated on the assumption that all other elements included in the system are required componentry that will be replaced in conjunction with the linear components and are expected to have similar expected useful lives and conditions as the linear components.

6.1.1 Linear Stormwater Assets

The total length of the linear stormwater assets by diameter is summarized in **Table 6-1**. There are 69 segments of storm sewer in Wallacetown with a total of 231 m in length that have an unknown diameter, which represents 2% of the entire system.

Table 6-1: Summary of Storm Sewers

Diameter Size Range (mm)	Total Length (m)	Percentage of System
100	110	1
150	1,284	12
200	2,854	26
250	1,119	10
300	1,278	11
350 - 450	1,509	14
Over 450	2,652	24
Unknown	231	2

6.1.1.1 Replacement Costs

Replacement costs for the linear stormwater assets were determined based on recent tender information at the Municipality and product information. The unit replacement costs represent project costs, with provision for full reconstruction of a segment including trench and surface restoration and contingency. It is assumed that reconstruction works on the assets will be done using PVC material for pipes that are 400 mm in diameter or less, and concrete for sizes larger than 400 mm diameter. The reconstruction costs are shown in **Table 6-2**.

Table 6-2: Linear Stormwater Asset Replacement Costs

Diameter	Replacement Costs ($/m)
< 250 mm	$1,750/m
250 mm – 400 mm	$2,400/m
Over 400 mm	$3,600/m

Using the units costs provided in **Table 6-2** and assuming that the 231 m length of unknown diameter is between 250mm and 400 mm, the total estimated replacement costs for the linear stormwater network is estimated to be $27,540,000.

6.1.1.2 Average Age

The average age of the linear stormwater network is currently unknown.

6.1.1.3 Expected Useful Life

The expected useful life of linear stormwater assets is summarized in **Table 6-3**. As the material of the storm network is unknown, the table includes typical linear stormwater pipe material types.

Table 6-3: Expected Useful Life of Linear Stormwater Assets by Pipe Material

Pipe Material	Expected Useful Life (years)
Concrete	85
PVC	75
Tile	25
CSP	25
Asbestos cement	70

6.1.2 Stormwater Facility Assets

There are two stormwater management facilities that are currently used by the Municipality, including the Nancy Street Stormwater Management Pond, a rectangular dry pond that is designed to manage the 1:100 year design storm, and the Nancy/Lila Street Stormwater Wet Pond that is designed to manage the 1:100 year design storm, and includes sediment forebay, permanent and extended stormwater storage.

6.1.2.1 Replacement Costs

The replacement cost for the stormwater management ponds is unavailable. The replacement costs should consider any structures associated with operation of the pond, including (but not limited to) inlet/outlet structures, treatment components, and safety components.

6.1.2.2 Average Age

The average age of the existing stormwater management facilities is currently unavailable.

6.1.2.3 Expected Useful Life

The stormwater management pond components will vary in their expected useful life. The structure components (assumed to be concrete) are expected to have a useful life of approximately 70 years. The stormwater pond facility proper does not have an expected useful life, and should continue to operate as intended contingent on factors such as climate, maintenance frequency, adjacent development, etc.

6.2 Condition – Stormwater

6.2.1.1 Linear Stormwater Assets

The Municipality does not currently have condition information available for their stormwater assets, however, have initiated a CCTV program occurring in late 2023 and early 2024 which will provide visual assessment of the condition of the storm network.

6.2.1.2 Stormwater Facility Assets

It is recommended that a condition assessment be completed of all components of each facility and incorporated into the next update of the AMP.

Comprehensive existing condition of the Municipality's stormwater facility assets is not currently available. The condition of the stormwater management ponds can be estimated through a condition assessment of the site elements, or through theoretical estimation using the expected useful life and age of the assets.

The primary indicators for condition will be the structure components (such as concrete structures), which will deteriorate over its expected lifespan. Throughout their lifecycle, these assets can be visually assessed to determine their condition. The condition of the stormwater pond facility proper will fluctuate throughout its lifecycle, and will be contingent on factors such as climate, maintenance frequency, adjacent development, etc.

6.3 Current Levels of Service – Stormwater

Levels of service for stormwater assets are outlined in Table 3 of the regulation, *O.Reg. 588/17*. **Table** 6-4 and **Table 6-5** and outline the Municipality's current community and technical levels of service for stormwater assets.

Table 6-4: Community Levels of Service – Stormwater

Service Attribute	Community Levels of Service (Qualitative Description)	Community LOS
Scope	Description, which may include maps, of the user groups or areas of the Municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system.	The stormwater management system in the Municipality is devised of a pipe network, drainage network, and stormwater management facilities which provide conveyance of stormwater to protect properties. A map showing the areas connected to the stormwater system is in Figures 3a-d of **Appendix A**.

Table 6-5: Technical Levels of Service – Stormwater

Service Attribute	Technical Levels of Service (Technical Metrics)	Technical LOS
Scope	Percentage of properties in municipality resilient to a 100-year storm.	The percentage of properties is currently unknown. It is recommended that further studies be completed in the future in order to assess the LOS metric.
	Percentage of the municipal stormwater management system resilient to a 5-year storm.	The percentage of properties is currently unknown. It is recommended that further studies be completed in the future in order to assess the LOS metric.

6.4 Current Performance – Stormwater

The Municipality does not currently have established performance parameters for the stormwater assets. Asset performance measures provide relevant metrics against which the Municipality can gauge the performance of their assets and can be established to provide the Municipality with a fuller picture of asset level of service provision and performance. The Municipality can consider selection and tracking of relevant indicators, including the following:

- Percentage of the community with stormwater quality and quantity control
- Inspection frequency of stormwater ponds
- Inspection frequency of catch basins

6.5 Risk Assessment – Stormwater

The risk assessment methodology utilizes information to perform a risk assessment that is not currently available for the stormwater assets, including the condition.

It is noted that condition information will be available to the Municipality following completion of the ongoing video inspection of the stormwater linear assets.

Once available, the Municipality can complete a risk assessment using the methodology described in Section 1.5, with the following suggested assumptions and criteria:

- Condition: Determined based on a 5-point rating from the last inspection (ranging from Very Good – 1 to Very Poor – 5).
- Performance: Always Reliable (value of 1) for all assets.
- Climate Change: Assets highly vulnerable to flood risks from climate change (value of 5).
- Impact: Moderate impact (value of 1) for all assets.
- Importance:
  - High importance (value of 3) attributed to assets of 400 mm diameter of larger
  - Moderate importance (value of 2) attributed to all other assets

6.6 Lifecycle Activities – Stormwater

The following section describes the lifecycle activities that can be implemented within the asset management strategy for stormwater assets. The primary lifecycle activities include construction, maintenance, renewal, operation, and decommissioning/disposal. The selection and implementation of a lifecycle activity will be dependent on the type of asset, attributes, and lifecycle history.

6.6.1 Construction

The design of the new assets should be consistent with jurisdictional design requirements, including provincial design guidelines, local and conservation authority requirements. New construction of assets will occur where no previous stormwater servicing is available. The risk associated with new construction includes the high cost of brand-new assets, and capacity for treatment and outlet of the stormwater flows.

Construction can also be the replacement of deteriorated assets. At the end of the useful life of an asset, it can be replaced for continuation of service provision. At the time of replacement, design should be undertaken to ensure design requirements are met, and adequate capacity is provided for current and future projections.

6.6.2 Maintenance

Maintenance activities are undertaken on linear storm sewer assets throughout their useful life to maintain their operating condition and performance. Maintenance works includes routine maintenance (flushing, cleaning), and minor repairs to assets. There exists the risk that a maintenance activity may be implemented that does not adequately mitigate a performance or condition issue, and additional costs are then required for further repair or replacement.

Routine inspections of the conditions of stormwater facilities and catch basins should be completed on an annual basis to identify any necessary cleaning and maintenance activities required.

The condition of the drainage area can have a significant impact on the maintenance cycle of a stormwater management facility. Soil erosion, construction and upstream sources of contamination should be identified and addressed in a timely manner. Addressing sediment and other contaminants at their source, in the contributing drainage area, is often much more manageable and cost effective than to remove sediment that has already accumulated in the facility.

Measures that can be taken to manage pollutant sources before they reach the SWM facility include: Erosion and sediment control measures during construction

- Regular catch basin cleaning
- Regular street sweeping
- Reducing pesticide and fertilizer use
- Industrial pollution prevention programs
- Optimizing practices for winter snow and ice management.

Any structural components associated with the stormwater management facilities should be regularly inspected in order to proactively identify when corrective actions will be needed. Inspection of structural components can reveal reasons for hydraulic malfunctioning (too high or too low water levels) which need to be addressed immediately. Inlets or outlets can become clogged with sediment and debris.

If an inspection reveals that the water levels are higher than expected after several days of dry weather, this may be an indication that the outlet is clogged with sediment, garbage and/or debris. Minor clogs that are accessible can be cleaned out by hand, but more significant clogs should be removed by flushing or a combination of jet washing and suctioning with a vacuum truck.

6.6.3 Renewal

Renewal of the storm sewer assets can include structural or non-structural lining. A lining can be used where the condition has deteriorated, however structurally the pipe segment is still sound. A lining can extend the useful life of an asset and improve performance. Risks associated with lining of a pipe include the improper installation of the pipe or continued deterioration of the original pipe such that the lining does not perform as expected.

To ensure long-term effectiveness, the sediment that accumulates in a stormwater management facility should be periodically removed. The required frequency of sediment removal varies between facilities and is dependent on several factors, including the type of facility and characteristics of the contributing drainage area. Sediment accumulation will typically be rapid for the entire construction period, but once the catchment area is completely developed and vegetation is established, sediment accumulation drops significantly.

Slow degradation of concrete structures can be caused by the sustained flow of sediment-laden stormwater and scour and freeze/thaw cycles. The need for structural repairs must be identified through routine preventative maintenance visits.

6.6.4 Operating

Operating activities for the storm sewer assets include those activities that do not directly deal with the physical state of the pipe, but work to extend the assets useful life. The operating activities can include non-infrastructure policies, and monitoring/inspection of the assets. The inspection of storm sewer assets can be undertaken through a condition assessment program, recommended to be visual inspection through CCTV or zoom camera means. Usage of the zoom camera technology has the risk of insufficient visual detail to make appropriate activity decisions.

6.6.5 Decommissioning

Decommissioning activities of the storm sewer assets includes abandonment or replacement of the asset at the end of its useful life. While typically assets are abandoned in place, the removal of the expended asset can provide additional space for new underground assets to be constructed.

6.7 Asset Management Strategy – Stormwater

6.7.1 Linear Stormwater Assets

The asset management strategy for the storm sewer mains in the Municipality will employ the lifecycle activities to maximize the useful life and economy of each asset.

The assets will deteriorate on a non-linear basis, and the various lifecycle activities can be implemented at varying stages within an asset deterioration

It is expected that maintenance and operating activities will occur through the full lifecycle of the asset. Renewal works are most appropriately employed within the rehabilitation zone, and reconstruction and decommissioning will most likely occur within the reconstruction zone.

The condition, a major factor in the asset management strategy, should be established to assist in decision making. The Municipality plans to complete the condition assessment program for the storm sewers in early 2024. The recommendation is to use visual inspection facilitated by CCTV or Zoom camera inspection on a 3 to 5 year basis.

When the condition of the asset has degraded such that, an intervention is required, it is recommended that maintenance be reviewed as the first opportunity to extend the useful life. Maintenance works can include localized repair work, or relining of a storm sewer pipe segment. Because of the non-intrusive nature of conducting relining, it can be done on an individual pipe segment at a time, or to localized repairs.

When the condition of the asset has degraded such that maintenance is no longer an appropriate activity, the segment can and should be reconstructed. The Municipality should follow best practices and applicable design guidelines when designing the reconstruction works. Assets at the end of their useful life should be abandoned in place or removed.

