AECOM

City of Sault Ste. Marie
Solid Waste
Asset Management Plan

August 2024

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AECOM: 2015-04-13

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1. Introduction

AECOM Canada Ltd. (AECOM) was retained by The City of Sault Ste. Marie (the "City") to develop an asset management plan (AMP) to comply with the requirements of Ontario Regulation 588/17 (O. Reg. 588/17) in respect to its non-core municipal infrastructure assets. The scope of work for this investigation is outlined in AECOM's proposal dated May 25th, 2023, and subsequent project correspondence.

1.1 Background

Sault Ste. Marie is a city located on the St. Mary's River, north of the United States of America, bordering three of the Great Lakes with an estimated population of 72,051 (2021). The City provides a wide range of public services to their constituents, with the public expectation that these services function efficiently at a certain level. The provision of these services requires the management of the physical assets to meet desired service levels, manage risks, and provide long-term financial sustainability. These assets include, but are not limited to roads, bridges, sidewalks, wastewater assets, stormwater management assets, landfill, fleets, buildings, and parks.

In accordance with the terms of reference for this assignment, it is understood that the City is proceeding with an AMP to comply with the second phase of the regulatory requirements in respect to its non-core municipal infrastructure assets, in accordance with O. Reg. 588/17, by July 1st, 2024. The non-core assets to be covered in the scope, as defined by the regulation, include the City's protection services, solid waste, parks and cemetery, facilities, fleet, roadway appurtenances, and active transportation.

1.2 Scope and Objectives

The objective of this AMP is to deliver a financial and technical roadmap for managing the City's solid waste sites and assets, and to provide the means for the City to maximize value from its assets, at the lowest overall expense, while at the same time enhancing service levels for its residents. Furthermore, the objective of this AMP is to align with the guidelines laid out in the City's Strategic AM Policy and Section 5 of Ontario Regulation (O. Reg.) 588/17.

Organizations that implement good asset management (AM) practices will benefit from improved business and financial performance, effective investment decisions, and better risk management. Stakeholders can expect lower total asset life cycle costs, higher asset performance, and confidence in sustained future performance.

The City has previously created a business plan to support the long-term operation and demand planning of the City's landfill assets and waste collection assets. This business plan has continuously evolved but is limited in its coverage of all infrastructure.

1.3 Asset Management Provincial Requirements

The O. Reg. 588/17 came into effect in 2018 and stipulates specific AM requirements to be in place within Ontario municipalities by certain key dates (**Table 1-1**). The development of this AMP is one of the steps to guide the City towards meeting the July 1st, 2024 deadline.

Table 1-1: O. Reg. 588/17: AM Planning for Municipal Infrastructure

Description: A regulation made under the Infrastructure for Jobs and Prosperity Act, 2015, stating that every municipality shall prepare and update a Strategic AM Policy, and that every municipality shall prepare an AM Plan for its core infrastructure assets by July 1, 2022, and an AM Plan for all other infrastructure assets by July 1, 2024. The regulation outlines several requirements that each AM Plan must follow, such as including current and proposed level of service. Core municipal infrastructure assets include water, wastewater, stormwater, road, and bridge assets.	
Deadline Date	**Regulatory Requirement**
July 1st, 2019	All municipalities are required to prepare their first Strategic AM Policy.
July 1st, 2022	All municipalities are required to have an AM Plan for its entire core municipal infrastructure (i.e., water, wastewater, stormwater, roads, and bridges & culverts).
July 1st, 2024	All municipalities are required to have an AM Plan for infrastructure assets not included under their core assets.
July 1st, 2025	All AM Plans must include information about the LoS that the municipality proposes to provide, the lifecycle activities and associated costs needed to achieve those LoS, available funding, any funding shortfalls, and the risk of failing to meet the proposed LoS.

1.4 Scope

The following elements are included within the scope of this AMP:

- A summary of the asset inventory, including the replacement cost of the assets, the average age of the assets, the condition of the assets, and data gap analysis (**Section 2**).
- The City's level of service (LoS) objectives, stakeholder identification, LoS framework, and future demand drivers (**Section 3**).
- Asset lifecycle management strategies and funding needs to maintain current LoS, minimize associated asset risks, and to optimize costs over the whole lifecycle of the asset (**Sections 4** and **5**).

1.5 Relationship to Other Corporate Documents

This AMP is a tactical plan which links "top-down" strategic objectives with "bottom-up" operational activities. **Figure 1-1** demonstrates the line-of-sight between AM strategic objectives and tactical and operational AM elements, including the relationship this AMP has to the other plans in the City's hierarchy of documents.

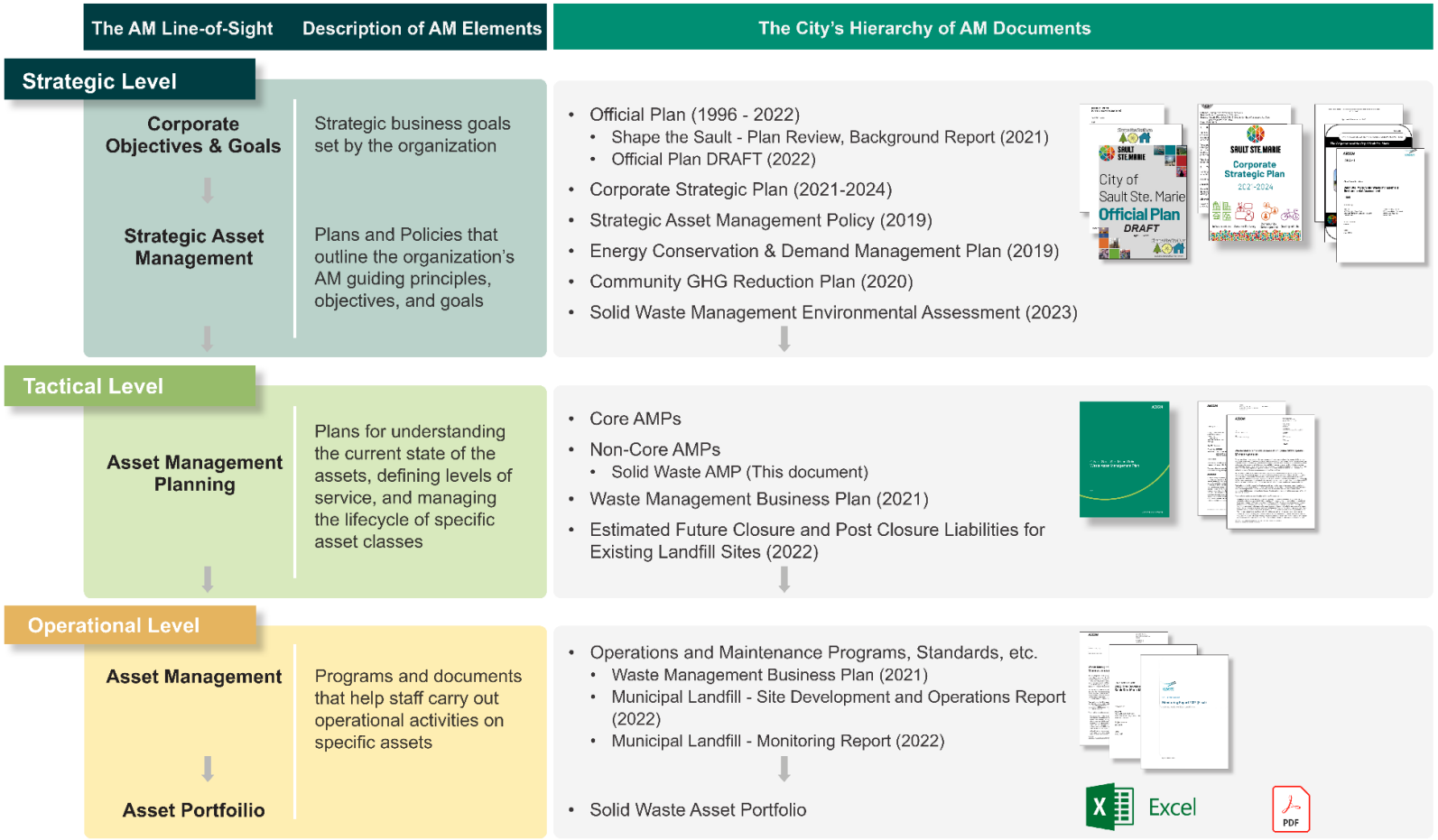

Figure 1-1: The City's AM Line of Sight

2. State of Infrastructure

Solid waste sites and assets encompass a diverse range of equipment crucial to the functionality, safety, and reliability of the City's solid waste sites and services. The City's solid waste assets include heavy equipment, fixed infrastructure (such as roads and pipelines), gas and leachate collection, landfill cell cap and liners, as well as various supporting assets and structures.

The inventory of solid waste assets is the first time the City has assembled a comprehensive catalog detailing the quantity, condition, and specifications of all of the relevant components within the City. By analyzing the inventory and assessing the data gaps, this section facilitates informed decision-making and strategic resource allocation, providing essential insights into the maintenance needs and financial requirements.

2.1 Asset Hierarchy

To fulfill the requirements of O. Reg. 588/17 and to pave the way for robust long range asset management planning, the City necessitates a logically segmented asset breakdown structure (hierarchy) within the ambit of this AMP. Achieving this requires a sufficiently granular classification of solid waste assets, enabling the identification of individual assets due for renewal. Striking the right balance is also crucial, as there is a fine trade-off between ensuring adequate granularity to provide essential information and avoiding excessive granularity that could make the effort to collect and manage information more burdensome than the usefulness derived from it.

The inventory submitted and analyses within this AMP was created using the following sources:

- City of SSM (2021) Active Capital Assets
- City of SSM (2021) Business Plan revised June 28 2021, and November 2023 revision
- AECOM (2022) Site Development and Operations Report
- AECOM (2021) Final Business Plan Update Memorandum
- Dillon Consulting (2022) Monitoring Report (Final)
- AECOM (2023) Draft Final EA – June 30 2023
- City of SSM (2023) CMMS Work orders for Methane Field
- Comcor Environmental (2023) Annual Proposal
- Comcor Environmental (2023) LFGCS Field Inspection

In **Figure 2-1**, the hierarchy of solid waste assets is illustrated, showcasing 10 main categories: storm/ground water, sanitary, buildings, leachate, landfill gas, environmental monitoring, waste collection, landfill infrastructure, landfill equipment, and liners & capping. Each category is further broken down into subcategories. This asset hierarchy establishes a logical indexing of the City's solid waste assets, categorizing them into primary (parent) and secondary (child- and grandchild) assets. Such a structure forms the foundational framework for subsequent discussions and analysis, enabling the drill-down to a specific asset within the hierarchy to support maintenance planning or track costs at the asset level or higher levels.

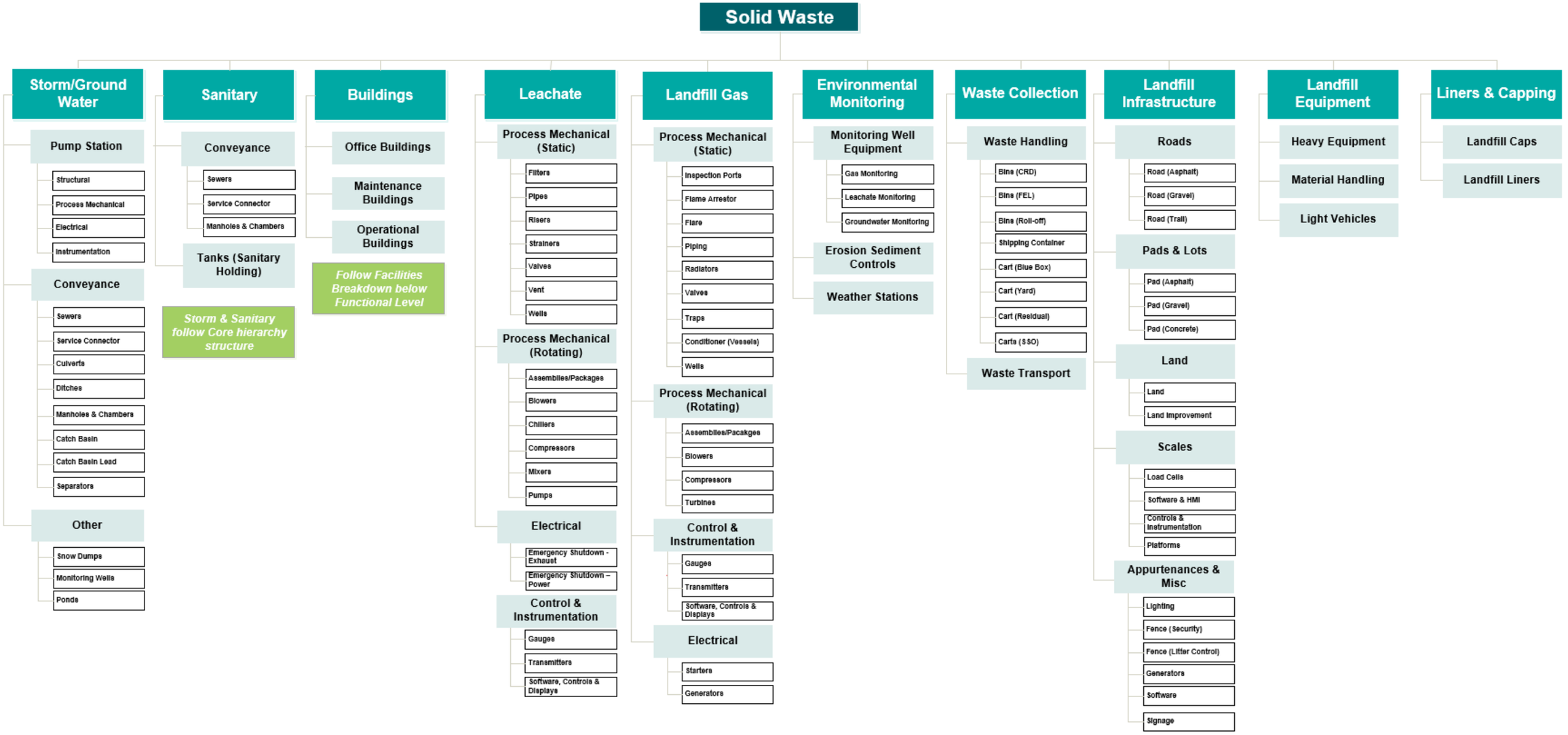

Figure 2-1: City of Sault Ste. Marie Solid Waste Asset Hierarchy

2.2 Current State of the Assets

2.2.1 Asset Inventory

Table 2-1 presents the summary of the City's solid waste inventory.

Table 2-1: Solid Waste Inventory Summary

Asset Group	Asset Category	Count (entries in inventory)	Quantity (sum of assets in inventory)	Unit
Solid Waste	Storm/Ground Water	4	1 / 411	ea., m
	Sanitary	1	370	m
	Buildings	6	493	m^2
	Leachate	27	677	ea.
	Landfill Gas	29	1317	ea.
	Environmental Monitoring	9	17	ea.
	Waste Collection	21	27,982	ea.
	Landfill Infrastructure	18	15,126 / 1,518,615 / 2,838	km, m^2, ea.
	Landfill Equipment	18	21	ea.
	Liners & Capping	1	162,000	m^2

2.2.2 Current Asset Replacement Value

The asset replacement value is the estimated cost that would be incurred to replace an existing asset with a new one of similar functionality, at current market prices or construction costs. This value represents the monetary amount required to reproduce or procure an asset, equivalent to the one being assessed. Examining the distribution of asset replacement values allows the City to comprehend which asset categories hold the highest value for both the City and the public.

Table 2-2 presents the unit replacement cost and the total replacement value for solid waste asset categories within the City. The most significant portion of the total replacement cost is for landfill infrastructure ($77 million). This includes approximately $70 million of estimated land costs due to the consumable nature of land in solid waste use. The combined replacement value for all these categories amounts to approximately $114 million.

For the purposes of this AMP there are several approaches that can be taken towards the valuation of the land costs. Options considered include the current market value based upon similar land sales (used as a basis in this AMP), the Municipal Property Assessment Corporation (MPAC) value, and the capacity use cost:

1. Use of the current market range for industrial land (found to be between $1.2 and $3.5 per square foot in January 2024 based upon available market data for similar land). Due to limitations on land and the relatively strong negotiation position of any seller the 75th percentile value of this range can be used. This is the preferred option but does have the drawback of lack of consideration for full replacement of landfill assets as a result of relocation.
2. MPAC value. This value is dated January 1, 2016 and is done on a cost approach basis. This value is unreliable as the majority of land improvements cannot be seen by the MPAC and the land value is outdated. The current land value is $1.35 million for the main landfill area (not including additional land) which equates to approximately $0.09 per square foot which is significantly below the current market range for industrial land. This option also has a lack of consideration for full replacement of landfill assets as a result of relocation.
3. Capacity usage cost. By determining the cost per cubic meter of landfill capacity and forecasting the volume used annually a pro-rata cost for replacement land per year can be arrived at. The drawback to this value is that

while it can assist in apportioning expenditure to land replacement value it does not give a forecast expenditure point for acquisition which is a key component of the financial forecast.

The capacity use cost would provide an accurate cost for the total replacement of land and the requisite upgrades but currently there is insufficient information to determine and end date for the useable life of the land as mining operations are planned to prolong life. Should the City ever reach a point where no more life extension is deemed possible the capacity use cost could be used as an approximate estimate of required land value and upgrades to acquire and make a site fit for use.

It should be noted that the total replacement values have been marked up by 45%, out of which 20% accounts for engineering and project management cost and 25% for contingency cost. This is the upper range for mark up and is used due to the immaturity of the asset inventory. As the inventory is used and further refined the City may decide to reduce the mark up applied to replacement values.

Table 2-2: Current Replacement Value

Asset Group	Asset Category	Unit Replacement Cost ($/Unit)	Total Replacement Value (2024)
Solid Waste	Storm/Ground Water	$50 - $70,000 /m and ea.	$1,177,000
	Sanitary	$380 – $100,000 ea.	$204,000
	Buildings	$161 - $268 / m^2	$2,582,000
	Leachate	$500 - $28,750 ea.	$2,501,000
	Landfill Gas	$285 - $48,175 ea.	$4,135,000
	Environmental Monitoring	$540 - $5,600 ea.	$372,000
	Waste Collection	$4300 - $1,011,345 ea.	$6,651,000
	Landfill Infrastructure	$47.73 - $1,200,180 / m^2 and km	$76,342,000
	Landfill Equipment	$253.41 - $458,471 / m and ea.	$5,052,000
	Liners & Capping	$64 / m^2	$14,935,000
TOTAL			**$113,951,000**

The asset sub-categories with the largest replacement costs not including land are summarized in **Table 2-3**. It is noted that the landfill caps are unlikely to be replaced under the current operating model and will likely by only maintained and repaired.

Table 2-3: Current Replacement Value Sorted From High to Low by Asset Category

Asset Category	Asset Sub-Category	Total Replacement
Liners & Capping	Landfill Caps	$14,935,000
Landfill Equipment	Heavy Equipment	$3,746,000
Waste Collection	Waste Handling	$3,619,000
Landfill Infrastructure	Roads	$3,238,000
Waste Collection	Waste Transport	$3,032,000
Landfill Gas	Process Mechanical (static - LFG)	$2,879,000
Leachate	Process Mechanical (static - LEA)	$2,462,000
Buildings	Maintenance Buildings	$1,727,000
Landfill Infrastructure	Pads & Lots	$1,465,000
Landfill Equipment	Material Handling	$1,306,000

2.2.3 Age and Remaining Service Life

The asset age is based on the install year of the assets or the assumed year if not available and the remaining service life (RSL) is estimated by considering both the age and the expected service life (ESL) in years. In practice, different assets will deteriorate at varying rates, and their deterioration may not necessarily follow a linear pattern over time. However, it is crucial to consider the level of effort required to predict failure in relation to the asset value. For highly valuable assets, more sophisticated deterioration modeling may be justified. Conversely, for low-value assets, the cost of deterioration modeling might surpass the replacement cost of the asset. Moreover, the actual service life can vary significantly from the ESL. ESL is defined as the period over which an asset is available for use and able to provide the required LoS at an acceptable risk and serviceability (i.e., without unforeseen costs of disruption for maintenance and repair). In some instances, a variation in expected vs. actual service life is evident due to the following factors:

- **Operating Conditions and Demands:** Cell usage is determined by how much waste is produced by the City and its residents. With increased focus on recycling (through the source separated organics plant) and reuse the cell usage could be reduced. Thus, the actual operating “age” of the asset is reduced. It should also be noted that estimates of the volume of industrial and commercial wastes deposited at the SSM landfill are heavily impacted by the regulation, tipping fees and Canadian to US dollar exchange rate. Due to these, significant producers of waste are able to dispose for a lower cost in the United States.
- **Environment:** Some assets are exposed to very aggressive environmental conditions (e.g., corrosive chemicals), while other assets are in relatively benign conditions; thus, the deterioration of assets is affected differently. The City’s experience of the typically more aggressive services within the landfill (such as leachate) are still at the upper end of estimated serviceable life compared to other landfills within Canada. As the waste disposed of becomes more refined the corrosive nature of the landfill is expected to change although the extent and rate cannot be forecast.
- **Maintenance:** Assets are maintained through renewal or replacement of components, which prolongs the service life of the asset. Critical assets are maintained (some through service contracts) but many are yet to experience failure and require replacement.
- **Technological Obsolescence:** Some assets can theoretically be maintained indefinitely, although considerations such as cost to maintain the asset, its energy efficiency, and the cost to upgrade to an updated technology that would result in cost savings are likely to render this approach uneconomical. The majority of solid waste assets are solid infrastructure that does not become technologically obsolete. Those assets at risk are software systems and instrumentation (such as the weigh scales). Some areas of technology may arise and become legislatively necessary such as landfill gas emissions control (either through recapture or flaring) or odour control.

Figure 2-2 shows the weighted average asset age and RSL as a proportion of average ESL for the asset subcategories. It is recommended to collect accurate installation date information for all assets and include it in the next iteration of the AMP. There are several classes that are approaching or at the end of their ESL, however the ESL used in this AMP are reduced values of those used in the core asset AMPs due to increased rate of wear. These values may be increased based upon the experience of the City for all solid waste assets and therefore may present an improved asset condition.

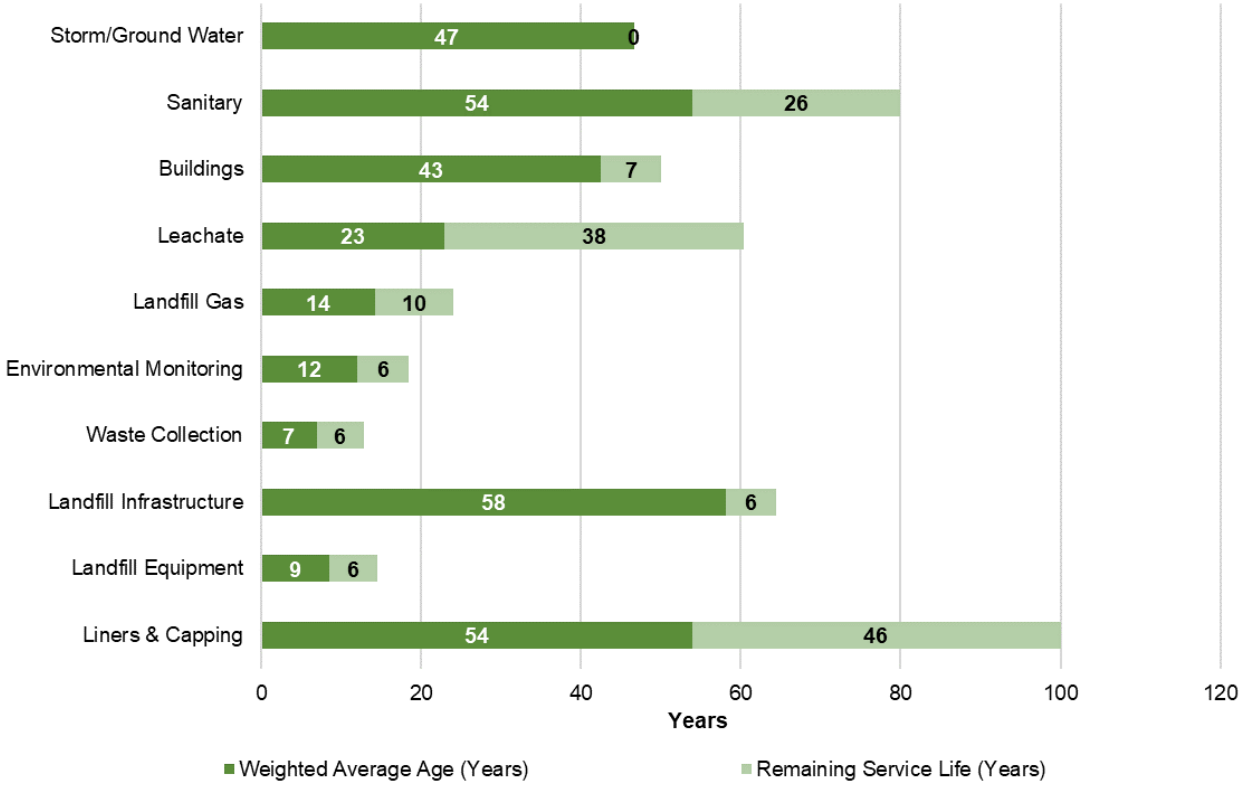

Figure 2-2: Solid Waste Asset Weighted Average Age and Remaining Service Life

2.2.4 Asset Condition

There are no regular field condition assessments for any solid waste assets that produce reliable condition gradings for AM purposes. To fill the gap with an interim data set to enable any financial forecasting to take place, the two-parameter Weibull distribution function was used to assess the current condition and to project the future condition of the City's solid waste assets. The Weibull distribution has been used extensively in reliability studies and lifetime prediction models in industries ranging from automotive to the oil & gas and provides a suitable distribution for this type of analysis.