A summary of recommended storm sewer pipe condition and associated lifecycle activity is provided in **Table 6-6**. Note that condition assessment should be undertaken on a routine basis throughout the lifecycle of the asset, and other factors should be considered when selecting a lifecycle activity.

Table 6-6: Storm Sewer Lifecycle Activities and Condition Ranges

Condition Range	Condition Description	Lifecycle Activity Category	Lifecycle Activity
1.0 to 0.60	Very Good to Good	Maintenance	• Maintenance Works (cleaning, flushing) • Manhole repairs • Small pipe section repairs • CCTV as required
0.60 to 0.35	Good to Fair	Rehabilitation	• Localized repairs • Structural relining • CCTV as required
0.35 to 0.0	Poor to Very Poor	Reconstruction	• Pipe replacement or abandonment

Current best practices suggest that that reconstruction and new construction works on the assets will be done using PVC material for pipes that are 400 mm in diameter or less, and concrete material for sizes larger than 400 mm diameter.

6.7.2 Stormwater Management Facilities

The asset management strategy for the stormwater management facilities will be designed to maximize the economic viability and lifespan of the assets.

The primary drivers of lifecycle activities for these assets are the condition and service delivery requirements. The stormwater management pond assets are complex, the componentry for which are expected to have differing rates of deterioration and expected useful lives. As such, lifecycle activities will be required to be implemented at varied frequency and timelines.

The timing and frequency of lifecycle activities can be established according to the condition and performance of the components. This can be determined theoretically using the expected useful life and age of the asset components, or through condition assessment/inspection of the assets and components. An inspection or assessment can be undertaken at regular frequency for understanding the actual condition, recommended to be at a minimum of every five years, or according to the preferences and schedule established by the Municipality.

Routine maintenance schedules are assumed to be in place currently, and are recommended to continue assuming that they are currently providing sufficient level of maintenance.

Following initial construction, maintenance works can be implemented to maximize the lifespan of the stormwater management facilities. To retain the capacity of the pond throughout its useful life, the pond should be cleaned at regular intervals, the frequency of which can be adjusted according to pond

performance. When sediment accumulation in a stormwater management facility has reached a point where removal efficiency has been reduced by 5% or more, sediment removal is required, as recommended in the MECP's Stormwater Management Planning and Design Manual (March 2003). In-situ measurement of sediment depth can also be carried out regularly (at least every three to five years) to determine when cleaning will be required. Once sediment dredging is complete, the facility is returned to its original design capacity and is again capable of providing effective hydraulic and water quality control. Routine site maintenance will occur at a higher frequency, including inspection, maintenance and grass cutting, etc.

The pond asset will not have a firm replacement date, as it is a passive asset. However, the other capital components such as the inlet structures, etc., have a finite lifespan and will need replacement or renewal when the condition, performance and risk are no longer acceptable to the Municipality.

6.7.3 Investment Strategy

In the absence of recommended replacement schedule based on a detailed engineering condition assessment, an alterative for estimating the annual expenditure for assets can be undertaken using the recommended reinvestment rate and replacement value of the assets.

The 2016 infrastructure report card suggests a reinvestment rate of 1.0 – 1.3% annually for stormwater (linear) assets. The current estimated replacement cost for all the linear stormwater assets is $27,540,000, which suggests the reinvestment rates noted in **Table 6-7**.

Table 6-7: Reinvestment Rate for Stormwater Linear Assets

Reinvestment Rate	Reinvestment Value
1.0%	$275,400
1.3%	$358,020

It is recommended that the Municipality continue to use this standard practice for future capital investment planning in the short term. Information determined through the condition inspection program being undertaken in late 2023 and early 2024 can be used to provide additional detail and guide the planned capital investments into stormwater infrastructure.

7.0 Buildings and Facilities

7.1 State of Local Infrastructure – Buildings and Facilities

The Municipality owns and maintains buildings and facilities, excluding water, wastewater and parks and recreation facilities which for the purposed of this asset management plan, are categorized under those respective asset categories. The Municipality's buildings and facilities considered within this AMP include the following:

- Municipal Building/ Theatre
- Fire Hall
- Water Depot Garage
- South Dunwich Hall
- Library/Meeting Room
- Community Center
- Equipment Dept/Office
- Salt Storage Building

7.1.1 Replacement Costs

The estimated replacement costs of the Municipality's buildings and facilities is $10,053,000 based on insurance replacement costs as supplied by the Municipality, inflated to 2023 dollars.

7.1.2 Average Age

The average age of the Municipality's buildings and facilities is 42 years. This accounts for the original construction of the buildings and facilities, noting that upgrades and renovations have occurred at some of the facilities since original construction.

7.1.3 Expected Useful Life

The Municipality tracks the expected useful life of its buildings and facilities, which ranges from 40 years (salt storage building) to 60 years (South Dunwich Hall and Library), with the most commonly applied expected useful life at 50 years. The Municipality can consider tracking expected useful life by componentry of the buildings and facilities in future.

7.2 Condition – Buildings and Facilities

The condition of the building and facilities assets were determined through condition assessments that took place during a site visit by a Dillon Consulting assessment team in January 2023. Facility condition assessments were completed based on componentry, which were assessed under the following categories; mechanical, electrical, architectural, structural, and site/civil.

Each component was given a condition rating which rated its current condition. The overall condition of each facility was estimated by averaging the condition of each inspected component that make up each facility. A condition descriptor and numerical value (on a scale from 1-5) were attributed for each of the assets' components based on the observed condition found during the assessments, according to the scale listed in **Table 7-1**.

Table 7-1: Condition Descriptors for Facility and Building Assets

Condition/Performance Descriptor	Condition/Performance Value
Very Good	1
Good	2
Fair	3
Poor	4
Very Poor	5

Using the method described above, the distribution of asset conditions shown in **Table 7-2** were found.

Table 7-2: Average Facility and Building Asset Conditions and Performance

Facility or Building	Architectural Condition	Structural Condition	Mechanical Condition	Electrical Condition	Sitework/ Civil Condition	Average Building Condition
Municipal Building /Theatre	N/A	Fair	Fair – Poor	Fair – Poor	Good – Fair	3.1 (Fair)
Fire Hall	Good	Good	Good – Fair	Fair – Poor	Good	2.4 (Good-Fair)
Water Depot Garage	Good – Fair	Good	Good	Good – Fair	Good – Fair	2.3 (Good-Fair)
South Dunwich Hall	Fair	Fair	Good – Fair	Poor	Fair – Poor	3.2 (Fair)
Library/Meeting Room	Good – Fair	Fair	Fair – Poor	Fair – Poor	Good – Fair	3 (Fair)
Community Center	Good – Fair	Fair	Fair	Good – Fair	Poor	3 (Fair)
Equipment Dept/Office	Good – Fair	Good	Good – Fair	Good – Fair	Good – Fair	2.4 (Good-Fair)
Salt Storage Building	Fair – Poor	Very Poor	N/A	Fair – Poor	Poor – Very Poor	4.1 (Poor)

7.3 Current Level of Service – Buildings and Facilities

Levels of service for building and facility assets are not defined in the regulation, *O.Reg. 588/17* as buildings are not considered core assets. As such, levels of service have been devised based on the content of the regulation, in consultation with the Municipality. **Table 7-3** and **Table 7-4** outline the Municipality's community and technical levels of service for buildings and facilities.

Table 7-3: Community Levels of Service – Buildings and Facilities

Service Attribute	Community Levels of Service (Qualitative Description)	Community LOS
Scope	Description, which may include maps of the asset category	The buildings and facilities considered within the scope of this report are located throughout the Municipality in urban and rural settings according to the services being provided from each facility.
Quality	Description of hours of operation and available services	• Municipal building provides administrative eservices, open during business hours • Other facilities are not open to the public. Used for administrative, public works, recreation, service delivery
Quality	Overall condition rating of buildings and facilities	Fair (value of 3)

Table 7-4: Technical Levels of Service – Buildings and Facilities

Service Attribute	Technical Levels of Service (Technical Metrics)	Technical LOS
Scope	Provide breakdown of number of buildings by type providing service compared to the size of the community (geography or population)	The buildings and facilities considered within the scope of this report each provide varying services to the Municipality, serving a population of 4,152 and land area of 294.38 sq.km (land area and population per 2021 Statistics Canada census).
Quality	Legal, regulatory, and local standards	The quality of Buildings and Facilities include the following legal, regulatory, and local standards for the services provided: • Accessibility (AODA Standards) • Health and safety • Buildings must be in compliance with Ontario Building Code.

7.4 Current Performance – Buildings and Facilities

The Municipality does not currently have established performance parameters for the building and facility assets. Asset performance measures provide relevant metrics against which the Municipality can gauge the performance of their assets and can be established to provide the Municipality with a fuller picture of asset level of service provision and performance. The Municipality can consider selection and tracking of relevant indicators, including the following:

- Water usage (m^3 per year)
- Energy usage (kWh per year)
- Operation and maintenance cost ($/population)

7.5 Risk Assessment – Buildings and Facilities

The risk ratings for the building and facilities follows the risk methodology and approach, presented in **Section 1.5**. The risk assessment for building and facility assets will be conducted according to the following assumptions and criteria:

- **Condition**: Rated according to the results of the 2022 facility condition assessment completed by Dillon.
- **Performance**: Always Reliable (value of 1) for all assets.
- **Climate Change**: Moderate (value of 3) for all assets (Limited impact with slower recovery; mitigation plan not in place).
- **Impact**: Moderate (value of 1) impact for all assets.
- **Importance**: Importance was assumed based on type of facility, according to:
  - Low importance (value of 1) for recreational facilities (community center, hall)
  - Moderate importance (value of 2) for administration buildings, public works garages, and salt domes
  - High importance (value of 3) for the Fire Hall

Using the assumptions and parameters listed above, a risk assessment was conducted where all building and facility assets were found to be within the Low-Risk Range.

The risk profile for the buildings and facilities is shown in **Figure 7-1**.

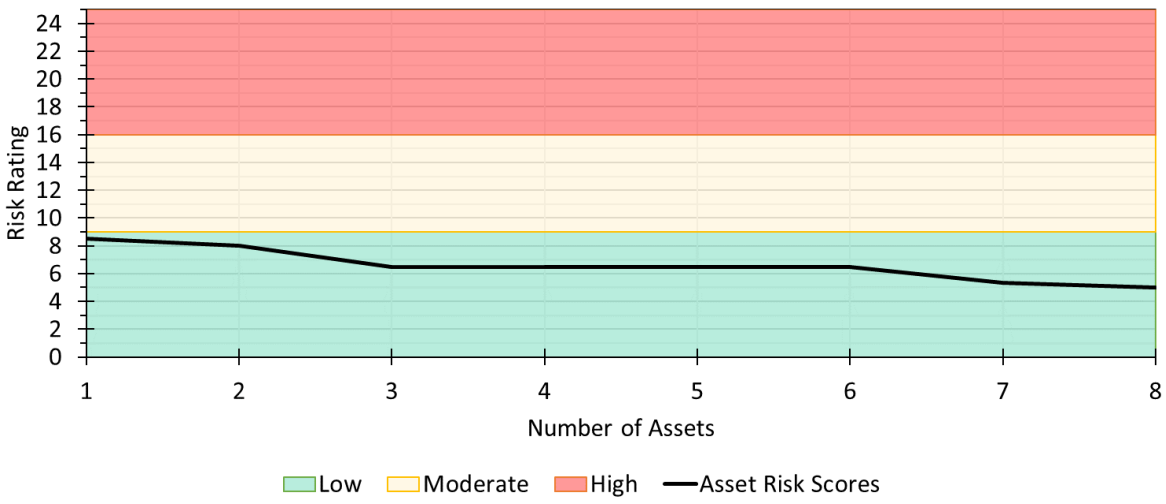


Figure 7-1: Buildings and Facilities Risk Profile

7.6 Lifecycle Activities – Buildings and Facilities

The following section describes the lifecycle activities that can be implemented within the asset management strategy for building assets. Note that, as previously discussed, building assets refers to the entirety of the asset which is made up of varying component systems depending on the use of the building. The primary lifecycle activities include construction, maintenance, renewal, and decommissioning/disposal.