The underlying premise of the Weibull-shaped deterioration is that while some assets fail prematurely due to severe conditions or improper installation, other assets are very long-lived and function well beyond their theoretical ESL. In order to perform a high order network-level analysis, it was assumed that assets would fail (and require replacement) within a deterioration envelope / curve approximated by a Weibull probability distribution. The two-parameter Weibull cumulative distribution has two parameters for scale and shape, as set out in Equation [1]:

$$f(x;\alpha,\beta) = e^{-\left(\frac{x}{\beta}\right)^{\alpha}} \quad [1]$$

Where: x = Age
α = Shape parameter (or slope)
β = Scale parameter

A set of Weibull cumulative distribution functions were leveraged to simulate a set of deterioration curves for assets with different ESLs as shown in **Figure 2-3**.

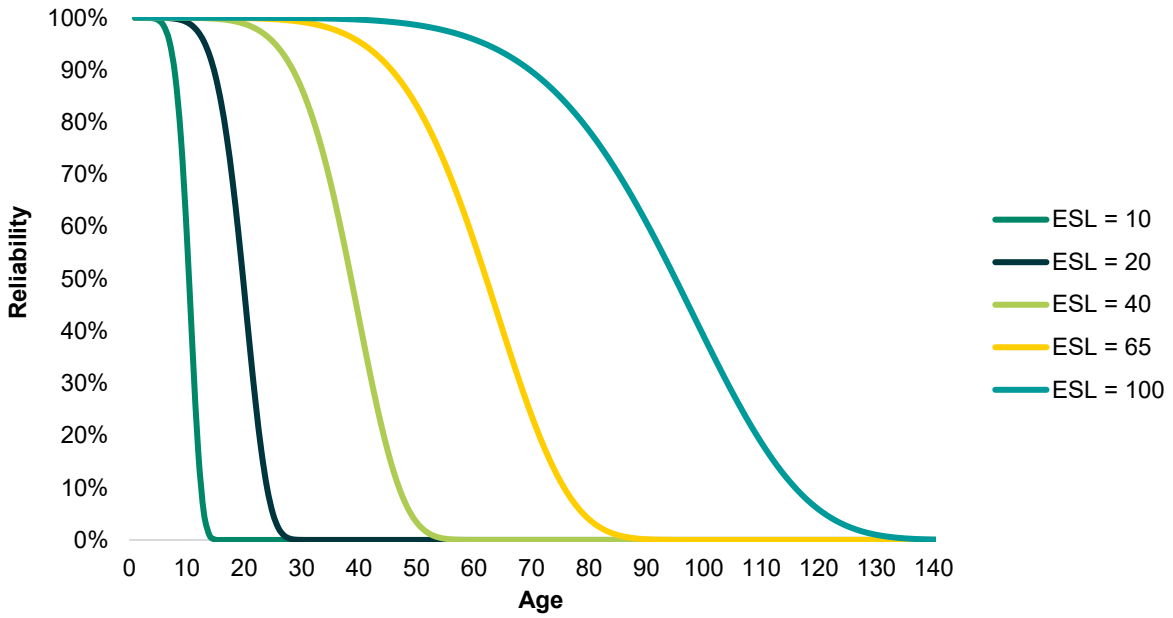

Figure 2-3: Asset Deterioration Curve Samples

Table 2-4 and **Figure 2-4** present the condition ratings of the City's solid waste assets with respective replacement values. As stated previously, a substantial number of roadway appurtenances lack installation date information. A small data gap exists (amounting to less than 0.01% of replacement value) with these assumptions based on a small shortfall in available data for 3 items, these assets are labelled as "Unknown" condition. The assumed condition ratings span from "Very Good" to "Very Poor," with "Very Good" and "Good" collectively contributing 90% of the overall replacement value.

It is vital to note that due to the inclusion of land value within the total replacement value of assets due to its consumable nature, this represents a significant percentage of replacement value. Once this is removed from consideration the relative percentage of replacement value of assets graded in Poor condition increases from 9% to 24%.

As a considerable assumption for the basis of this AM plan it is recommended that the City consider a routine condition assessment program to increase the reliability of condition grades and therefore also increase the reliability of the financial forecasts.

Table 2-4: Solid Waste Condition Summary

Rank	Condition Rating	Total Replacement Value	% of Total Replacement Value	Replacement Value excluding land cost	% of Replacement Value excluding land cost
1	Very Good	$38,329,855	34%	$32,195,625	73%
2	Good	$274,714	0%	$274,714	1%
3	Fair	$64,779,454	57%	$936,561	2%
4	Poor	$10,008,976	9%	$10,008,976	23%
5	Very Poor	$531,962	0%	$531,962	1%
6	Unknown	$0	0%	$0	0%
TOTAL		**$113,924,960**	**100%**	**$43,947,838**	**100%**

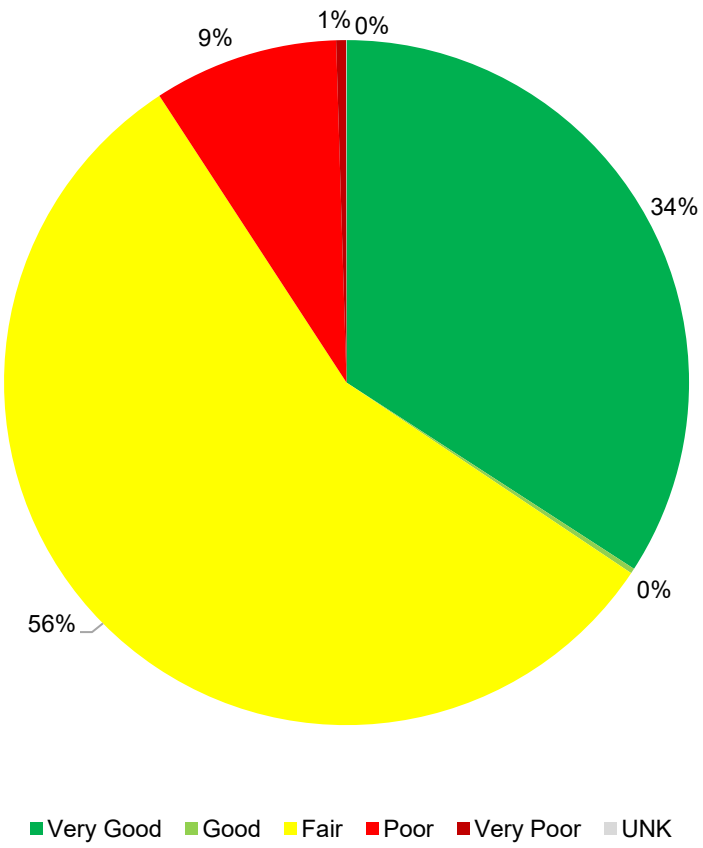

Figure 2-4: Solid Waste Asset Condition Weighted by Replacement Value

Figure 2-5 demonstrates the condition of the assets based on asset subcategories and their respective replacement values. It is important to note that the land replacement costs ($64 million in Fair condition and $6 million in Very Good condition) are removed to allow better resolution of other assets. The replacement cost per condition is reliant on the calculated condition demonstrated previously. The largest groups of assets in Poor and Very Poor condition are found in buildings, waste collection, leachate, landfill infrastructure and landfill equipment.

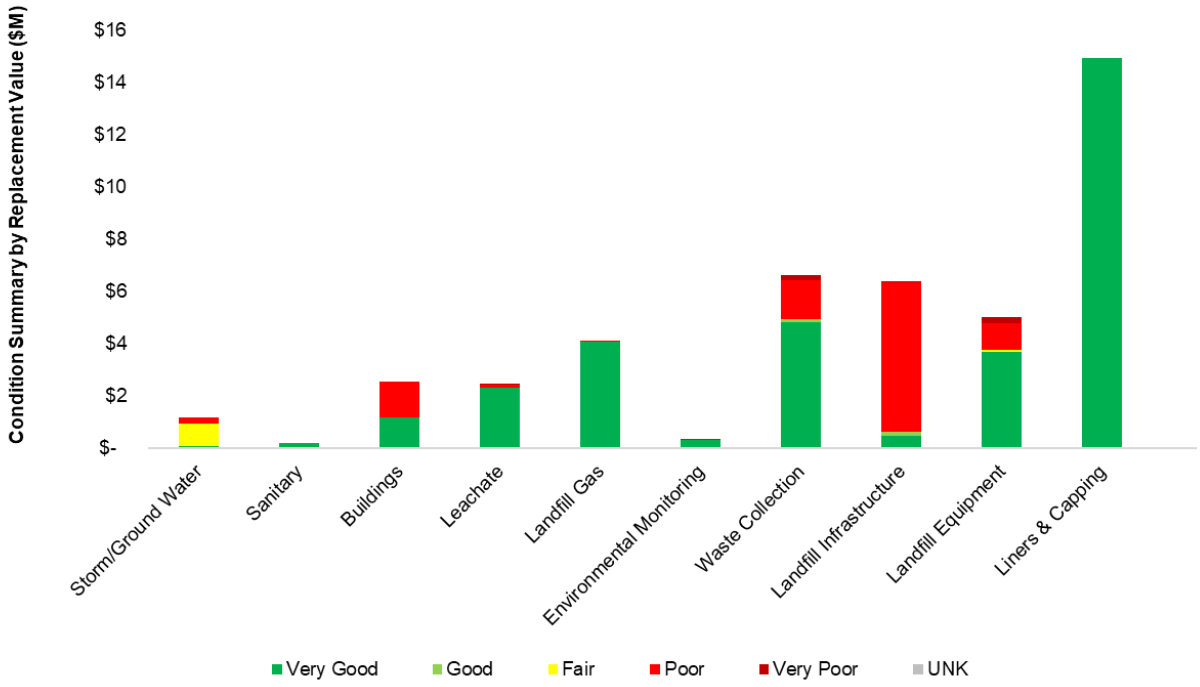

Figure 2-5: Replacement Value per Condition and Category

The top items in Very Poor condition are as follows:

1. Roll off bin containers (purchased 1998). Cost $0.21 million. Confirm if assets are still active and if so its current condition.
2. Sidewalk tractor with plow. Cost $0.16 million. Confirm if asset is still active and if so its current condition.
3. Odour control turbine costing $78 thousand. No installation date was provided. Confirm installation date and current condition.
4. Leachate Wells and Pumps costing $58 thousand. The acquisition or installation data assumes these are original. Confirm if asset is still active and if so its acquisition and installation date and current condition.

It should be noted that groundwater well condition has been estimated as Fair in the absence of detailed condition assessment and with consideration for the fact that the 40 currently in use can be used adequately.

2.3 Asset Data Gap Analysis

This section summarizes the current state of the City's asset data by assessing the quality of the asset inventory. Specifically, this section identifies existing data gaps, determines the overall confidence in the current asset data, and introduces good practices of data management.

2.3.1 Data Gap Observations

The City's solid waste assets were not previously stored in a single inventory. The multiple spreadsheets and GIS databases that did exist only housed a partial listing of the City's assets. This project has used the 3rd party reports provided to AECOM such as the annual monitoring report, the environmental assessment and the annual site development report, as well as consulting the authors of those reports to build the first solid waste asset inventory. Additionally, it has addressed and filled gaps in key data where available, such as expected service life and replacement costs based upon the City's own experience. This has been supplemented by additional data sources such as RS Means and experience from other solid waste operations.

Table 2-5 provides a summary of data completeness levels in the compiled solid waste inventory across key data attributes. It is recommended that the City continue to work on filling any remaining gaps, ensuring a comprehensive and up-to-date database.

Table 2-5: Asset Data Completeness

Asset Group	Inventory Completeness (%)					
	Asset ID	Location	Install Date	Condition	Expected Service Life	Replacement Cost
Solid Waste	34%	98%	81%	98%	98%	96%

Note that installation date value does not include any asset with a date of installation equal to January 1, 1970 as this value is used as a placeholder based upon the original construction to baseline any asset installations not available.

Improvement activities that support continuous improvement of the asset inventory are:

- Asset ID: Add asset ID to new assets identified in the asset inventory and not previously recognized in the list of capital assets.
- Installation year: It is recommended to collect accurate installation date information for all assets and include it in the next iteration of the AMP.
- Installation date: Review all assets with a 1970-01-01 installation date and refine as far as practicable based upon available information.
- Condition Assessment: Consider a routine condition assessment program.

2.3.2 Data Confidence

The quality of asset data is critical to effective AM, accurate financial forecasts, and informed decision-making. For this reason, it is important to know what the reliability of the information is for the State of Infrastructure analysis of the solid waste assets. **Table 2-6** provides a description for the data confidence grades used to classify the reliability of the asset data. This can serve as a reference for the City to assess the quality of their asset data. A brief summary and explanation of the available data can be seen in **Table 2-7**.