7.6.1 Construction

The start of a building asset lifecycle is its construction. The building should be constructed to adhere with the requirements of the Ontario Building code, and any and all other applicable regional codes and requirements for the building and its use. Each building should be designed and constructed to provide the services for which it is intended.

7.6.2 Maintenance

Throughout the full lifecycle of a building, the majority of the expected lifecycle activities to be undertaken will be maintenance works. Maintenance activities can be used to improve the level of service of an asset (or component), or to maintain it. Activities that fall under the maintenance category can be varied by response type and scale of maintenance requirements. Activities can be required through routine maintenance works, response to Poor condition or performance, or on an emergency basis. In general, the expected types of maintenance activities within the lifecycle of a building include:

- Preventative maintenance
    - This type of maintenance activity is undertaken to prevent failure or Poor performance of a building asset component. Preventative maintenance works can be undertaken on an ad-hoc basis based on knowledge of condition or be undertaken according to a maintenance schedule.

Manufacturer directives and condition assessments should assist in determining frequency of preventative maintenance activities.

- Reactive maintenance
  - This type of maintenance activity is undertaken in response to an issue or fault in the building or component systems, on an ad-hoc basis. Scale of reactive maintenance works will be variable depending on the system and type of failure or decrease in level of service.
- Major maintenance (replacement)
  - This type of maintenance activity is undertaken in response to a component which is no longer able to provide adequate level of service. Major maintenance (replacement) will be undertaken for one or more components of a building asset. Major maintenance works can be preventative (in anticipation of end of service life of a component), or in response to a system failure.

7.6.3 Renewal

Renewal works can be used to update a building asset for modernization, to achieve compliance with updated codes and requirements, to expand on an existing building, or to renovate to suit changes to services provided. Renovation works can include:

- Addition of new components to an existing building asset
  - New components can be added to an existing building with the existing building largely unchanged.
- Updating of existing components
  - Updating of existing components can prolong the expected lifespan of a building asset.

7.6.4 Decommissioning/Disposal

Disposal activities can include the removal from service of a building, or a portion of a building and components. Disposal activities should be conducted such that health and safety and environmental protocols are being followed, and spent materials are disposed of at appropriate or approved facility.

Disposal activities can also include removal of the building from the Municipal building portfolio through sale of property if it is no longer required for service delivery.

7.7 Asset Management Strategy – Buildings and Facilities

The asset management strategy for the building and facility assets seeks to use the lifecycle activities in a manner that will achieve cost-effective and sustainable management of the building assets.

The Municipality's strategy should be to maintain the condition and performance of the building assets such that the level of service to the customer is likewise maintained. An industry standard of 2% of the current portfolio replacement value is recommended as a minimum annual investment into capital projects for major maintenance (replacement) and renewal activities.

Implementation of the lifecycle activities for the building assets will vary across the assets, according to the components, condition, and services provided. A detailed condition assessment of the building assets would guide the Municipality in determining what maintenance works are required at each of the building assets, and the expected remaining useful life of the components. A maintenance schedule and forecast of asset improvements should be based on this detailed review, which should be updated at a frequency suitable to the Municipality, suggested to be every 5 years. If it is not possible to complete the condition assessment of all buildings in the near term, priority buildings for the condition assessment program are suggested to be identified by the presented risk assessment, condition, and performance measures. Buildings with high risk or Poor condition/performance components should be prioritized in the condition assessment program.

Routine maintenance schedules are assumed to be in place currently and are recommended to continue assuming that they are currently providing sufficient level of maintenance.

Management of building assets should also include climate change considerations, in new construction, maintenance or renewal lifecycle activities. Assessment should be undertaken to understand vulnerability of building assets to a changing climate, which will inform lifecycle activity requirements, and potential changes to the way lifecycle activities are undertaken.

The Municipality should continuously audit asset data to ensure information is current. It is suggested that additional classifications be implemented to clearly identify the lifecycle activities implemented for building components. Capital investments and betterments of existing assets should be included or amended to the asset data of the corresponding building components.

The Municipality should provide annual updates to LOS and performance measures to gauge performance of the Municipality against quantified targets. Where data is not yet available to LOS performance measures, a strategy for collecting, verifying, and integrating the data should be developed and implemented.

7.7.1 Current Projection of Works

The current projection of works for the Municipal buildings and facilities is based on the findings of the 2023 Building Condition Assessment. The current building condition assessment provides a projection of maintenance and rehabilitation works to be undertaken to the assessed buildings for a timeframe of 10 years from the date of the report.

A summary of the estimated costs was attributed to each projected work across the buildings. The total across each timeframe for each building are summarized in **Table 7-5**.

Table 7-5: Projection of Works for Building and Facility Assets

Asset Category	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Municipal Building/ Theatre	$31,900	$130,400	$14,600	$0	$62,900	$14,250	$60,000	$5,000	$9,500	$59,950
Fire Hall	$1,200	$1,845	$0	$0	$8,300	$950	$7,700	$2,200	$0	$10,200
Water Depot Garage	$300	$1,400	$4,000	$0	$300	$17,500	$0	$0	$15,000	$5,800
South Dunwich Hall	$12,350	$5,200	$600	$16,200	$1,000	$7,200	$2,500	$500	$0	$17,900
Library/Meeting Room	$9,300	$2,000	$23,250	$6,300	$23,200	$1,000	$1,000	$2,200	$0	$6,400
Community Center	$9,320	$7,750	$2,500	$188,600	$5,040	$1,000	$2,200	$0	$0	$6,000
Equipment Dept/Office	$3,300	$4,000	$8,000	$14,250	$24,600	$1,800	$0	$6,200	$9,600	$27,300
Salt Storage Building	$12,200	$100,000	$0	$0	$0	$0	$0	$0	$0	$0
Totals	**$79,870**	**$252,595**	**$52,950**	**$225,350**	**$125,340**	**$43,700**	**$73,400**	**$16,100**	**$34,100**	**$133,550**

The expenditure expected fluctuates between timeline categories – ranging from less than $50,000 to just over $250,000. The variation in these expenditures can be refined to assist in the affordability of the expenditures – prioritisation can be informed by continued condition assessment and monitoring of maintenance requirements and performance.

The average annual expenditure across the 10-year timeframe is just over $100,000.

7.7.2 Expenditure Based on Reinvestment

An alternative for estimating the annual expenditure for assets is through estimation using the recommended reinvestment rate and the replacement value of the assets. The 2016 infrastructure report card suggests a reinvestment rate of 1.7-2.5% annually for buildings and facilities. The current replacement cost for all the building assets is $10,053,000, which suggests the reinvestment rates noted in **Table 7-6**.

Table 7-6: Reinvestment Rate for Buildings

Reinvestment Rate	Reinvestment Value
1.7%	$171,000
2.5%	$252,000

The reinvestment values are higher than the average projections found through the condition assessment. It is recommended that the buildings be maintained according to their condition and performance information, and the Municipality consider maintaining a budget based on the reinvestment value to allow for building of reserves to assist in future expenditures.

8.0 Fleet and Equipment

8.1 State of Local Infrastructure – Fleet and Equipment

The Municipality owns and maintains 87 fleet and equipment assets, which support service delivery across multiple Municipal departments including (but not limited to) fire services, recreational services, water and wastewater services, and administration. Of these 87 assets, the Municipality has further categorized 32 of them as Fleet assets, and 55 as Equipment.

8.1.1 Replacement Costs

The estimated replacement costs for the fleet and equipment assets were based on historical acquisition costs of the assets, which were then inflated to 2023 dollars. The estimated replacement cost for fleet and equipment assets is $7.7 million, noting that there are 3 assets for which an acquisition cost was not known.

8.1.2 Average Age

The in-service date for the fleet and equipment assets ranges from 1990-2023 resulting in an age range of 1 year to 33 years. The average age of the Municipality's fleet and equipment assets is 10.4 years old, noting that there are 3 assets for which an in-service year (and therefore age of the asset) was not known.

8.1.3 Expected Useful Life

The expected useful life of each fleet and equipment asset ranges from 5 to 30 years, with the most common useful life at 10 years (accounting for approximately 1/3 of the assets).

8.2 Condition – Fleet and Equipment

Condition information was assessed and gathered by Municipal staff. The ratings were provided on a 1 to 5 scale, indicating Very Good (1) to 'Very Poor' (5) condition. The average condition for fleet and equipment is Fair (2.6) and Good (1.8), respectively. The overall condition rating for all fleet and equipment is Good (2).

8.3 Current Level of Service – Fleet and Equipment

Levels of service for fleet and equipment assets are not defined in the regulation, *O. Reg. 588/17* as fleet and equipment are not considered core assets. As such, levels of service have been devised based on the content of the regulation, in consultation with the Municipality. **Table 8-1** and **Table 8-2** outline the Municipality's current community and technical levels of service for fleet and equipment.

Table 8-1: Community Levels of Service – Fleet and Equipment

LOS Parameter	Community Levels of Service (Qualitative Description)	Community LOS
Scope	Description, which may include maps of locations where fleet and equipment is stored	Storage facilities for fleet and equipment assets are located across the Municipality. The storage location is dependent on the type of equipment.
Quality	Description of fleet condition (i.e., maintained in good or better condition in order to provide reliability)	The fleet condition is in Fair condition.

Table 8-2: Technical Levels of Service – Fleet and Equipment

LOS Parameter	Technical Levels of Service (Technical Metrics)	Technical LOS
Scope	Breakdown of number of fleets by department providing service compared to the size of the community (geography or population)	Fleet: 1 asset per 181 persons Equipment: 1 asset per 77 persons Not currently available by department. (Population of 4,152 in 2021 per Statistics Canada census)
Quality	Legal, regulatory, local standards	The fleet assets must adhere to applicable legal, regulatory, and local standards, including: • Equipment in vehicle must meet Ontario Provincial Equipment Standards • Manufacturer's recommendations or maintenance and life expectancy on equipment • Vehicle/equipment preventative maintenance program • Vehicle maintenance, safety • Driver training, equipment functioning (negligence, risk management).

8.4 Current Performance – Fleet and Equipment

The Municipality does not currently have established performance parameters for the building and facility assets. Asset performance measures provide relevant metrics against which the Municipality can gauge the performance of their assets, and can be established to provide the Municipality with a fuller picture of asset level of service provision and performance. The Municipality can consider selection and tracking of relevant indicators, including the following:

- Fleet maintenance expenses or annual operating cost to provide service ($/household)
- Emergency services (distance travelled, fuel consumption, calls)
- Maintenance expense per utilization ($/km or hour)

8.5 Risk Assessment – Fleet and Equipment

The risk assessment for fleet and equipment assets will be conducted according to the following assumptions and criteria:

- Condition: Provided by the Municipality
- Performance: Always Reliable (value of 1) for all assets
- Climate Change: Low (value of 1) – no or limited impact, quick recovery, or mitigation in place
- Impact: Moderate (value of 1) impact for all assets
  - High impact (value of 2) for assets used for water/wastewater or fire service delivery, and generators
  - Moderate impact (value of 1) for all other fleet and equipment assets
- Importance: Assumed based on the use of the fleet or equipment asset as follows:
  - High importance (value of 3) for assets used for water/wastewater or fire service delivery, and generators
  - Moderate importance (value of 2) for all other fleet and equipment assets

Using the assumptions and parameters listed above, a risk assessment was conducted. The risk ratings for the fleet and equipment assets range from 2 to 7 – all within the Low-Risk Range.

8.6 Lifecycle Activities – Fleet and Equipment

The following section describes the lifecycle activities that can be implemented within the asset management strategy for fleet and equipment assets. The primary lifecycle activities include acquisition, maintenance, and decommissioning/disposal. The selection and implementation of a lifecycle activity will be dependent on the type of asset, attributes, and lifecycle history.

8.6.1 Acquisition

Acquisition of a fleet or equipment asset should consider the intended usage of the asset. Acquisition should be undertaken based on an understanding of the requirements of the asset for providing service delivery and should follow municipal procurement procedures. Acquisition of an asset could be as a new purchase, or purchase of a used asset. Acquisition of a new asset can provide the Municipality with an asset in Very Good condition; however, the condition of a used asset could vary.

Acquisition activities can also include direct replacement of existing fleet or equipment assets. When a fleet asset reaches the end of its useful life, and the asset is found to be adequate for providing service delivery required, the acquisition activity may be asset replacement.

8.6.2 Maintenance

Maintenance activities will vary across the fleet or equipment assets due to the variability in type and usage of assets. The maintenance activities should be undertaken according to manufacturer specifications and as required to address condition and performance issues that arise through regular usage. Maintenance activities should include regular inspections of fleet or equipment for condition and recording of maintenance activities undertaken.

8.6.3 Decommissioning/Disposal

Disposal activities can include the removal from service through disposal, sale of asset or transfer of an asset to a different department. Disposal activities should be conducted such that health and safety protocols are being followed, and out of service assets are disposed of at appropriate or approved facility.

8.7 Asset Management Strategy – Fleet and Equipment

The asset management strategy for the fleet and equipment assets seeks to use the lifecycle activities in a manner that will achieve cost-effective and sustainable management of the assets.

Generally, if acquired new, the assets will begin their expected useful life in Very Good condition and performance. Throughout the lifecycle of the assets, routine maintenance should be conducted. As required, specific maintenance should be conducted. As an asset ages and approaches the end of its useful life, it is expected that the risk and maintenance costs associated with the asset will increase. There will be a point in the lifecycle where the risk and maintenance costs are such that replacement of the asset will be the preferred solution. This point will vary depending on the type of asset and the services delivered by each.

The Municipality should review usage of fleet and equipment assets to confirm if services are being provided adequately. The assets should also be routinely assessed and monitored for condition and performance, to inform any maintenance or replacement works required.

The Municipality's strategy is to maintain the condition and performance of the fleet and equipment assets such that the level of service to the customer is likewise maintained. An industry standard of 2% of the current portfolio replacement value is recommended as a minimum annual investment into capital projects for major maintenance (replacement) and renewal activities. The Municipality has also developed a replacement schedule specifically for fleet based on a standard frequency for trading in for new fleet or rotating fleet through departments internally.

8.7.1 Current Projection of Works

The projection of works for the fleet and equipment asset considers the estimated replacement date based on the expected useful life, year of acquisition, and replacement cost of the assets. The year of replacement was determined assuming a linear deterioration of the assets, for their expected useful life beginning in the year of acquisition. The capital works projections are shown in **Figure 8-1.**

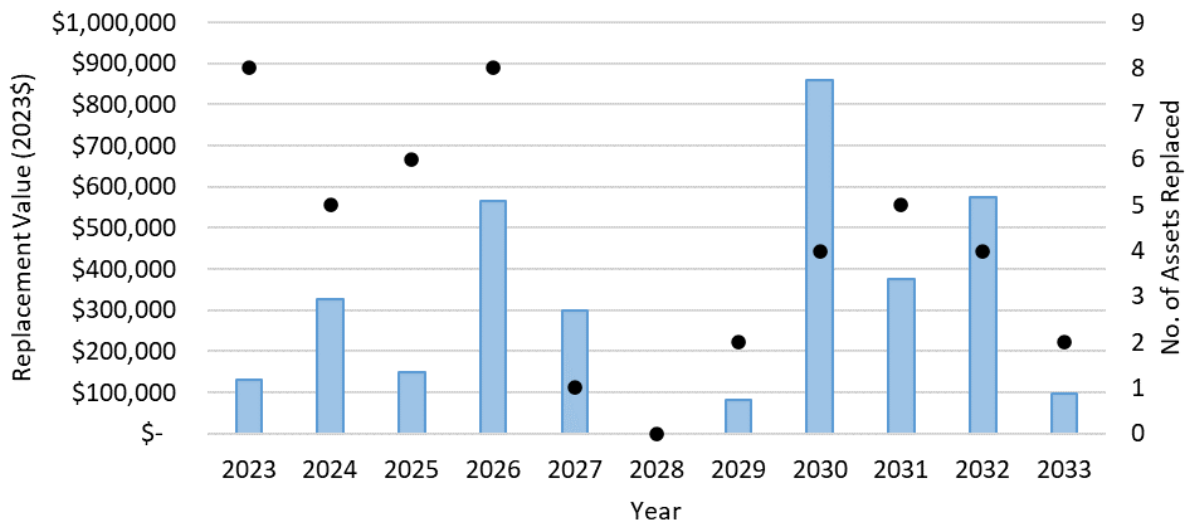


Figure 8-1: Projection of Works for Fleet and Equipment

The average expenditure over the 10-year timeframe is just under $314,000, with a maximum in 2030 at just over $860,000, and a zero-expenditure year in 2028. The Municipality has the opportunity to adjust the replacement year of the assets (where appropriate) to make the plan more affordable on an annual basis.

Based on the year of acquisition and expected useful life information provided by the Municipality, there are 24 assets that were identified for replacement in years up to 2023, with a total replacement cost (in 2023 dollars) of over $1.3M. The condition assessment of these assets varies from very poor to good. The Municipality should continue to review the condition of these assets to determine the appropriate year for replacement based on their continued useful life.

In addition, the Municipality ahs identified the replacement of two fleet assets as part of the Water 5-year plan, including a water truck in 2025 and 2028-2029. No expenditure estimates have been determined at this time for these replacements.

The Municipality should undertake a prioritization exercise with the assets to understand the impact of adjusting the projection of works, considering the condition, importance, risk, and usage of the assets to determine if any assets do not require replacement once they reach the end of their service life.

Additional condition assessment can help refine the projections above, as it can help determine whether an asset has exceeded its useful life with sufficient condition, or if it prematurely requires replacement.

9.0 Sidewalks

9.1 State of Local Infrastructure – Sidewalks

The Municipality owns and maintains 11.4 km of concrete sidewalk.

9.1.1 Replacement Costs

The total estimated replacement cost for the sidewalk network is $1.74 million. The unit replacement cost used is $152 per lineal meter, based off recent costing information experienced at the Municipality. The unit cost is based on a 60” width concrete sidewalk, and includes contingency for removals, material, and time to complete the replacement.

9.1.2 Average Age

The average age of the sidewalk assets is estimated to be 30 years, with the oldest segments having been constructed in 1987.

9.1.3 Expected Useful Life

The expected useful life for concrete sidewalks is 30 years.

9.2 Condition – Sidewalks

Condition of the sidewalk assets was assumed using the age and useful life of assets. The age and expected useful life were used to make an estimation of condition based on percentage of useful life elapsed. Condition ratings were determined on a scale of 1 to 5, where 1 describes an asset in Very Good condition and 5 in Very Poor condition. The condition ratings and corresponding useful life remaining ranges are shown in **Table 9-1**.

Table 9-1: Sidewalk Condition Assessment Remaining Useful Life Rating System

Condition Rating	Condition Rating Description	Expected Remaining Useful Life (%)	Total length of Sidewalk (m)
1	Very Good	80 to 100	0
2	Good	60 to 80	0
3	Fair	40 to 60	849
4	Poor	20 to 40	926
5	Very Poor	0 to 20	9,664

The majority of the sidewalk assets are near or in excess of their expected useful life, and are therefore categorized in fair or worse condition. It is recommended that the Municipality undertake an assessment of actual condition to refine the condition and resulting project works. Conditions can be determined through inspection by Municipal staff, and review for defects such as ditching, tripping hazards, distortion, and cracked panels.

9.3 Current Level of Service – Sidewalks

Levels of service for sidewalk assets are not defined in the regulation, O. Reg. 588/17 as sidewalks are not considered core assets. As such, level of services has been devised based on the content of the regulation, in consultation with the Municipality. **Table 9-2** and **Table 9-3** outline the Municipality's community and technical levels of service for sidewalks.

Table 9-2: Community Levels of Service – Sidewalks

LOS Parameter	Community Levels of Service Qualitative Description	Community LOS
Scope	Description, which may include maps of sidewalk network in the Municipality and its level of connectivity	Sidewalk assets are located throughout the Municipality, adjacent to the road network. Sidewalks are located on one or both sides of the roads.
Quality	Overall condition rating of sidewalks, description or images of levels of sidewalk condition	Condition is sidewalks is estimated to be in the fair to very poor range based on expected useful life.

Table 9-3: Technical Levels of Service - Sidewalks

LOS Parameter	Technical Levels of Service Technical Metric Description	Technical LOS
Scope	Total length of sidewalks as a proportion of square kilometers of land area in the Municipality	0.04 km of sidewalk per sq.km of land area (Land area per 2021 census: 294.38 sq.km.)
Scope	Percentage of roads with adjacent sidewalks	By length, 5% of roads have sidewalks
Quality	Average condition index of sidewalks	4.8 (estimated)
Quality	Percentage of sidewalks that meet AODA requirements	Not currently tracked

9.4 Current Performance – Sidewalks

The Municipality does not currently have established performance parameters for the sidewalk assets. Asset performance measures provide relevant metrics against which the Municipality can gauge the performance of their assets, and can be established to provide the Municipality with a fuller picture of asset level of service provision and performance. The Municipality can consider selection and tracking of relevant indicators, including the following:

- Percentage of sidewalks in fair or better condition
- Percentage of sidewalks meeting AODA compliance requirements
- Instances of slip, trip and fall instances (complaints received)

9.5 Risk Assessment – Sidewalks

The risk assessment for the sidewalk assets was conducted using the following risk assumptions and criteria:

- **Condition:** Determined based on estimated condition (using age and expected useful life)
- **Performance:** Always Reliable (value of 1)
- **Climate Change:** No or limited impact, quick recovery, or mitigation in place (value of 1)
- **Impact:** Low impact (value of 0)
- **Importance:** Low importance (value of 1)

All sidewalk assets were found to be within the Low-Risk Range, with values ranging between 3.3 and 4.7.

9.6 Lifecycle Activities – Sidewalks

The following section describes the lifecycle activities that can be implemented within the asset management strategy for sidewalk assets. The primary lifecycle activities include construction, maintenance, and decommissioning/disposal.

9.6.1 Construction

The initial lifecycle activity of a sidewalk asset is its construction. The sidewalk asset should be constructed to adhere to applicable requirements, codes, and design guidelines, particularly AODA standards (which include provision for wider sidewalk assets, and requirements for tactile plates, among other specifications). Design of the sidewalk asset should consider the level of service expected to be provided by that particular asset. Sidewalk construction is often conducted as part of road reconstruction projects.

9.6.2 Maintenance

Maintenance works on sidewalks can be preventative or in response to an issue and can occur to address localized issues or to larger segments.

Maintenance works can be identified through inspections, complaints, or other mechanisms, and can address safety or aesthetic concerns. Maintenance activities and inspections should be undertaken according to best practices and applicable regulation (O. Reg. 239/02, for example). Maintenance works can include the following activities:

- Repair of surface discontinuities
- Repair or replacement of deformed or cracked sections
- Repair or removal of surface encroachments
- Winter control activities (snow removal, salt or sand or surfaces)
- Root and foliage control

Where maintenance works are required for surface issues, it is recommended that the maintenance works seek to address any underlying issues that have attributed to the surface issues, to mitigate against the issue reoccurring.