Table 2-6: Data Confidence Grading Scale

Confidence Grades	Description
A - Highly reliable	Data is based on sound records, procedures, investigations and analysis, documented properly and agreed as the best method of assessment. Dataset is complete and estimated to be accurate ± 2%
B - Reliable	Data is based on sound records, procedures, investigations and analysis, documented properly but has minor shortcomings, for example some of the data is old, some documentation is missing and/or reliance is placed on unconfirmed reports or some extrapolation. Dataset is complete and estimated to be accurate ± 10%
C - Uncertain	Data is based on sound records, procedures, investigations and analysis which is incomplete or unsupported, or extrapolated from a limited sample for which grade A or B data are available. Dataset is substantially complete but up to 50% is extrapolated data and accuracy is estimated ± 25%
D - Very Uncertain	Data is based on unconfirmed verbal reports and/or cursory inspections and analysis. Dataset may not be fully complete, and most data is estimated or extrapolated. Accuracy ± 40%
E - Unknown	None or very little data held.

Table 2-7: Asset Data Confidence

Asset Group	Inventory Confidence					
	Asset ID	Location	Install Date	Condition	Expected Service Life	Replacement Cost
Solid Waste	NA	A	C	E	B	B

- Location data has been reviewed and confirmed by the City. The majority of asset entries are located within the fenced boundary of the City's main landfill site. By total% a significant volume are at unique locations not recorded as they are individual bins provided to City residents, as a result these location are not entered or considered.
- Installation dates as mentioned previously have been assumed to be 1970-01-01 where not available. The accuracy of the data to the year of installation where available is high but over 20% are assumed resulting in a lower confidence grade.
- Condition assessment data is graded E as all is extrapolated from the installation data (which itself has a confidence grade of C).
- Expected service life is deemed to be reliable as it is founded on available data accumulated for such a purpose (professional construction cost estimating software) and is supplemented with the City's own experience for specific assets that are not on available databases.
- Replacement cost is also graded reliable as it is derived from a combination of professional construction cost estimating software and supplemented with the City's own purchasing data. To include a tolerance for the imperfect data the upper range for mark up is used due to the immaturity of the asset inventory. As the inventory is used and further refined the City may decide to reduce the mark up applied to replacement values.

2.3.3 Data Management Practice

The asset data lifecycle is a sequence of stages that data goes through from its initial build (i.e., data capture and entry) to its eventual archival and/or deletion at the end of its useful life[1]. A clear definition and understanding of the organization's process for acquiring, storing, utilizing, assessing, improving, archiving, and deleting data (see **Figure 2-6**) will ensure good data management practices and help to sustain levels of data quality required to support AM activities.

Figure 2-6: Asset Information Lifecycle

[1] TechTarget Network, Definition: Data Life Cycle, 2020.

The seven key stages of the asset data lifecycle are described in more detail below:

- **Acquiring New Data**: The majority of new asset data arises from asset creation, refurbishment and overhaul activities. New data may also come by way of inheritance or transfers from other business units, organizations, or third parties. As such, it is important to have clearly defined processes in place not only to add or update asset data, but to migrate and merge data from other sources.
    - New assets for solid waste should be consistently added to the inventory and a minimum required data set defined to maintain inventory accuracy and reliability.
- **Storing Data**: The way asset data is stored is an important consideration for overall data quality. Having a planned approach to data storage will inevitably reduce the likelihood of duplication and inconsistencies across datasets within the organization. Depending on the needs of the organization, this stage may involve procuring a new software to adequately house the data, along with a data backup and recovery plan to ensure that the necessary data protection and privacy standards are met.
    - Assets are typically stored in either the CMMS or the GIS. For solid waste assets, due to the relative lack of linear infrastructure and the fact that the majority of assets are within the fence line, and those that aren't are located at private residences the GIS is not required but should be considered for use to align with other asset classes.
- **Utilizing / Analysing Data**: This aspect of the asset information lifecycle is where users encounter the data to support data-driven activities within the organization. Data can be viewed, processed, edited, and published to allow users to access the data outside the organization. Critical data that has been modified should be fully traceable to maintain the integrity of the data. As such, it is important to communicate to the users why asset data is so important, and how it is used to inform decisions within the organization.
    - Currently no analysis of the use of solid waste assets is carried out. Use of the core asset AM plans (such as sanitary and water) and mature inventoried non-core (such as fleet) should be considered to drive a better understanding of solid waste asset performance. This includes improved understanding of estimated serviceable life and true replacement cost value from the City's experience.
- **Assessing Data**: Assessing the data quality helps to determine the level of confidence in the information and ensures that decision-makers are making informed decisions based on the quality of data available to them. Moreover, it is important to fully understand the availability and quality of the asset data before issuing information publicly. Some of the results of data degradation, due to improper or lack of assessment, may include:
    - Poor asset performance due to lack of information and understanding of asset behaviour.
    - Non-compliance with statutory regulations or safety requirements.
    - Safety incidents due to risks not being identified or reported.
    - Asset failure due to gaps in maintenance planning.
- **Improving Data**: Improving data quality involves establishing clear targets which are intended to be communicated widely across the organization. It is imperative that the organization understands the costs, benefits, and risks associated with any data improvements since the cost of the improvement may outweigh the overall benefit. It is also important to note that *more* data does not necessarily mean *better* data. It is very possible to collect data that does not add value to the organization. As such, it is critical that the organization aligns its data improvement targets with its AM objectives, and considers the data-driven decisions staff need to make at the operational and strategic level, to ensure that the *right* data is being improved upon.
- **Archiving Data**: Archiving data is the process of storing data that is no longer active or required but is able to be retrieved in case it is needed again. Data that is archived is stored in a location where no usage or maintenance occurs. It is recommended that a data archive strategy exists within an organization in order to lay out the data archival requirements, which includes the following factors:
    - Consider what data should be archived and articulate the reasons behind the archival decisions.
    - Examine any legal obligations pertaining to the retention of data records.

  - Determine the appropriate duration for retaining different categories of data records.
  - Evaluate the risks associated with the inability to retrieve specific data records.
  - Specify the authorized individuals or entities who should have access to archived data records.
  - Establish the expected timeframe for retrieving archived data records.
  - Communicate these requirements across the organization to ensure staff understand why records are being archived, how they can access archived data records, and for how long archived data records can still be accessed.

  When assets are formally disposed of, their entry in the inventory should be archived to maintain data integrity and to further build the City's understanding of its waste assets. Several instances of inactive assets were found during the creation of the inventory from available sources.

- **Deleting Data:** The deletion of data is the final component of the asset information lifecycle. Typically, within organizations there is a resistance to permanently delete data, otherwise known as data "squirrelling", due to the overall capacity of storing data increasing and the cost decreasing. However, within the organization's data archive strategy, a retention period should be specified to indicate when data should be deleted, along with any processes to follow, such as obtaining prior authorization.
  - The retention period is driven by best practice for solid waste as the life of the asset is in far in excess of defined regulation or profession bylaw (such as Engineering document retention).

3. Levels of Service

3.1 Purpose

Level of Service (LoS) supports every aspect of the overall AM System. The objective of establishing clearly defined service levels is to help the City meet stakeholder values, achieve its strategic goals, make informed decisions, and implement effective asset lifecycle activities.

Documenting LoS is a proven practice that will enable the City to:

- Link corporate strategic objectives to customer expectations and technical operations.
- Balance customer needs and expectations while evaluating the effectiveness of operations and whether the right LoS is being provided at the right cost.
- Transition from an “Asset Stewardship” approach that focuses on making decisions based on maintaining assets in an acceptable condition to a “Serviceability” approach that is geared towards making decisions based on balancing the costs, risks, and goals for the LoS being provided by the City’s assets.
- Communicate the physical nature of infrastructure that the City owns and is financially responsible for while promoting the use of LoS to enable effective consultation with stakeholders regarding alternative funding options according to desired LoS outcomes.
- Make recommendations on strategies that the City can take now to minimize future renewal costs while ensuring that adequate LoS can be delivered without burdening future generations.
- Assess internal (e.g., program changes) and external (e.g., climate change) factors that have the potential to impact the City’s ability to deliver services and how these factors may impact the LoS being provided.
- Implement a corporate continuous improvement program to further optimize AM across all service areas.

O. Reg. 588/17 mandates that Ontario municipalities must report their current LoS by July 1, 2024. Additionally, the proposed LoS for all municipal assets including core and non core assets should be reported by July 1, 2025.

3.2 Objectives

Defining LoS objectives is important for drawing a line of sight between the City’s corporate objectives and the tangible asset performance outcomes. To do so, the LoS objectives must take into consideration stakeholder interests to develop asset performance measures that aim to meet the needs and expectations of the community. By doing this, the City will ensure that their assets are striving towards optimal performance, not only operationally, but economically, socially, and sustainably as well.

Every stakeholder has certain interests in the service being provided and in general. The City’s corporate objective is to lift up the community and build pride, and attract people (visitors, employers, and employees). The City’s Comprehensive Background Report[2] for the New Official Plan outlined the overarching themes that reflect the City’s value, as shown in **Table 3-1.** Each overarching theme is also assigned a corporate service objective.

The development of level of service targets should be aligned with these corporate objectives which will be addressed in the next iteration of the AMP.

Table 3-1: The City’s Overarching Themes and Objectives

Overarching Themes	Corporate Objective
Healthy Community	Supports healthy living, active transportation, access to passive and active recreation, social interaction and the creation of spaces that are comfortable, safe, and accessible for all ages and abilities (the “8 to 80 Cities” concept).
Environmental Sustainability	Supports energy conservation and efficiency, improved air quality, reduced greenhouse gas emissions and climate change adaptation.

[2] City of Sault Ste. Marie. 2021. Comprehensive Background Report.

Overarching Themes	Corporate Objective
Integrated Mobility	Supports accessibility and choice of a diversity of transportation modes.
Sense of Place	Fosters a welcoming place for all that establishes connection and provides a memorable experience to visitors.
Sustainable Growth	Stimulates reinvigoration of neighbourhoods to provide a complete range of housing, services, employment, and recreation.
Economic Resiliency	Supports the growth and diversification of the city's economy.
Social Equity	Contributes to creating a welcoming and inclusive community, focusing on the removal of systemic barriers so that everyone has access to an acceptable standard of living and can fully participate in all aspects of community life.
Cultural Vitality	Celebrates the City's history, diverse communities, and natural and cultural heritage, with the Downtown as the City's core destination for arts and culture.

3.3 Stakeholder Identification

A stakeholder is any person or organization that can affect, be affected by, or perceive themselves to be affected by a decision or an activity. Stakeholder analysis is the process of understanding stakeholder needs, expectations, and perceptions relative to the stakeholder's level-of-interest and level-of-influence over the organization. The organization typically engages with their stakeholders to:

- Establish which activities or services matter most to them.
- Understand their risk appetite and risk threshold.
- Understand their willingness to pay for services.

Stakeholders can take many forms and may be internal (i.e., staff, Council) or external (i.e., the public, regulatory agencies, suppliers, neighbouring municipalities, etc.) to the organization. The following groups were identified as key stakeholders for solid waste during the LoS workshop held with City staff. This is not intended to be an exhaustive list; however, the following groups provide a good starting point for the City to move forward to the next stage. The City's key stakeholder groups are identified below:

- Residential Customers. For example, single family homes for waste collection and landfill usage. Multifamily homes are not considered as a stakeholder for waste collection as City bylaws require their waste collection to be contracted to an external agency.
- Industrial, Commercial & institutional (ICI) Customers. The most considerable potential customer from an ICI perspective currently does not utilize City facilities. Currently, exporting the waste to the USA is a more cost-effective solution. Should the exchange rate swing considerably or there is external regulatory change limiting waste transport across the border then ICI usage of the landfill may increase. This increase is accounted for as the worst-case scenario in the City's business plan.
- Regulatory Agencies.
- Neighbouring Municipalities.
- Developers.
- First Nations
- Environmental Groups
- Internal City Departments

3.3.1 Legislated and Regulatory Requirements

Solid waste assets are critical to the City's ability to provide essential services to the community, and for protecting the health and safety of the public. As such, key legislative requirements exist for the City's infrastructure assets, which ensure that minimum requirements are met and standards are in place that promote a high quality of life (i.e., clean drinking water and safe roads, etc.). A sample of key Federal and Provincial legislated requirements are outlined below in **Table 3-2**. Monitoring and development programs relevant to solid waste assets are also listed.