9.6.3 Decommissioning/Disposal

Disposal activities can include the removal from service of a sidewalk segment. These activities can be implemented when a sidewalk segment has been determined to be no longer required. A sidewalk may be removed from service by removal and disposal of the asset components, or establishment of a barricade to prevent continued usage of the asset. Disposal activities should be conducted such that health and safety protocols are being followed, and spent materials are disposed of at an appropriate or approved facility. Decommissioning or disposal of a sidewalk asset can be done in conjunction with road works, as required.

9.7 Asset Management Strategy – Sidewalks

The strategy for the sidewalks will utilize the lifecycle activities to prolong the lifespan of the sidewalks, minimize safety risks to the users, and maintain overall condition and performance to the preferred service level.

The Municipality's strategy for sidewalks can include inspections for identification of deficiencies or deteriorated assets. Through the inspection, the extent and severity of issues will be identified, and can be used to select the appropriate lifecycle activity to mitigate the issue and identify a timeframe through which works will be undertaken. Inspections will be conducted on a routine basis, and in response to complaints received by the public.

Following initial construction of the sidewalk, the majority of lifecycle activities will be maintenance, which will be informed by inspection and observation of condition and performance of the assets. Selection of the appropriate maintenance activity will depend on the type of deterioration being experienced on the asset, and the condition of the asset.

Following initial construction of the sidewalk, the majority of lifecycle activities will be maintenance, which will be informed by inspection and observation of condition and performance of the assets. Selection of the appropriate maintenance activity will depend on the type of deterioration being experienced on the asset, and the condition of the asset.

A sidewalk asset may be replaced once maintenance works no longer provide sufficient means to improve the asset. The Municipality conducts sidewalk replacements as part of road reconstruction works. Stand-alone replacement of long sections is not typically undertaken. Localized replacement of small sections can be considered where road reconstruction works are not expected, and improvement of the asset is required to maintain current level of service. Where a sidewalk is replaced, it will be replaced to the existing standard unless determined otherwise by the Municipality.

If an asset has deteriorated to where it presents a hazard to public safety, the Municipality should remove the section of sidewalk from service until such time as the issue can be mitigated.

New sidewalks being constructed in the Municipality are to be constructed to meet regulatory and design requirements, such as local design standards and AODA requirements.

9.7.1 Current Projection of Works

The Municipality's strategy does not include stand-alone sidewalk replacement projects, instead addressing capital works as part of road reconstruction projects. Accordingly, the analysis to determine projection of works for sidewalk assets considers the replacement value of the network, and the reinvestment rate to inform the approximate reinvestment value the Municipality should be considering carrying to address sidewalk needs in their road reconstruction projects on an annual basis to maintain the sidewalk assets.

The 2016 infrastructure report card suggests a reinvestment rate of 2.0-3.0% annually for roads and sidewalks. The current replacement cost for the sidewalk assets is $1,740,000, which suggests the reinvestment rates noted in **Table 9-4**.

Table 9-4: Reinvestment Rate for Sidewalks

Reinvestment Rate	Reinvestment Value
2.0%	$34,800
3.0%	$52,100

To be conservative, the Municipality can reinvest $52,100 annually for addressing the lifecycle needs of the sidewalk assets.

10.0 Financial Strategy

10.1 Introduction

This chapter identifies the funding required to sustainably finance the lifecycle management strategies presented in the previous sections. Two capital expenditure scenarios are presented, based on maintaining different levels of service (LOS), to provide an upper and lower bound on the Municipality's funding needs. The analysis is intended to inform the Municipality's proposed LOS, which will be set at a future date. This financial strategy should be examined and re-evaluated during the annual budgeting processes to ensure the sustainability of the Municipality's financial position as it relates to its assets.

O. Reg. 588/17 requires that municipalities have approved proposed LOS and the lifecycle management and financial strategy for 10-year period to achieve the proposed LOS by July 2025. Various financing options, including reserve funds, debt, and grants can be considered during the process of developing the financing strategy.

10.2 Funding

The Municipality currently funds capital projects through debt with an annual debt repayment limit of $1,745,897 as of January 1, 2022.

Table 10-1 summarizes the current government funding that the Municipality receives for baseline capital investments, based on the Municipality's 2023 OCIF revised allocation notice. With limited information on the Municipality's capital funding sources, this was not considered in the financial analysis. Therefore, this financial strategy should be re-evaluated as additional financial information is identified.

Table 10-1: Baseline Capital Funding Capacity (2023 Dollars)

Funding Source	Amount
Ontario Community Infrastructure Fund (OCIF)	$305,420
Total	**$305,420**

10.3 Capital Expenditures

The level of capital expenditure required each year is dependent on the Municipality's target LOS for its capital assets. Since this target has not yet been determined, two capital expenditure scenarios have been forecasted to provide an upper and lower bound on the Municipality's financing needs.

Figure 10-1 compares the Municipality's forecasted capital expenditures under the following scenarios:

- **Unlimited**: This upper bound scenario is based on replacing assets at the end of their useful life. In reality, funding constraints will limit the Municipality's ability to achieve this level of capital expenditure. The capital expenditure forecast by asset category for this scenario is included in **Table 10-2**.
- **Maintain Existing LOS**: This lower bound scenario is based on the minimum level of capital expenditure required to maintain the current LOS of the Municipality's assets. The capital expenditure forecast by asset category for this scenario is included in **Table 10-3**.

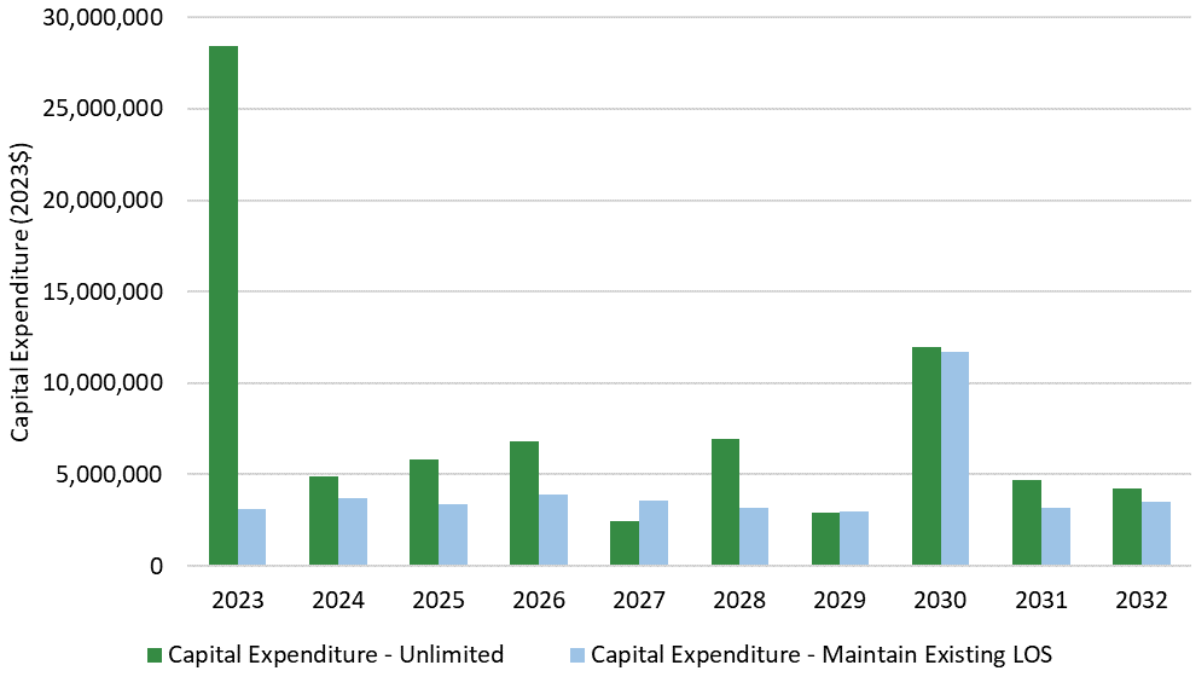


Figure 10-1: Forecasted Capital Expenditures Relative to Baseline Capital Funding Capacity (2023 Dollars)

Table 10-2: Capital Expenditure Forecast – Unlimited Scenario (2023 Dollars)

Asset Category	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Roads	11,885,390	3,365,210	4,655,025	5,093,290	1,048,200	5,967,255	2,191,980	2,415,240	3,734,220	2,944,930
Bridges and Culverts[1]	100,500	368,200	368,200	368,200	368,200	368,200	0	0	0	0
Water - Linear	0	0	0	0	0	0	0	8,012,800	0	0
Water - Facility	0	0	0	0	0	0	0	74,000	0	0
Wastewater - Linear	15,625,000	0	0	0	0	0	0	0	0	0
Wastewater – Facility[2]	173,300	173,300	173,300	173,300	173,300	173,300	173,300	173,300	173,300	173,300
Stormwater – Linear[2]	358,020	358,020	358,020	358,020	358,020	358,020	358,020	358,020	358,020	358,020
Stormwater - Facility	0	0	0	0	0	0	0	0	0	0
Buildings and Facilities	79,870	252,595	52,950	225,350	125,340	43,700	73,400	16,100	34,100	133,550
Fleet and Equipment	131,000	327,000	150,000	570,000	300,000	0	82,000	861,000	376,000	575,000
Sidewalks[2]	52,100	52,100	52,100	52,100	52,100	52,100	52,100	52,100	52,100	52,100
Totals	**28,405,180**	**4,896,425**	**5,809,595**	**6,840,260**	**2,425,160**	**6,962,575**	**2,930,800**	**11,962,560**	**4,727,740**	**4,236,900**

[1] Under the bridges and culverts, $1,841,500 in capital expenditures were projected for the 1 to 5 year timeframe (2024 – 2028). For the purpose of the analysis, this amount is assumed to be equally allocated between those projected years.

[2] In the absence of a recommended replacement schedule based on a detailed engineering condition assessment, annual expenditure estimations are based on the recommended reinvestment rates and replacement value of assets.

Table 10-3: Capital Expenditure Forecast – Maintain Existing LOS Scenario (2023 Dollars)

Asset Category	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Roads	1,848.400	1,801,000	1,822,370	1,785,600	1,814,160	1,765,170	1,845,690	1,792,140	1,763,580	1,811,500
Bridges and Culverts[1]	100,500	368,200	368,200	368,200	368,200	368,200	0	0	0	0
Water - Linear	0	0	0	0	0	0	0	8,012,800	0	0
Water - Facility	0	0	0	0	0	0	0	74,000	0	0
Wastewater - Linear	398,229	396,355	393,465	391,131	399,555	399,555	398,190	395,850	399,555	394,485
Wastewater – Facility[2]	173,300	173,300	173,300	173,300	173,300	173,300	173,300	173,300	173,300	173,300
Stormwater - Linear[2]	358,020	358,020	358,020	358,020	358,020	358,020	358,020	358,020	358,020	358,020
Stormwater - Facility	0	0	0	0	0	0	0	0	0	0
Buildings and Facilities	79,870	252,595	52,950	225,350	125,340	43,700	73,400	16,100	34,100	133,550
Fleet and Equipment	131,000	327,000	150,000	570,000	300,000	0	82,000	861,000	376,000	575,000
Sidewalks[2]	52,100	52,100	52,100	52,100	52,100	52,100	52,100	52,100	52,100	52,100
Totals	**3,141,419**	**3,728,570**	**3,370,405**	**3,923,701**	**3,590,675**	**3,160,045**	**2,982,700**	**11,735,310**	**3,156,655**	**3,497,955**

[1] Under the bridges and culverts, $1,841,500 in capital expenditures were projected for the 1 to 5 year timeframe (2024 – 2028). For the purpose of the analysis, this amount is assumed to be equally allocated between those projected years.

[2] In the absence of a recommended replacement schedule based on a detailed engineering condition assessment, annual expenditure estimations are based on the recommended reinvestment rates and replacement value of assets.

10.4 Funding Needs Analysis

10.4.1 Forecasted Debt Repayment

The two capital expenditure scenarios are assessed based on what they will cost the Municipality in terms of annual debt repayment to fund capital works fully through debt over the 10-year period to determine if funding gaps exist. Both assessments were completed under the assumption that revenue remains consistent with 2022 revenues across the 10-year period. **Figure 10-2** compares the Municipality's projected annual debt repayments associated with forecasted capital expenditures for each scenario.

Under the Unlimited scenario, the projected annual debt repayment exceeds the Municipality's debt repayment limit of $1,745,897 (as of January 1, 2022) by the first year. Whereas that limit is exceeded by 2029 under the Maintain LOS scenario. These scenarios work under the assumption that most if not all projected capital expenditures are financed through debt if there is an absence of annual budget surpluses. Both scenarios are not feasible from a financial perspective given the current debt repayment limit.

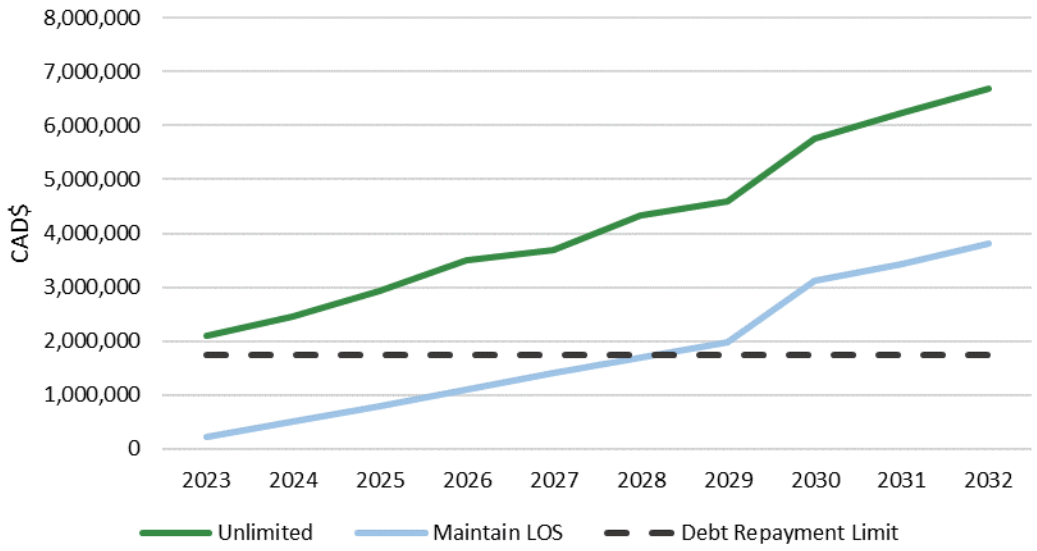


Figure 10-2: Forecasted Annual Debt Repayments Relative to 2022 Debt Repayment Limit (Adjusted for Inflation)

While debt financing will continue to be an important part of the Municipality's capital financing strategy, fully relying on debt is not sustainable. A number of strategies could be implemented by the Municipality to mitigate the projected capital funding shortfalls while reducing reliance on debt:

- **Grants and subsidies**: Government grants and subsidies should be used where possible as a supplemental source of capital funding to reduce reliance on debt.
- **Tax levy increases**: Increasing the overall tax levy by more than the projected 14% per year, or increasing the portion of the tax levy allocated to capital, would reduce the capital funding shortfall. The Municipality's operating needs would need to be considered if changing the allocation of tax revenues to the capital budget. Alternatively, a dedicated capital levy could be introduced.
- **Dedicated Capital Levy**: Dedicating an increasing portion of collected funds from levies are earmarked and dedicated exclusively to the specified purpose of funding capital expenditures.
- **Reduce Operational Expenditures**: Reducing operational expenditures for a municipality involves a combination of efficiency improvements, cost-cutting measures, and strategic planning. Reductions in operational expenditures can help the Municipality achieve operational budget surpluses which can be dedicated towards capital expenditures.
- **Capital Reserves**: It is important for the Municipality to create capital reserves with annual budgeted contributions to build up healthy balances that can sustainably contribute to capital investments or debt repayment, recognizing that capital expenditures will fluctuate from year-to-year.

10.4.2 Reinvestment Rates

Another useful perspective for evaluating the adequacy of an asset management financial strategy is reinvestment rates. The reinvestment rate is the annual capital investment as a percentage of the asset replacement value.

The 2016 Canadian Infrastructure Report Card found that rates of reinvestment are lower than targets recommended by asset management practitioners. The rate can vary based on factors such as the age of the infrastructure, the level of service and risk tolerance. The values provided are based on the experience of municipal asset management practitioners and are intended to be informative in nature. **Table 10-4** demonstrates the gap between current and target reinvestment levels for the core assets that the Municipality owns. Insufficient reinvestment will result in a gradual decline of physical condition levels that will impact municipal services.

Table 10-4: Target Reinvestment Rates vs 2016 Canadian Average Reinvestment Rate

Infrastructure Category	Lower Target Investment Rate	Upper Target Investment Rate	Canadian Average Reinvestment Rate (2016)
Potable Water (Linear)	1.0%	1.5%	0.9%
Potable Water (Non-Linear)	1.7%	2.5%	1.1%
Wastewater (Linear)	1.0%	1.3%	0.7%
Wastewater (Non-Linear)	1.7%	2.5%	1.4%
Stormwater (linear)	1.0%	1.3%	0.3%
Stormwater (non-linear)	1.7%	2.0%	1.3%
Roads and Sidewalks	2.0%	3.0%	1.1%
Bridges	1.0%	1.7%	0.8%
Buildings	1.7%	2.5%	1.7%

While the financial analysis in the previous section has the benefit of illustrating years where there will be peaks in capital expenditure needs, reinvestment rates provide a simple annual target.

As summarized in **Section 1.3.1**, the total replacement cost for the Municipality of Dutton Dunwich's infrastructure assets is $556,508,000 (in 2023 dollars).

Table 10-5 summarizes the equivalent reinvestment rate for the two capital expenditure scenarios considered in this report.

Table 10-5: Reinvestment Rates (2023 Dollars)

Scenario	Average Annual Capital Expenditures	Reinvestment Rate
Unlimited	7,919,707	1.82%
Maintain Existing LOS	4,228,744	0.97%

As previously noted, this financial strategy has been completed with several key assumptions and may be subject to change in the event of additional financial information that can add further context to the nature of the Municipality's source and allocation of capital funds. This financial strategy should be re-evaluated during the annual budgeting processes to ensure the sustainability of the Municipality's financial position as it relates to its assets.

11.0 Reference Reports

Municipality of Dutton Dunwich Documents

1. Municipality of Dutton Dunwich - Asset Management Plan
   Prepared by Dillon Consulting Limited March 2014
2. Official Plan of the County of Elgin
   Consolidated Version February 2015
3. The Official Plan of the Municipality of Dutton Dunwich
4. Adopted by the Municipality of Dutton Dunwich By-law #2021-14, February 10, 2021 (OPA #4)

Building Condition Assessments

1. Technical Memo for Facility Condition Assessments (including Community Centre, Equipment Depot Office, Fire Hall Building, Library Building, Municipal Building – Theatre Building, Salt Storage Building, South Dunwich Hall, Water Department Building
   Prepared by Dillon Consulting Limited June 2023

Water

1. Annual Compliance Report for the Dutton Dunwich Distribution System for the year 2021. (Reporting period of January 1 – December 31, 2021).
2. Prepared by Municipal Staff
3. Annual Compliance Report for the Dutton Dunwich Distribution System for the year 2022. (Reporting period of January 1 – December 31, 2022).
4. Prepared by Municipal Staff
5. Water Department 5 Year Plan 2022-2027.
6. Prepared by Municipal Staff

Wastewater

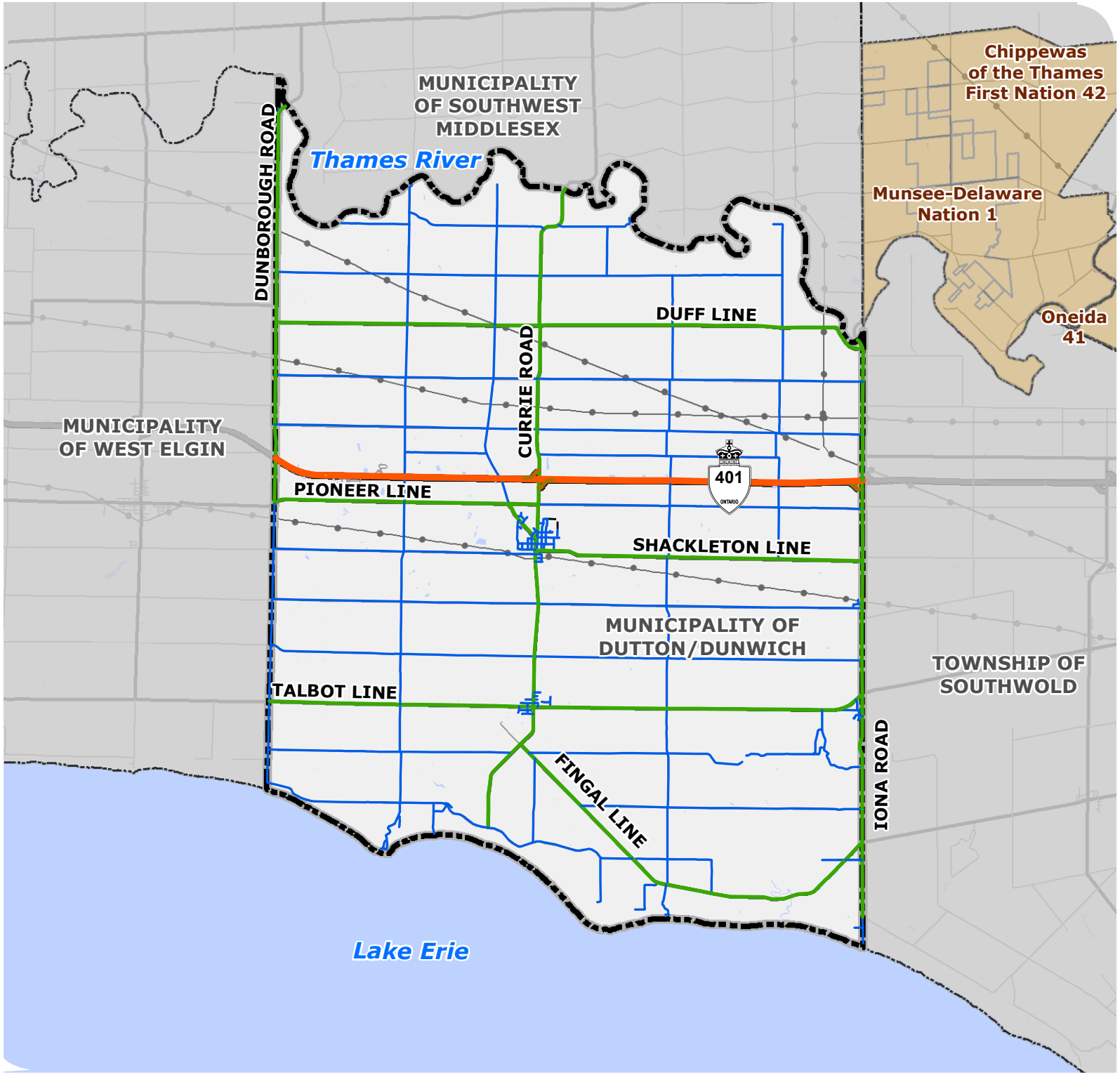
1. Wastewater Annual Report for the Dutton Wastewater Treatment Plant. (Reporting period of January 1 – December 31, 2021).
2. Prepared by Municipal Staff March 7, 2022
3. Wastewater Annual Report for the Dutton Wastewater Treatment Plant. (Reporting period of January 1 – December 31, 2022).
4. Prepared by Municipal Staff February 22, 2023