Table 3-2: Legislated and Regulatory Requirements

Federal	Provincial
• Canadian Environmental Protection Act (CEPA) • Canadian Environmental Assessment Act (CEAA) • Canadian Food Inspection Agency (CFIA) • Migratory Birds Convention Act and Regulation • Fisheries Act • Fertilizers Act • Environmental Contaminants Act • Transportation of Dangerous Goods Act • Federal Weight and Measures Act • Canadian Food inspection Agency for composting	• Environmental Protection Act (EPA) – Ontario Regulation 347 – General – Waste Management – Ontario Regulation 232 – Landfilling Sites – Ontario Regulation 267 – Compost – Ontario Regulation 103 – Industrial, Commercial and Institutional Source Separation Programs • Waste Diversions Transition Act (WDTA) • Pesticides Act • Ontario Drainage Act – Ontario Water Authority Ontario ▪ Water Resources Act ▪ Ontario Regulation 903 – Wells ▪ Regarding monitoring of wells • Resource Recovery and Circular Economy Act – Food and Organic Waste Policy Statement

3.3.1.1 Regulatory Change Impacts

The Food and Organic Waste Policy Statement (2018)[3] was issued to provide policy direction in reaching Ontario's interests of a circular economy. The policy statement aims to support the province's goals of zero waste and zero greenhouse gas emissions from the waste sector. In support of these goals, the policy statement has established waste reduction and recovery targets for municipalities and relevant sectors within Ontario. The policy statement targets and timelines relevant to the City are summarized below in **Table 3-3.**

The impact of this change has led the City to plan and initiate the design and construction of a Single Sourced Organics (SSO) facility (also referred to as the Biosolids Management Facility), the cost of which is split across City departments.

Table 3-3: Food and Organic Waste Policy Statement Targets

Person or entity	Targets and Timelines
Municipalities subject to policy 4.1	70% waste reduction and resource recovery of food and organic waste generated by single-family dwellings in urban settlement areas by 2023
Multi-unit residential buildings subject to policy 4.10	50% waste reduction and resource recovery of food and organic waste generated at the building by 2025
Industrial and commercial facilities subject to policy 4.14	70% waste reduction and resource recovery of food and organic waste generated in the facility by 2025
Industrial and commercial facilities subject to policy 4.15	50% waste reduction and resource recovery of food and organic waste generated in the facility by 2025
Educational institutions and hospitals subject to policy 4.18	70% waste reduction and resource recovery of food and organic waste generated in the facility by 2025

- Additional benefits of the new facility are summarized as follows:
- Biosolids processing will increase projected landfill longevity and reduce the impact of the shortage of earthen cover materials for use at the landfill.

[3] Food and Organic Waste Policy Statement. (2018). Pursuant to section 11 of the Resource Recovery and Circular Economy Act (2016). Government of Ontario. https://www.ontario.ca/page/food-and-organic-waste-policy-statement. Retrieved on March 15, 2024.

- Mitigation of off-site environmental impacts , especially odour, water contamination, dust, noise and vermin.
- The design has sufficient redundancy and capacity to allow for routine maintenance of all equipment, equipment breakdowns and operational anomalies.

3.4 O. Reg 588/17 Levels of Service Metrics

Currently, O. Reg 588/17 only identifies levels of service metrics for core assets. A number of key LoS performance measures for solid waste assets have been identified in consultation with City staff through workshops, are detailed in **Section 3.5**.

3.5 Levels of Service Performance Metrics

- The City's current practices to meet regulatory levels of service:
- Tracks odour complaints, and reports to the Ministry of Environment, Conservation and Parks as necessary,
- Established a biosolids management plan to improve odour management,
- Conducts water monitoring for surface water and at groundwater wells,
- Conducts gas monitoring.

Through a review of the legislated and regulatory requirements required for solid waste and collaboration with the City during the LoS workshop, three (3) LoS performance metrics were determined for solid waste, as presented in **Table 3-4.**

Table 3-4: Solid Waste Levels of Service Performance Metrics

Asset Category	Universal Service Value	LoS Performance Measure	Unit	Is Data Available? (Y/N)
1. Solid Waste	Environment & Sustainability	Curbside residential waste per capita	Tonnes / Capita	Yes
2. Solid Waste	Environment & Sustainability	Amount of waste diverted from landfill at the Household Hazardous Waste Depot	%	Yes
3. Solid Waste	Environment & Sustainability	GHG emissions	Tonnes	Yes

3.6 Levels of Service Performance Targets

Establishing LoS targets is an important part of continual improvement and performance management. Without performance targets, it is difficult to ascertain whether goals are being met, or the extent of the gap if they are not. Incorporating targets into the City's LoS framework helps to ensure that targets are reasonable, aligned with customer expectations, and evaluated on an objective basis by considering cost-benefit trade-offs.

One of the key challenges in setting infrastructure performance targets in a municipal environment is that they can often become biased and/or politically motivated. Therefore, it is important to review LoS targets with internal and external stakeholders, especially the customers who will be impacted the most by changes in service delivery. An important aspect of evaluating LoS targets is determining how the user is willing to pay for the service. Regulatory requirements are an exception; however, they only provide the minimum service standard. Cost is still an important parameter to consider when assessing the merits of service improvements. To deal with the financial realities, it is necessary to:

- Calculate how much the service costs based on current LoS.
- Determine the cost associated with varying the LoS.

- Assess the customers' willingness to pay.

It is important that any targets set be realistic and achievable. Therefore, it is not advisable that the City sets any firm targets until their current performance has been fully assessed. O. Reg. 588/17 requires AMPs to include proposed levels of service and a formalized financial strategy by July 1, 2025.

3.7 Future Demand Drivers

Demand management is a critical component of managing the desired LoS in a sustainable manner, now and into the future. Understanding demand drivers enables the City to proactively develop effective, long-term strategies that are suitable for the City's unique political, environmental, social and technological landscape.

A summary of factors identified from the LoS workshop that would impact Solid Waste service levels include, but are not limited to, the following:

- **Growth**. Projected growth anticipated to come predominantly from multi-family house holds which are a lower contributor to landfill capacity due to bylaw impacts previously stated and commercial design making by ICI stakeholders. General population growth is expanded upon below.
- **Inflation and Cost of Living**. Reduced disposable income due to interest rate rises and inflation for the life of this plan will negatively impact waste production as stakeholders become less likely to replace and more likely to repair, repurpose or reuse items that would typically go to landfill.
- **Technology**. Increasing use of electronics containing printed circuit boards will increase the volume of waste that cannot be recycled.
- **Electrification**. Predicted to have minimal impact on waste generation but will impact the waste collection fleet and the fueling costs. Regulations published by Federal Government in 2023 laid out plans to phase out passenger vehicles powered only by gasoline or diesel in 2035. As these vehicles are replace the City should be mindful of the increased maintenance and purchase costs of Hybrid Electric Vehicles (HEV) and Plug-In Electric Vehicles (PEV).
- **Funding level**. The future levy determined by the City for use will have an impact on total usage and fly-tipping around the city.
- **Climate Change**. Increase rainfall levels may require additional leachate control should levels occur beyond that which can be processed by existing equipment.
- **Per- and Polyfluorinated Substances (PFAS) contamination.** Limited impact to solid waste due to low occurrences on City land (except Fire service training pad near the airport).
- **Regulatory Changes**. Future changes to the source separated organics and other recycling regulation will impact the demand for solid waste service and the type of services required.

On November 2, 2021, the City's Planning Division released the Comprehensive Background Report for updating the Official Plan[4]. The City's Official Plan guides local decision-making on land use, development, and public infrastructure over the next 20 years. The City's population is expected to reach 80,000 by 2031, and 83,300 people by 2036. Employment is projected to grow by approximately 6,000 jobs, from 31,000 jobs in 2016 to 36,900 jobs in 2036.

When additional assets to accommodate this population and employment growth are introduced to the City's portfolio, additional human resources, training and funding are required to maintain and operate, and renew or replace those assets. O. Reg. 588/17 requires municipalities by July 1, 2025, to estimate capital expenditures and significant operating costs to achieve the proposed LoS and accommodate projected increases in demand caused by population and employment growth. This includes the estimated capital expenditures and significant operating costs related to new construction and / or to upgrade existing municipal infrastructure assets. The City will have to address these aspects during the later phases of the AM regulatory compliance process and before the 2025 deadline.

[4] City of Sault Ste. Marie. 1996. Official Plan

4. Asset Management Strategies

4.1 Asset Lifecycle Management Introduction

Asset lifecycle management focuses on the specific activities that should be undertaken during all phases of the asset lifecycle. Considering the entire asset lifecycle ensures that the City makes sound decisions that take into account present and future service delivery needs.

The overarching goal of lifecycle management is to maximize the long-term benefits and services that the City's assets deliver while minimizing the associated costs and risks in the long run. Every asset has a lifecycle cost, which is the total cost of all activities undertaken throughout its service life. Part of the purpose of the AM planning process is to fully understand and predict the long-range financial requirements for the City's infrastructure, facilitating planning and resource management in the most cost-effective manner possible. **Figure 4-1** illustrates how costs typically accumulate over an asset's life. It is worth noting that the ongoing operations and maintenance, renewal & replacement, and disposal costs accumulate up to many multiples of the initial acquisition costs. As such, it is important to fully understand the entire lifecycle costs before proceeding with asset acquisition.

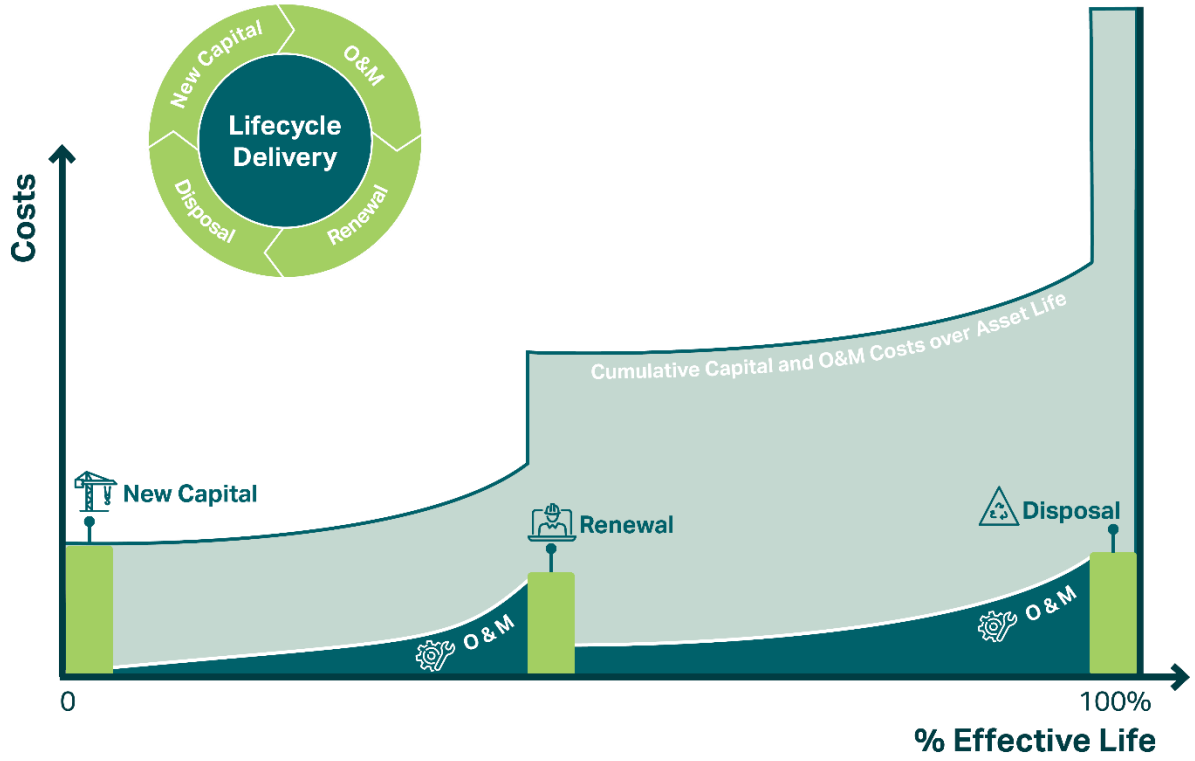

Figure 4-1: Lifecycle Cost Accumulation Over Asset Life

Asset lifecycle management strategies are typically organized into the following categories.

1. **Asset Acquisition / Procurement / Construction**: Acquisition includes expansion activities and upgrading activities to extend services to previously unserved areas or meet the demands of growth and functional requirements. When acquiring new assets, the City should evaluate credible alternative design solutions, considering how the asset will be managed at each of its lifecycle stages. AM and full lifecycle considerations for the acquisition of new assets include, but are not limited to, the following:

    - The asset's operability and maintainability.

- Supply chain considerations.
- Availability and management of detours.
- Staff skill and availability to manage the asset.
- The manner of the asset's eventual disposal.

2. **Asset Operations and Maintenance (O&M)**: As new infrastructure is commissioned, the City assumes the responsibility of operating and maintaining the infrastructure according to O&M standards to ensure its safety and reliability. The operations staff provides the necessary day-to-day support for operating the assets. Maintenance expenses include periodic preventive maintenance to ensure that the infrastructure can provide reliable service throughout the life of the asset and corrective maintenance that is required to repair defective assets as needed. Inadequate funding for O&M will adversely impact the lifespan of assets. The number of O&M resources required in any period is a function of the current inventory of infrastructure and the total O&M needs for each asset. As the inventory of infrastructure grows, total O&M requirements will also increase.

3. **Renewal and Replacement:** The third aspect of full lifecycle costing pertains to the renewal and replacement of assets that have deteriorated to the point where they no longer provide the required service. Renewal or rehabilitation costs may be incurred during the life of an asset where an investment is made to improve its condition and/or functionality, for example, resurfacing an access road or composting pad. Replacement activities are expected to occur once an asset has reached the end of its useful life, and renewal is no longer a viable option.

4. **Decommissioning and Disposal:** There will inevitably come to a point in time when an asset must be removed from service, and depending on the type of asset, there may be significant costs associated with its decommissioning and disposal. Factors that may influence the decision to retire an asset include changes leading to non-compliance, the inability of the asset to handle increased LoS, technological advances rendering the asset obsolete, the cost of retaining the asset exceeding the benefits gained, the current risk associated with the asset's failure becoming intolerable, assets negatively impacting service delivery or negative impacts on the environment.

Normally, major costs that may be incurred during disposal and decommissioning derive from the environmental impact of the disposal and, if required, the rehabilitation and decontamination of land. However, some cost savings may be achieved through the residual value of the asset or by exploring alternative uses for the asset. In all cases, it is important to consider disposal and decommissioning as the strategy employed has the potential to attract significant stakeholder attention. For that reason, the costs and risks associated with disposal and decommissioning should be equally considered in the City's capital investment decision-making process.

4.2 Asset Acquisition Strategies

The City has completed a Waste Management Environmental Assessment report and submitted it to the Ministry of the Environment Conservation, and Parks for review and approval. According to the report, the current landfill is projected to reach maximum capacity in 2027. As a solution, an expansion has been proposed to provide an additional disposal capacity of approximately 1.78 million tonnes of waste over a planning period of 25 years[5]. The comprehensive report is available on the City's website, and **Table 4-1** summarizes key activities associated with the proposed expansion.

[5] Solid Waste Management EA Final Report. (2024). City of Sault Ste. Marie. Solid Waste Management EA Final Report - City of Sault Ste. Marie (saultstemarie.ca). Retrieved on February 22nd, 2024.

Table 4-1: Acquisition Activities for Solid Waste Assets

Asset Group	Asset	Activities Undertaken by the City	Guiding Documents
Solid Waste	Storm/Gound Water	• Planning to build two separate pump stations at the landfill in conjunction with landfill expansion. – Leachate collection system for abandoned landfill site will require two pump stations installed as flow increases. – One main station to be built within the next 5 years. Additional smaller pump station for leachate collection as part of the expansion, dependent on waste disposal rates over time. The final need will be assessed post-installation of the new station. • Planning to add stormwater management ponds as part of landfill expansion. – One will begin construction within the next 5 years, while the other two are proposed as part of the overall site and will be constructed based on need.	• Official Plan • Corporate Strategic Plan • Energy Conservation & Demand Management Plan • Community GHG Reduction Plan • Strategic Asset Management Policy • Development & Operating Report • Monitoring Report • Environmental Assessment • Solid Waste Business Plan • Post Closure Plan
	Buildings	• Planning to demolish the existing buildings and initiate the construction of new facilities over the next 10 to 20 years.	
	Landfill Gas	• Acknowledging that more landfill gas wells are needed as part of landfill expansion.	
	Landfill Infrastructure	• Planning to hard surface a section of the road to manage dust emissions and may utilize asphalt millings from other reconstruction projects.	
	Landfill Equipment	• Ongoing update and revision of the business plan to reflect biosolids handling.	

4.3 Asset Operations and Maintenance Strategies

Effective O&M of assets is crucial for sustainable performance and longevity. Managing O&M costs involves developing comprehensive strategies that optimize resource utilization while ensuring asset reliability. Proactive maintenance schedules and condition monitoring can help identify potential issues before they escalate, reducing unplanned downtime and minimizing repair costs. Implementing energy-efficient technologies and best practices in solid waste AM also contribute to cost-effectiveness over the asset's lifecycle. **Table 4-2** summarizes the O&M activities associated with the City's solid waste assets.

Table 4-2: O&M Activities for Solid Waste Assets

Asset Group	Asset Category	Activities Undertaken by the City
Solid Waste	Storm/Gound Water	• Ongoing maintenance program for groundwater and purge wells, managed by an external contractor. • An alert system to notify if purge wells are offline, requiring field staff to check and identify issues.
	Buildings	• Maintenance completed internally through public works facilities team. – A building maintenance expert for the upkeep of air conditioning systems, heaters, plumbing, etc. – Annual check on air conditioning units, which may involve topping up refrigerant or necessitate an upgrade due to availability.
	Leachate	• Public works checks (frequency not specified). • Regular pump checks: – Contractors will remove, clean, and re-install pumps. – Cleaning is conducted on a regular basis. – Overhaul is based on run-hours and condition. • Periodic forcemain flushing.

Asset Group	Asset Category	Activities Undertaken by the City
	Environmental Monitoring	• Utilizing computer equipment to measure methane gas readings for environmental report. • Sampling and testing at monitoring wells, documented in annual reports. • Monitoring equipment within buildings, calibrated once a year as part of ventilation system inspections.
	Landfill Equipment	• Biosolids trailer washing is completed once a week on Fridays as a preventative measure.

4.4 Renewal and Replacement Strategies

Renewal often involves upgrading or refurbishing existing assets to extend their lifespan, while replacement entails acquiring new assets. The costs associated with these activities include not only the direct expenses of acquisition but also indirect costs such as downtime during the transition, training for new technologies, and potential disposal or recycling costs. **Table 4-3** summarizes the renewal and replacement activities associated with the City's solid waste assets.

Table 4-3: Renewal and Replacement Activities for Solid Waste Assets

Asset Group	Asset Category	Activities Undertaken by the City
Solid Waste	Storm/Gound Water	• Pump Station renewal. • Pump overhaul and replacement.
	Buildings	The buildings will be reconstructed as part of landfill expansion.
	Leachate	• Pump replacement. • Handling system replacement.
	Landfill Gas	• Prefab well head and kanaflex replacement. • Well replacement due to collapse. • Occasional hose replacement if damaged. • Welding material to extend the well to continue filling the landfill. • Valve stem extension.
	Landfill Infrastructure	• Pads repair based on condition.

4.5 Decommissioning and Disposal Strategies

Effective asset decommissioning and disposal are integral components of strategic asset management. As the City's solid waste assets approach the end of their lifecycle or become obsolete, a systematic methodology to their removal and decommissioning is essential. This process involves careful planning, environmental considerations, and adherence to the City's regulatory requirements.

In the realm of solid waste AM, the disposal of landfill sites necessitates additional considerations due to potential environmental impacts. The Province of Ontario has established regulatory requirements in O.Reg 232/98 under the Environmental Protection Act to address these concerns[6].

Site closure activities entail the progressive closure of portions of the fill area as they reach final approved contours. For smaller sites like natural attenuation sites, completion of the final soil cover and limited post-closure monitoring may suffice. In contrast, larger, highly engineered sites would likely require the completion of various constructed works and significant ongoing monitoring and maintenance. Regardless of the site's size, the overarching goal for all

[6] Landfill standards: A guideline on the regulatory and approval requirements for new or expanding landfilling sites. (2012). Government of Ontario. Landfill standards: A guideline on the regulatory and approval requirements for new or expanding landfilling sites | ontario.ca. Retrieved on February 22nd, 2024.

closure activities is to ensure the outcomes are aesthetically pleasing and can provide long-term protection to the environment.

Post-closure care is also mandatory, with the duration depending on factors such as the environmental setting, the level of engineering, the required service lives of any engineered works, and the type of waste and remaining contaminant concentrations. This post-closure period may extend from many decades to several hundred years.

Table 4-4 summarizes the decommissioning and disposal activities associated with the City's solid waste assets.

Table 4-4: Decommissioning and Disposal Activities for Solid Waste Assets

Asset Group	Asset Category	Activities Undertaken by the City
Solid Waste	Buildings	• The demolition is planned as part of the Waste Management Environmental Assessment report. – Asbestos may present challenges during the process. – Demolition and rebuild is required during Cell #3 mining operations.
	Roads	• Road demolition and reconstruction will also be required during expansion and mining operations.
	Waste Collection	• Recycle or landfill carts. • Sell the old vehicles for residual value or scrapping. There is a market for old but functional municipal vehicles in smaller townships and villages that cannot afford or do not require brand new vehicles.

4.6 Risk Associated with Lifecyle Activities

In the context of AM, risk is defined as the consequence or impact of uncertainties on AM objectives. These uncertainties span a spectrum of events, including financial market fluctuations, unexpected asset failures, changes in regulatory environments, and other factors capable of influencing the performance or condition of assets. Risk management, developed to handle uncertainties in a systematic and timely manner, is a practical framework that ensures thoughtful decision-making and protects the achievement of goals. The risk management process generally follows a series of steps, as outlined in **Table 4-5**.

Table 4-5: Key Steps in the Risk Management Process

Step	Description
1. Establish the context	• Define the scope of the risk management process and the objectives that the City seeks to achieve through effective risk management. • Consider the City's internal and external factors and understand stakeholder expectations.
2. Risk identification	• Identify potential risks that could impact the City's AM objectives.
3. Risk analysis	• Utilize qualitative or quantitative analysis methods to assess risks.
4. Risk evaluation	• Evaluate the likelihood and impact of identified risks. • Prioritize risks based on their criticality.
5. Risk treatment	• Develop strategies to reduce the likelihood and impact of identified risks. • Implement preventive measures to address potential issues proactively. • Establish contingency plans for managing risks that cannot be eliminated.
6. Monitor and review	• Regularly update risk assessments to reflect evolving circumstances. • Develop KPIs and monitoring tools to track the effectiveness of risk treatment strategies. • Learn from the City's past experiences and continuously improve risk management strategies.

Over the course of an asset's service life, the accelerating rate of deterioration with age poses inherent risks, inevitably leading to a corresponding increase in maintenance costs. **Figure 4-2** illustrates a general asset deterioration curve. This trend becomes particularly pronounced in the final phase of the asset's service life, where the cost of maintenance experiences a rapid escalation, highlighting the financial risks associated with prolonged

neglect. This phenomenon underscores the critical importance of preventive maintenance in the early stages of an asset's service life. By addressing risks proactively during these initial periods, the potential financial burden tied to accelerated deterioration in later stages can be effectively mitigated.

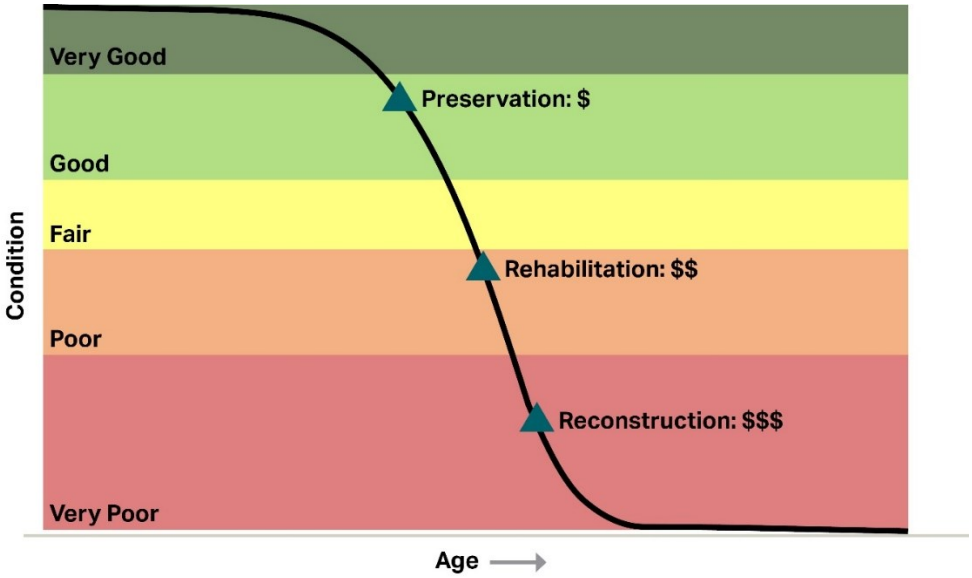

Figure 4-2: Asset Deterioration Curve and Rehabilitation Costs

Beyond the general guidance, the City's approach to risk management should be tailored to their overarching goals, financial resources, and willingness to tolerate uncertainties. To help shape the City's risk management process, AECOM recommends taking into account the following key considerations:

1. **Limited Specialist Vendors**: Specialist vendors for specific equipment maintenance are typically reliant on ongoing contracts and due to their size and specialist nature are more sensitive to losses of custom. Key vendors which are identified as of high importance to the City should be engaged proactively to build an improved relationship. Vendors which are identified as of high importance, and where the City is of significant importance to them, should be engaged proactively for a strategic relationship that can encourage improved efficiencies and reliability.
2. **Increasing Maintenance Costs**: By implementing consistent and proactive maintenance schedules for landfill assets, the City can identify and address potential issues before they escalate. This preventive approach reduces the likelihood of major breakdowns or emergency repairs, ultimately minimizing the overall O&M expenses. Additionally, regular maintenance extends the lifespan of assets, enhances their efficiency, and ensures that they comply with safety standards, contributing to a more sustainable and cost-effective management of municipal resources.
3. **Specialized Parts and Limited Vendor Pool**: The supply chain for specialty equipment, like waste collection trucks, often rely on a limited pool of specialized vendors, while few of them are located within Ontario. In many instances, the required parts need to be shipped from overseas. This dependency can result in vulnerability to disruptions, such as production delays, supply shortages, or unexpected events affecting the vendor's operations. Consequently, it may lead to longer lead times and potential delays in maintenance. Addressing these challenges requires a strategic approach to enhance local capabilities, streamline vendor dependencies, and optimize the supply chain, ensuring the efficient operation and maintenance of crucial fire service assets within the City.
4. **Stringent Safety Standards and Changes in Regulations**: Specialty equipment is subject to rigorous safety standards and regulations; however, regulatory frameworks are dynamic and prone to change due to technological advancements, lessons learned from incidents, and evolving societal expectations. Therefore, staying ahead of these changes is crucial for the City to proactively identify and mitigate potential risks associated with non-compliance.