Bridge OSIM Reports

1. 2020 OSIM Inspection Report – Municipality of Dutton Dunwich
   Prepared by Spriet Associates May 2020

Appendix A

Current Level of Service (Scope) Figures



MUNICIPALITY OF DUTTON-DUNWICH - ASSET MANAGEMENT PLAN

Municipality of Dutton-Dunwich

MAP OF THE DUTTON-DUNWICH ROAD NETWORK

FIGURE 1

Road Class

- Freeway
- Ramp
- Arterial
- Local / Street
- Service
- Unknown Class
- Utility Line
- Municipal Boundary
- Water Body
- First Nation Reserve

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF

MAP CREATED BY: LMM
MAP CHECKED BY: -
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

SCALE 1:145,000

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STATUS: DRAFT
DATE: 2024-01-11

FILE LOCATION: K:\2023\235684\Product\Client\Network\235684_F1_RoadNetwork.mxd

MUNICIPALITY OF DUTTON-DUNWICH - ASSET MANAGEMENT PLAN

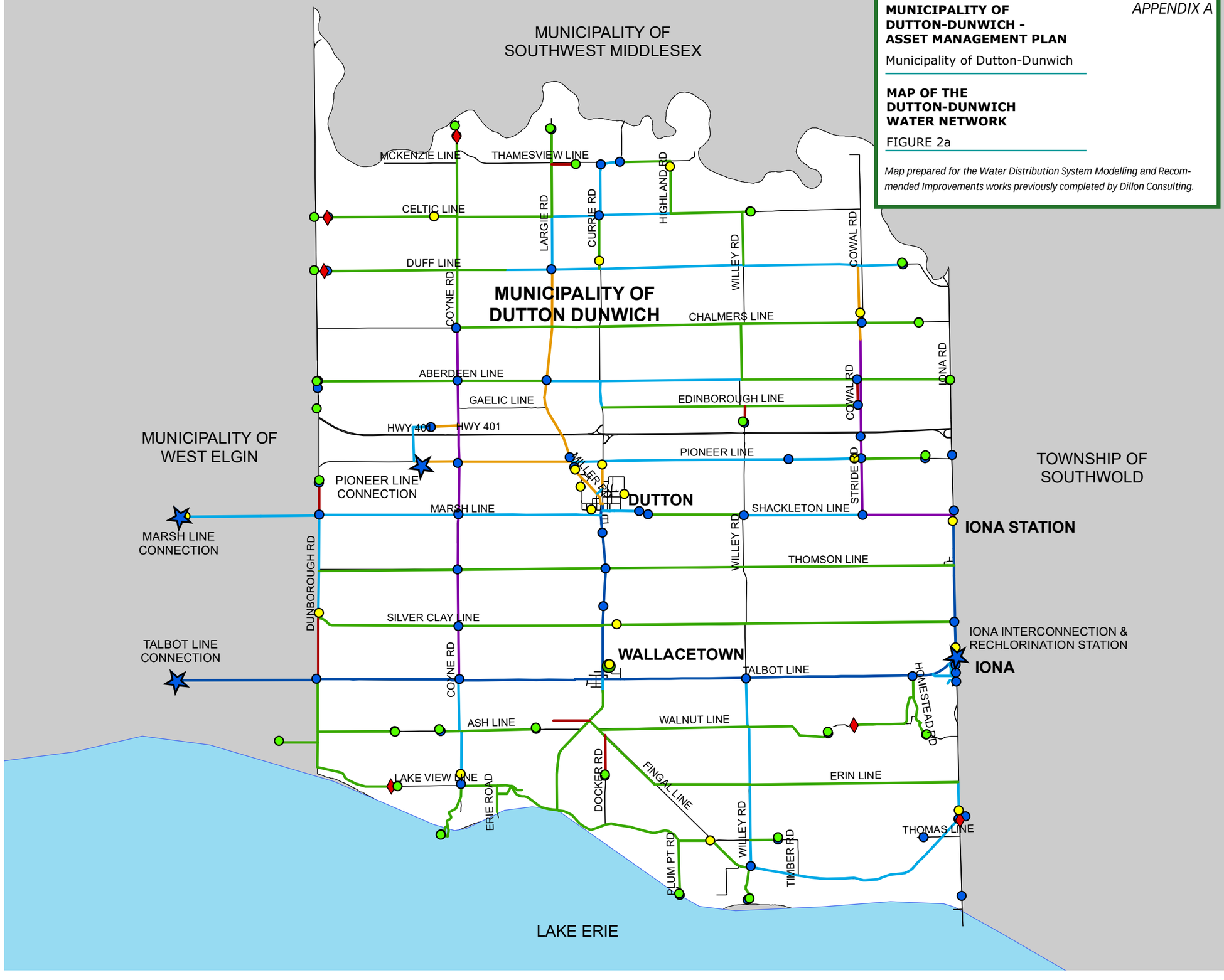
Municipality of Dutton-Dunwich

APPENDIX A

MAP OF THE DUTTON-DUNWICH WATER NETWORK

FIGURE 2a

Map prepared for the Water Distribution System Modelling and Recommended Improvements works previously completed by Dillon Consulting.



Municipality of Dutton Dunwich

MUNICIPALITY OF
DUTTON DUNWICH

WATER DISTRIBUTION SYSTEM

OVERALL WATER DISTRIBUTION SYSTEM
FIGURE 1

WATERMAIN DIAMETER

- 50 mm
- 100 mm
- 150 mm
- 200 mm
- 250 mm
- 300-350 mm

- BLOW-OFF
- TESTING LOCATION
- AUTO-FLUSHER
- HYDRANT
- WALLACETOWN TOWER & RECHLORINATION FACILITY

0 500 1,000 2,000 Meters

SCALE 1:95,000

MAP DRAWING INFORMATION:
DATA PROVIDED BY MUNICIPALITY OF DUTTON DUNWICH

MAP CREATED BY: CEL
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 23-5684
STATUS: DRAFT
DATE: 06/28/23

APPENDIX A

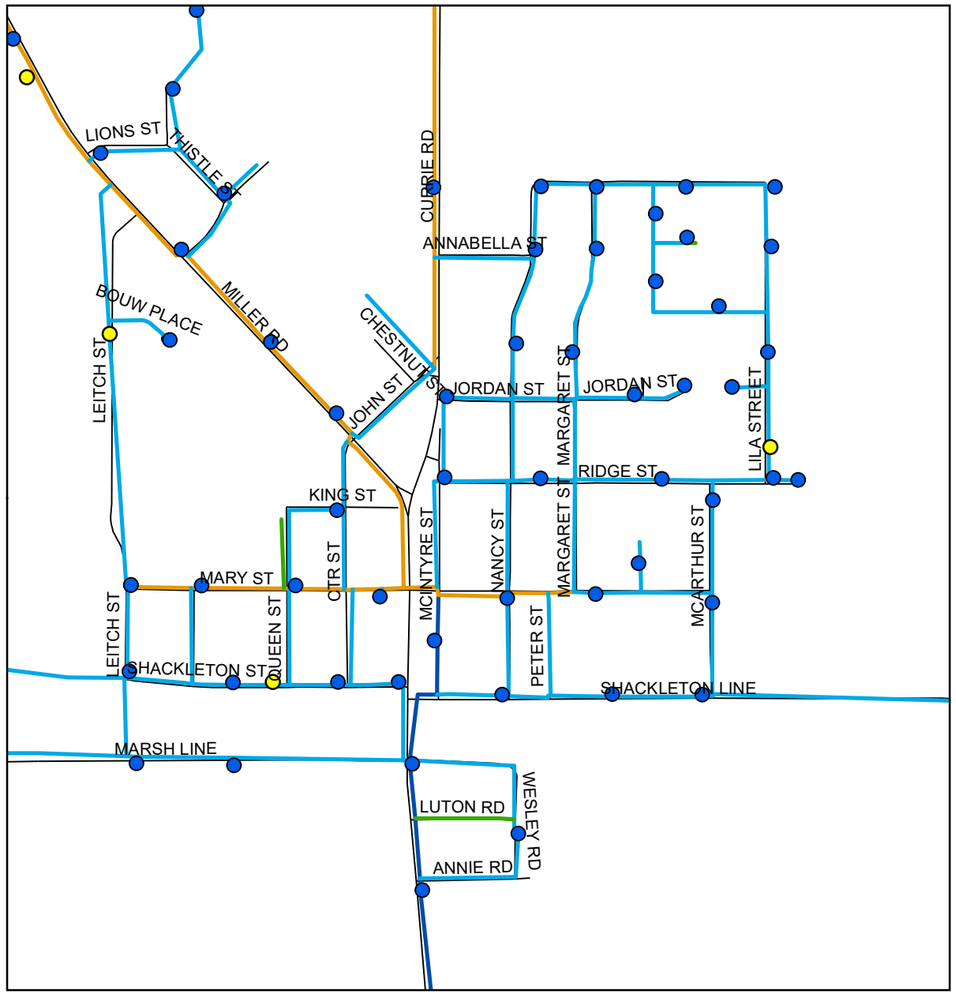
MUNICIPALITY OF DUTTON-DUNWICH - ASSET MANAGEMENT PLAN

Municipality of Dutton-Dunwich

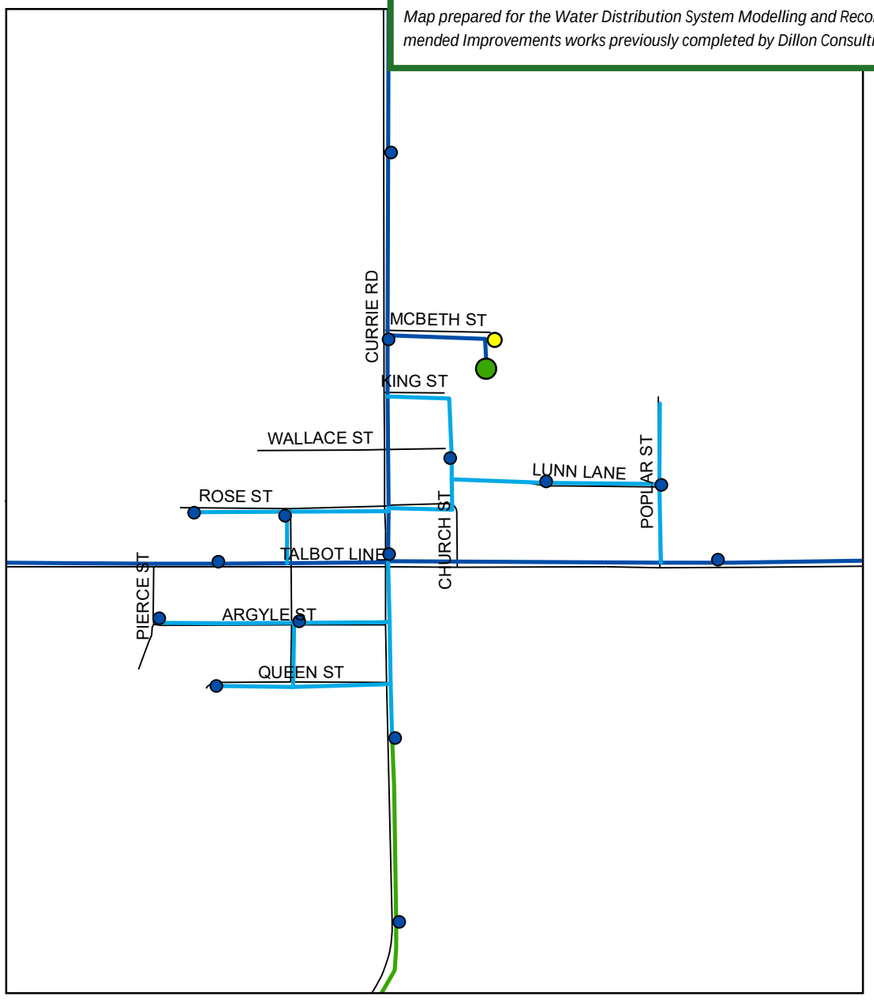
MAP OF THE DUTTON-DUNWICH WATER NETWORK

FIGURE 2b

Map prepared for the Water Distribution System Modelling and Recommended Improvements works previously completed by Dillon Consulting.