5. Funding Need Analysis

Financial forecasting and capital planning are a critical element of ensuring the efficient and sustainable management of infrastructure. This involves estimating future financial needs and developing a strategic plan to secure the necessary funding for maintenance, renewal, or expansion of assets. By accurately forecasting financial requirements and implementing a well-structured capital plan, the City can not only ensure the long-term viability of their infrastructure systems but also effectively manage costs, reduce environmental risks, and protect public health.

The financial projections presented in the subsequent sections provide visualizations of the results from the financial model. The subsequent sections are structured as follows:

Section 5.1 shows the assumptions adopted in the financial model to determine the reinvestment or replacement decisions for each sub-category of solid waste assets.

Section 5.2 assesses the annual funding requirements for the next 20 years (2024-2043). Additionally, a smoothed allocation of annual funding is provided to align with the City's budgeting requirements. Some assets already have funding for their replacement set aside by the solid waste business plan which was created by the City with AECOM's input. As no asset inventory was available at the time of creation there is a gap in coverage for asset replacement and reinvestment.

Section 5.3 presents the full funding needed over the next 10 years (2024-2033). The full funding expenditure profile includes the budget required for capital, O&M, and disposal.

5.1 Reinvestment Forecast and Lifecycle Modeling

The lifecycle analysis was conducted using an MS Excel Asset Lifecycle Model that integrated asset inventory, age, ESLs, replacement values, and condition to establish a theoretical replacement cycle for each solid waste asset. The reinvestment forecasts prepared for this assessment provide estimates of the costs required over the next 20 years to sustain each of the City's solid waste assets. A financial dashboard was developed to present the results of the lifecycle modeling (**Appendix A**). Investments were also compared to the existing business plan to confirm alignment and understand gaps in planned expenditure.

The annual reinvestment needs for the solid waste assets were determined based on their age and ESL in years (i.e., replacing assets that have exceeded their ESL) in inflated dollar values and is based on the following assumptions:

- Base year: The base year used is 2024. Any historic asset valuations have been inflated using the experienced inflation rate.
- Reinvestment rate: The installation date was assumed to be 1970-01-01 for assets of unknown age as described previously in **Section 2** and historic and future replacements carried out using the available ESL. This method was used in preference to an averaged percentage reinvestment based on the total replacement value as the relatively small number of entries with a significant variance in value compared to other classes will require a volatile level of reinvestment which will not be demonstrated with an average value. For groundwater monitoring a reinvestment rate of 7% was used as this is approximately equivalent to the current expenditure which has been proven effective.
- The inflation value used was a flat 2%. This value aligns with that used in the most recent official solid waste business case. This is likely to be addressed in the next update of the case and therefore the financial model built for this plan includes the ability to use varying inflation figures as well as the current future forecast.
- Markup: The project management and engineering, and contingency mark ups are 20% and 25% respectively.
- Disposal Rate: 1% of the annual reinvestment is used as an allocation for disposal costs.

- Growth Rate: The same growth rate (0%) as the business plan has been used in the model. The model does include the ability to use the Statistics Canda forecast used in the community profile[7] available on the City website.
- Land costs are not accounted for as the remaining serviceable life is unclear. The option for inclusion of the land costs in forecasts is included in the master inventory in **Appendix A.** All forecasts in this section are exclusive of replacement land costs.

Key reinvestment sensitivities for the AMP forecast and their relative assumptions and impacts are provided in **Table 5-1**.

Table 5-1: Solid Waste Asset Capital Reinvestment Sensitivities

Assumption	Forecasting Impact	Risk	Mitigation
Short Term Future Scenarios			
It is assumed that the City receives approval for expansion using the land previously purchased. The closure plan has not been considered as an option as should this be realized then an alternative site and business plan will be required	Should expansion not be approved then the closure plan will be put into effect and the costs outlined within will be actualized. There will also have to be a significant expenditure to acquire and construct a new facility for the residents of the City.	Determined to be low likelihood but high consequence by City staff.	None
Long Term Future Scenarios			
Long term future scenarios for Cell #2 and #3 are not currently built into the financial forecast as there is minimal definition to the current scope of any plans	It is anticipated that in approximately 2032 to 2033 cell #2 will be mined and in 2037-2038, cell #3. These dates are preliminary estimates based on historical usage of the landfill cells. When cell #3 is mined it will likely coincide with an expansion which will require full building replacement of the maintenance and administration buildings.	Likelihood is a certainty but the timeframe for which is currently uncertain. The consequence to the City's budget would be considerable as cell mining and building replacement will be greater than $1million.	Approximate costs are included in the Solid Waste business plan but not examined within the AMP.
Business Plan			
The November 2023 issue of the solid waste business plan has been used as the basis for comparison.	The business plan uses a flat 2% inflation rate which differs considerably from 2023-2024 and beyond.	All assumptions impact the current business case. The consequence of impact is more considerable for the gap in reinvestment. The gap in expenditure for large capital projects is yet to be determined.	The model has the ability to alter these variables. Future revisions of the business plan should consider updated variables.
	Not all equipment or infrastructure has been included for reinvestment. An expenditure gap is reported within the AMP.		
	No growth has been assumed – see "Growth" sensitivity for further assessment. This is mitigated in the AMP.		
	The business plan includes partial expenditure for the SSO facility. This is used in the AMP full financial needs forecast.		
Growth			
To align with the business plan, no growth is assumed	The City is forecasting growth based upon Statistics Canada and its community profile document[7].	The upper limit of investment calculated by the financial forecast is	The model has the ability to account of growth

[7] SSM-Community Profile (2023) City of Sault St Marie.

Assumption	Forecasting Impact	Risk	Mitigation
	The ability to apply a growth factor aligned with published forecasts is included in the financial forecast. This growth factor does not consider the fact that a percentage of growth will not be single family homes and therefore not require a full level of service from the City.	likely to be more accurate than the any that does not. The forecast of any growth is limited by the use of total population and not household type.	should it be desired.

5.2 Capital Reinvestment Need Analysis

The City's solid waste assets require an average annual reinvestment rate of $1.4 million over the period 2024-2033 and $1.8 million over 2034-2043 in inflated dollar values, as presented in **Figure 5-1**. This is equivalent to a total of approximately $31 million over the next 20-year period. Notably, the reinvestment funding needs for waste collection account for the largest share in most years.

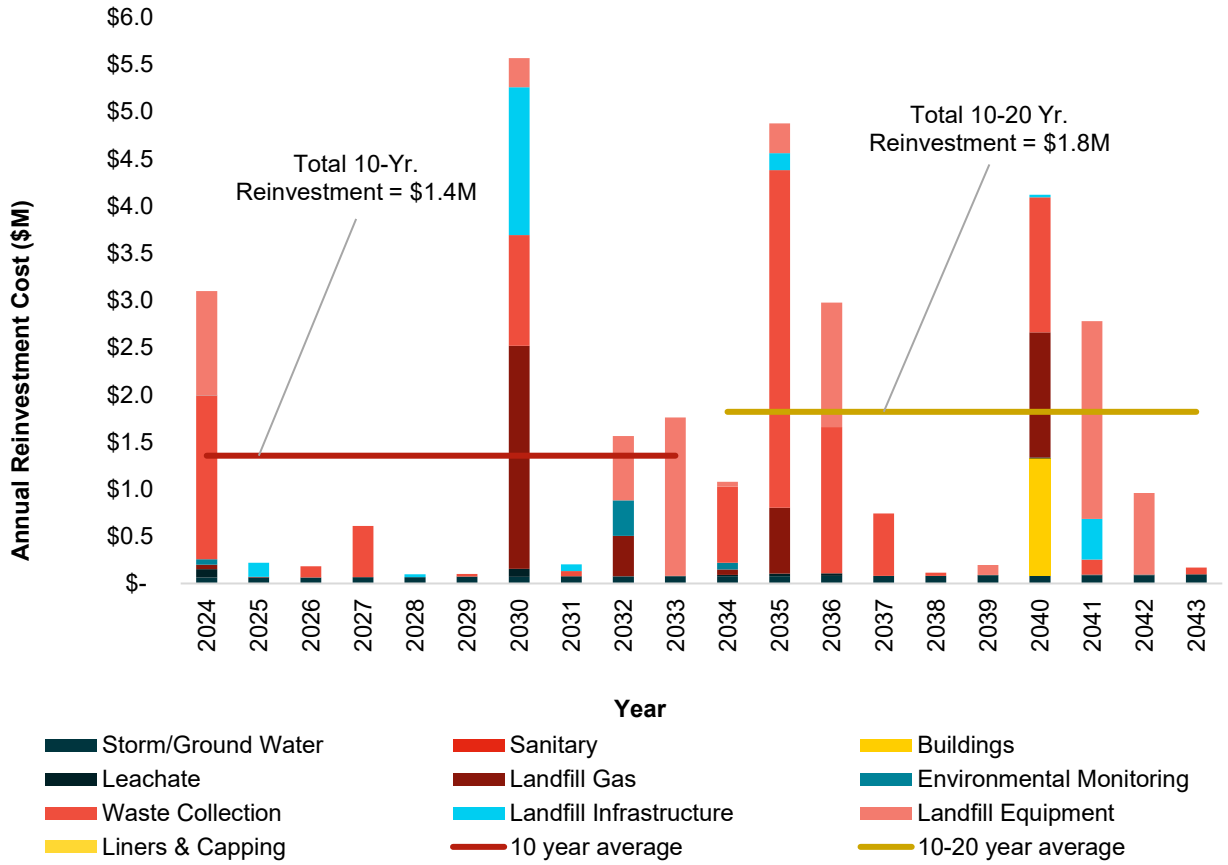

Figure 5-1: Solid Waste 20-Year Reinvestment Need

The detailed 20-year reinvestment needs for solid waste assets are presented in **Table 5-2** in inflated dollar values according to the business case values.

Table 5-2: Solid Waste Assets 20-Year Total and Annual Average Reinvestment Need (inflated)

Asset Sub-Category	Annual Average Need	20-Year Total
Storm/Ground Water	$75,500	$1,510,000
Sanitary	$-	$-
Buildings	$62,050	$1,241,000
Leachate	$15,050	$301,000
Landfill Gas	$246,550	$4,931,000
Environmental Monitoring	$-	$-
Waste Collection	$25,250	$505,000
Landfill Infrastructure	$614,300	$12,286,000
Landfill Equipment	$105,550	$2,111,000
Liners & Capping	$424,900	$8,498,000
TOTAL	**$1,569,150**	**$31,383,000**

To better align with the City's budgeting requirements, the annual capital reinvestment needs for the City's solid waste assets have been evenly distributed over the next 20 years, as illustrated in **Figure 5-2**. This smoothing of reinvestment requirements aims to facilitate the City's budgeting processes by providing a more predictable and steadier financial outlook. Rather than experiencing significant fluctuations in capital expenditure from year to year, this approach allows for a more consistent and manageable financial planning for the City throughout the period of 2024-2043.