DUTTON



WALLACETOWN

Municipality of Dutton Dunwich

MUNICIPALITY OF
DUTTON DUNWICH

WATER DISTRIBUTION SYSTEM

DUTTON & WALLACETOWN

FIGURE 2

WATERMAIN DIAMETER

- 50 mm
- 100 mm
- 150 mm
- 200 mm
- 250 mm
- 300-350 mm

- BLOW-OFF
- TESTING LOCATION
- AUTO-FLUSHER
- HYDRANT
- WALLACETOWN TOWER & RECHLORINATION FACILITY

0 50 100 200 Meters

SCALE 1:10,000

MAP DRAWING INFORMATION:
DATA PROVIDED BY MUNICIPALITY OF DUTTON DUNWICH

MAP CREATED BY: CEL
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 23-5684
STATUS: DRAFT
DATE: 06/28/23

APPENDIX A

MUNICIPALITY OF DUTTON-DUNWICH - ASSET MANAGEMENT PLAN

Municipality of Dutton-Dunwich

MAP OF THE DUTTON-DUNWICH SANITARY AND STORM NETWORKS

FIGURE 3a

Map generated for the Consolidated Linear Infrastructure Environmental Compliance Application (Feb 2022)

Municipality of Dutton Dunwich

MUNICIPALITY OF DUTTON DUNWICH

CONSOLIDATED LINEAR INFRASTRUCTURE ENVIRONMENTAL COMPLIANCE APPROVAL

LOCATION MAP

FIGURE 1

- Municipality of Dutton Dunwich
- Highway
- Arterial Road
- Local Road
- Watercourse
- Waterbody

SCALE 1:85,000

0 0.5 1 2 Kilometres

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF

MAP CREATED BY: ZJB
MAP CHECKED BY: TO
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 22-3528
STATUS: DRAFT
DATE: 2022-02-25

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap

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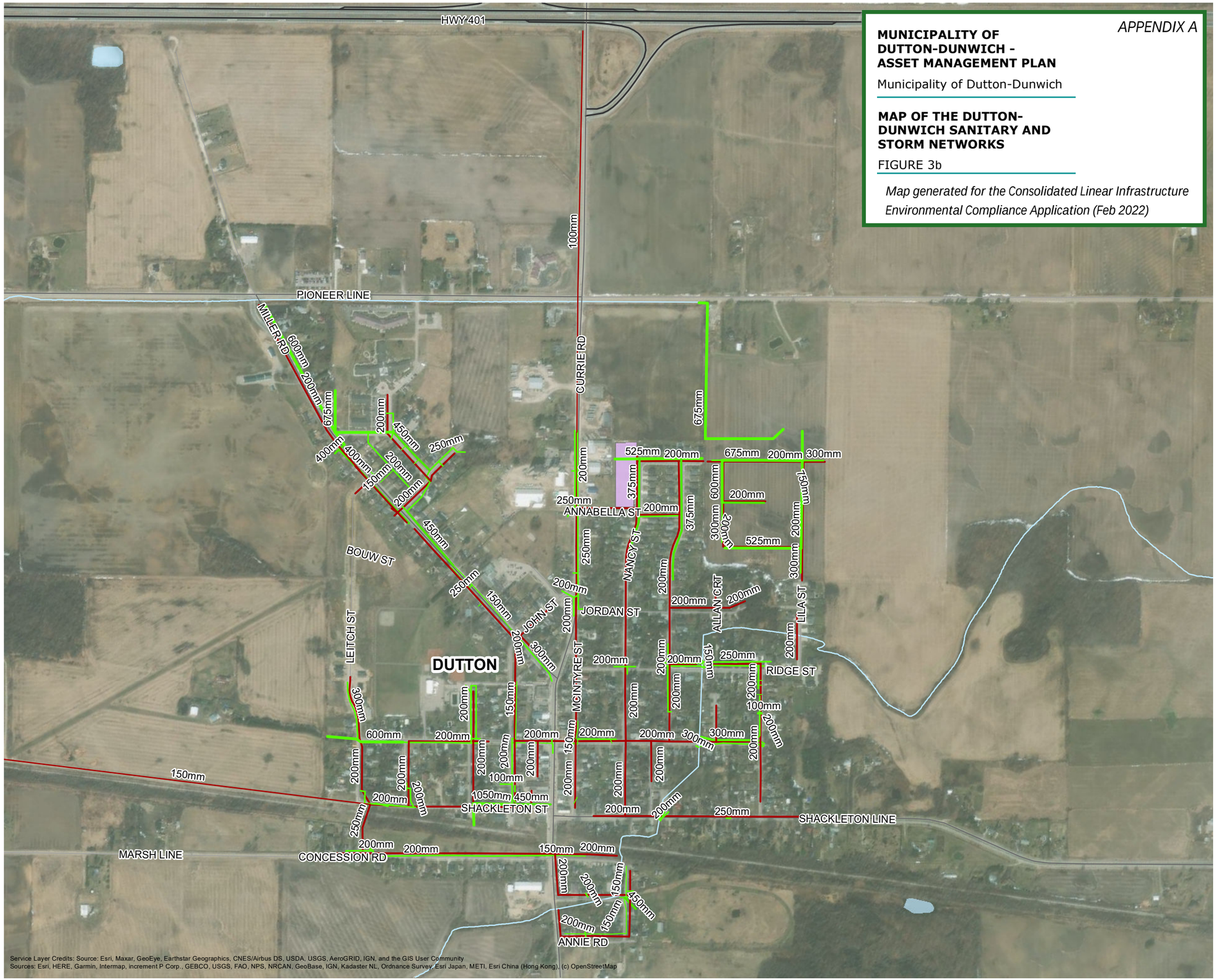


APPENDIX A

MUNICIPALITY OF DUTTON-DUNWICH - ASSET MANAGEMENT PLAN

Municipality of Dutton-Dunwich

MAP OF THE DUTTON-DUNWICH SANITARY AND STORM NETWORKS

FIGURE 3b

Map generated for the Consolidated Linear Infrastructure Environmental Compliance Application (Feb 2022)

Municipality of Dutton Dunwich

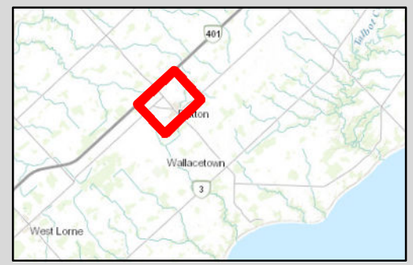
MUNICIPALITY OF DUTTON DUNWICH

CONSOLIDATED LINEAR INFRASTRUCTURE ENVIRONMENTAL COMPLIANCE APPROVAL

SANITARY COLLECTION SYSTEM AND STORMWATER MANAGEMENT SYSTEM

FIGURE 2.1

- Sanitary (100mm - 150mm)
- Sanitary (200mm - 250mm)
- Storm (100mm - 150mm)
- Storm (200mm - 300mm
- Storm (375mm - 450mm
- Storm (500mm - 1050mm)
- Highway
- Arterial Road
- Local Road
- Watercourse
- Waterbody
- Stormwater Management Pond



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MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF

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MAP CHECKED BY: TO
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 22-3528
STATUS: DRAFT
DATE: 2022-02-25

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APPENDIX A

MUNICIPALITY OF DUTTON-DUNWICH - ASSET MANAGEMENT PLAN

Municipality of Dutton-Dunwich

MAP OF THE DUTTON-DUNWICH SANITARY AND STORM NETWORKS

FIGURE 3c

Map generated for the Consolidated Linear Infrastructure Environmental Compliance Application (Feb 2022)

Municipality of Dutton Dunwich

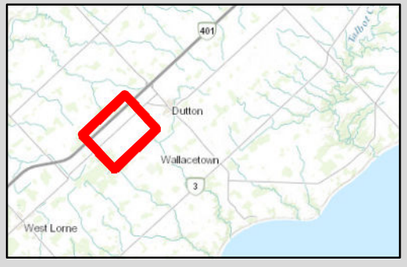
MUNICIPALITY OF DUTTON DUNWICH

CONSOLIDATED LINEAR INFRASTRUCTURE ENVIRONMENTAL COMPLIANCE APPROVAL

SANITARY COLLECTION SYSTEM AND STORMWATER MANAGEMENT SYSTEM

FIGURE 2.2

- Sanitary (100mm - 150mm)
- Sanitary (200mm - 250mm)
- Storm (100mm - 150mm)
- Storm (200mm - 300mm
- Storm (375mm - 450mm
- Storm (500mm - 1050mm)
- Highway
- Arterial Road
- Local Road
- Watercourse
- Waterbody



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MAP CHECKED BY: TO
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DILLON CONSULTING

PROJECT: 22-3528

STATUS: DRAFT

DATE: 2022-02-25

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APPENDIX A

MUNICIPALITY OF DUTTON-DUNWICH - ASSET MANAGEMENT PLAN

Municipality of Dutton-Dunwich

MAP OF THE DUTTON-DUNWICH SANITARY AND STORM NETWORKS

FIGURE 3d

Map generated for the Consolidated Linear Infrastructure Environmental Compliance Application (Feb 2022)

MCBETH ST
KING ST
WALLACE ST
ST ANDREWS ST
ROSE ST
CHURCH ST
CURRIE RD
POPLAR ST
TALBOT LINE
PIERCE ST
GORDON ST
ARGYLE ST
SIFTON ST
WALLACETOWN
375mm
750mm
150mm
400mm
100mm
200mm
250mm
300mm
525mm
675mm
575mm
600mm
350mm
380mm
450mm
515mm

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap

Municipality of Dutton Dunwich

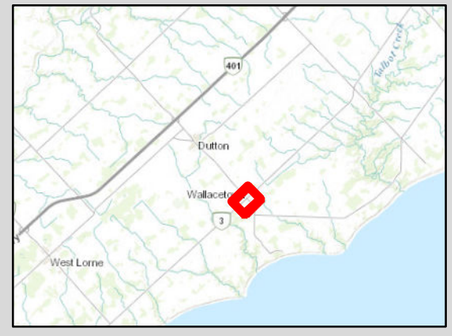
MUNICIPALITY OF DUTTON DUNWICH

CONSOLIDATED LINEAR INFRASTRUCTURE ENVIRONMENTAL COMPLIANCE APPROVAL

STORMWATER MANAGEMENT SYSTEM

FIGURE 3

- Size Unknown
- 100mm - 250mm
- 300mm - 450mm
- 525mm - 750mm
- Highway
- Arterial Road
- Local Road
- Watercourse
- Waterbody



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MAP DRAWING INFORMATION:
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DILLON CONSULTING

PROJECT: 22-3528

STATUS: DRAFT

DATE: 2022-02-25

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