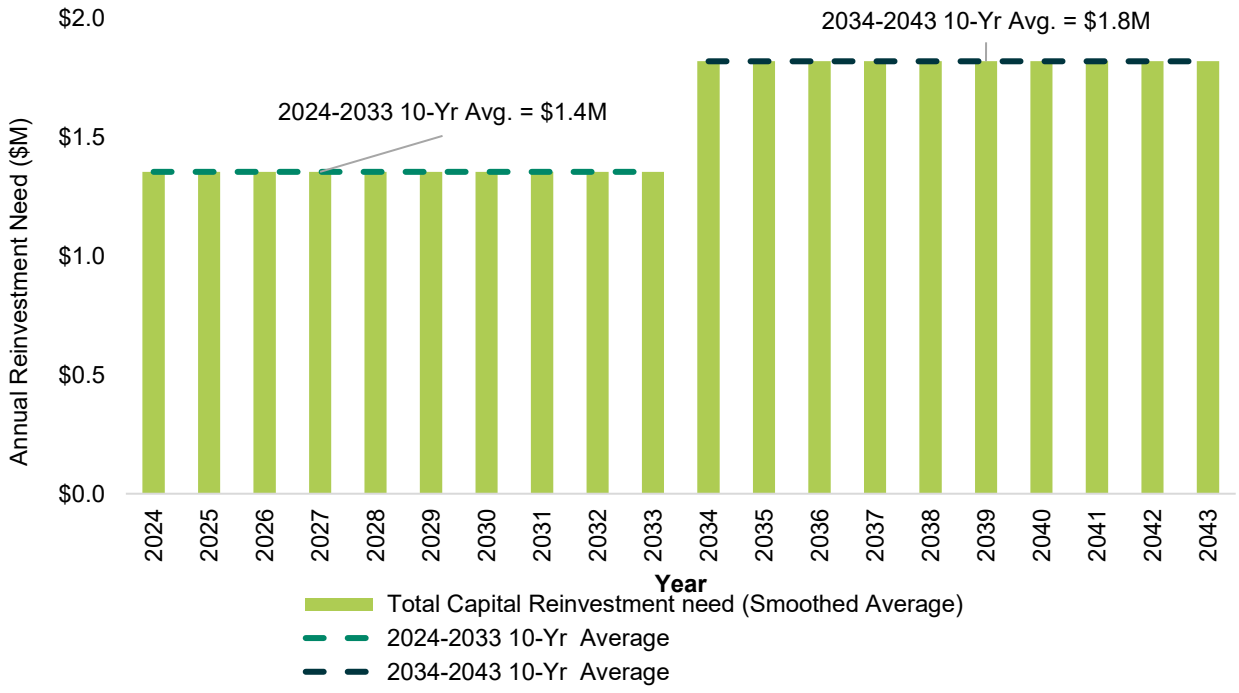

Figure 5-2: Solid Waste 20-Year Smoothed Annual Reinvestment Needs

5.2.1 Capital Reinvestment – Gap Analysis

It should be noted that some assets already have funding for their replacement set aside by the solid waste business plan. This business plan was created by the City with AECOM's input over a decade ago and has been continually updated to account for new funding sources, changes in demand, updated regulatory structure, and new recycling initiatives reducing the total waste to landfill. The assets included in the business plan are shown in **Table 5-3** below.

Table 5-3: Assets Included and Excluded within the Solid Waste Business Plan

Business Plan Category	Asset Sub-Categories within AMP	
Infrastructure	• Paved Areas • Administration Building • Maintenance Garage • Weigh Scales and Scale House • Compost Pad • Storm Management Ponds	• Public Drop-off • Footprint Perimeter Road • Landscaping/Reforestation • Site Services (water, wastewater, electrical, gas, telecommunications) • Pump Station and forcemain
Equipment	• Roll-off Containers • Roll-off Truck • Compost Turner • Rock Truck • Trommel Screen • Loader • Bulldozer • Windrow Manager	• Pickup Trucks • Odour Turbo Fan and Trailer • Bobcat Including Attachments • Madvac • Compactor • Plow Truck Including Attachments • Farm Tractor • Category – Waste Collection
Not included	• Storm/Groundwater • Sanitary • Leachate • Landfill	• Category – Landfill Gas • Category – Environmental Monitoring • Category – Liners and Capping

The business plan partially accounts for some equipment and infrastructure replacement. When this is taken into account the total gap is reduced to $0.8 million. The relevant assets have been removed from the total capital reinvestment needs and the 20-year need based on the gap is shown in **Figure 5-3**.

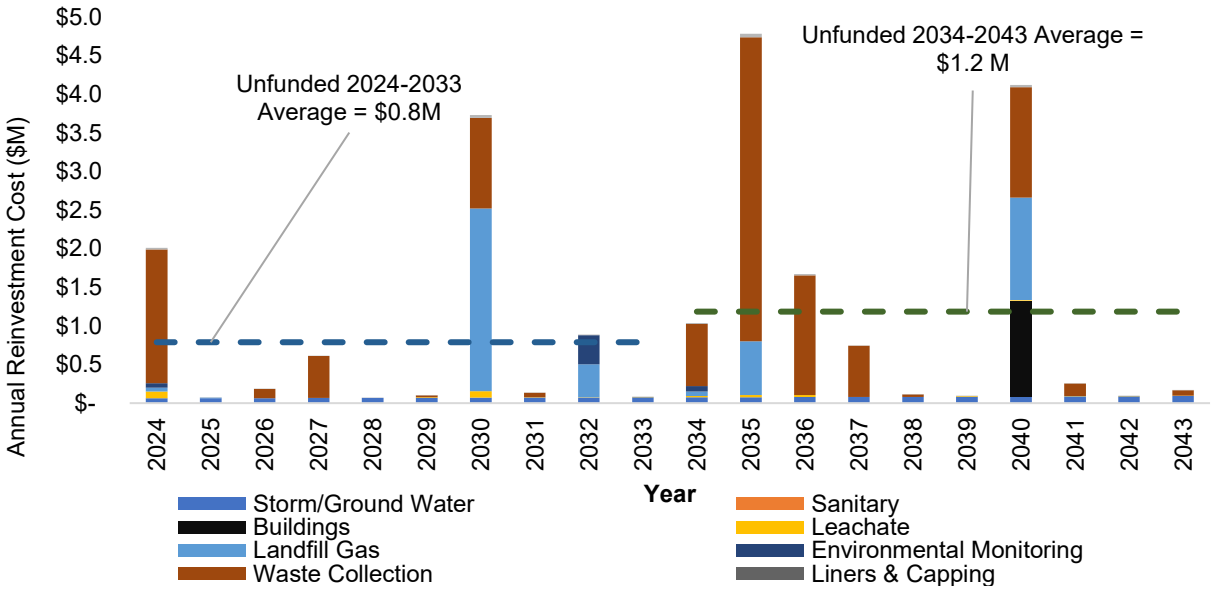

Figure 5-3: Solid Waste 20-Year Reinvestment Need – Gap with Business Plan

This equates to the following smoothed annual reinvestment to sustain the funding gap per remaining asset class shown in **Figure 5-4**.

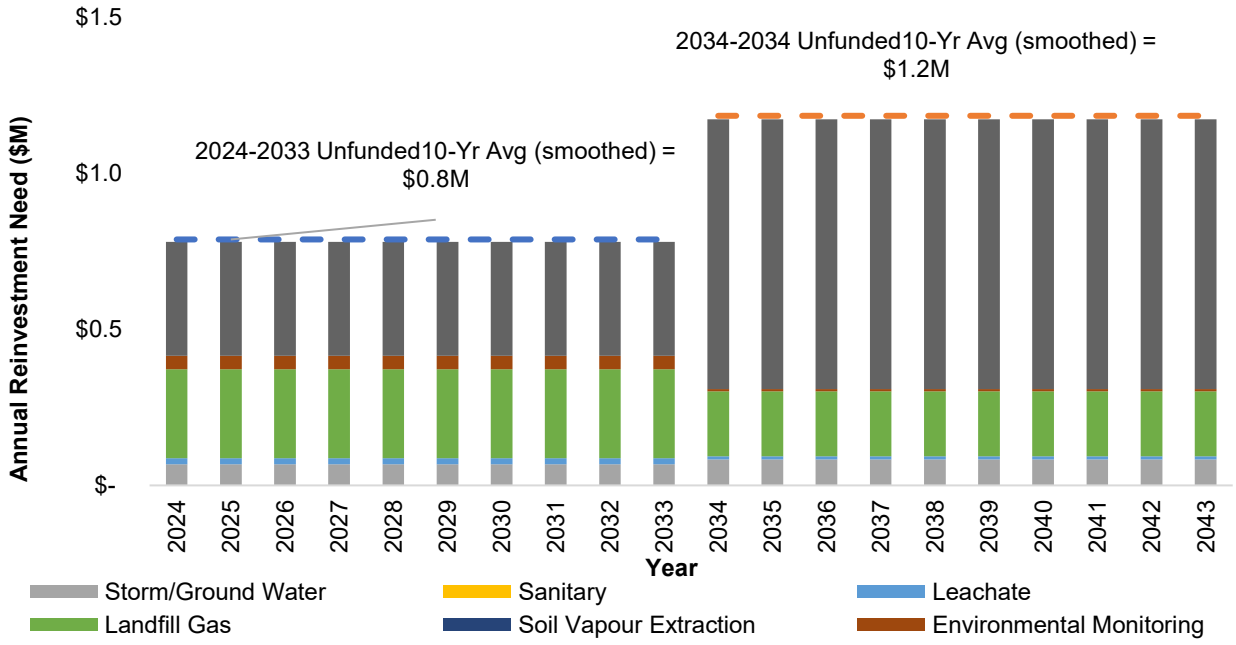

Figure 5-4: Solid Waste 20-Year Reinvestment Need Smoothed Gap

For the creation of the 10-year funding need, the solid waste business plan was used as a basis and was then combined with the total annual reinvestment need. Duplicated costs in the business plan were removed and consolidated into asset reinvestment costs. To validate this approach the duplicated costs were compared to those derive from the AMP approach and found to have the same 10-year average reinvestment for the same assets. This is shown in **Figure 5-5**.

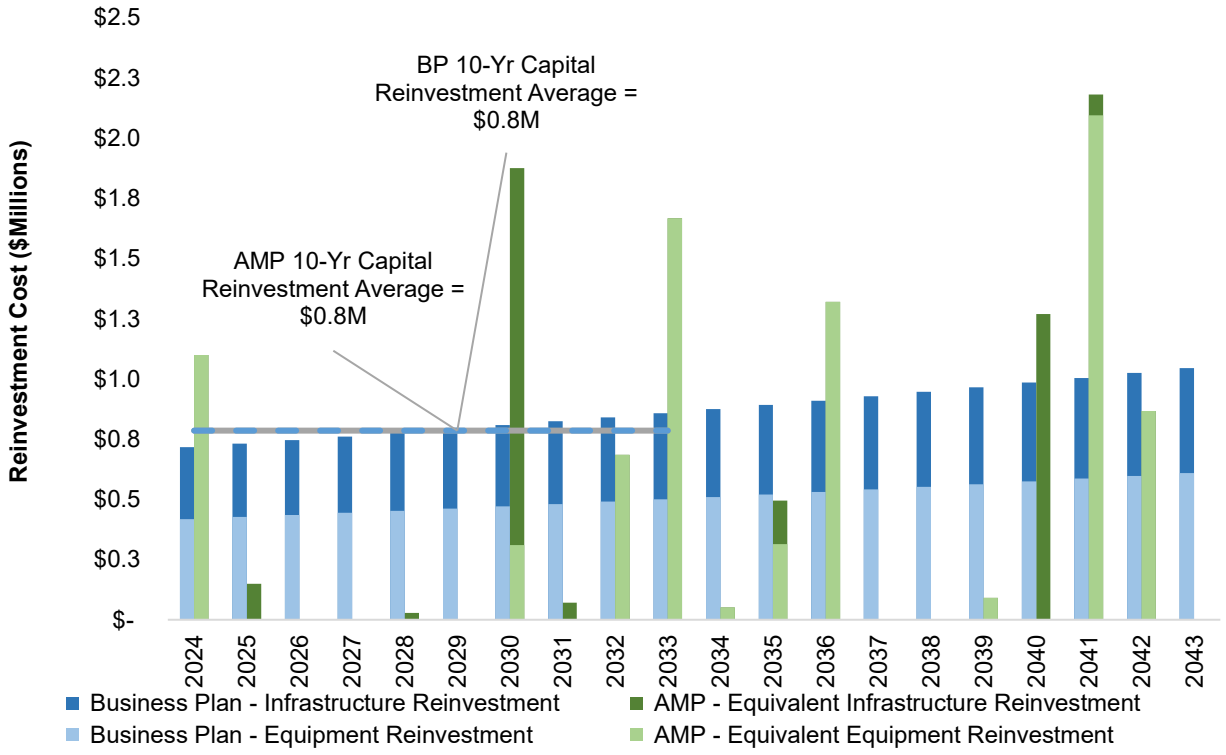

Figure 5-5: Business Plan and AMP Reinvestment Comparison

5.3 Full Funding Need Profile

Figure 5-6 shows a full picture of the City's solid waste funding forecast for the next 10 years. This graph provides the City with a comprehensive understanding of the full funding requirements, essential for effective financial planning activities.

One percent of the annual replacement cost was added to account for the asset disposal cost. With these additions, the City's solid waste full funding requirement is calculated to be approximately $118 million over the next 10 years, averaging $11.8 million per year in inflated dollar value (using the same inflation forecast as the business plan). This funding need is shown in **Figure 5-6** where alongside the disposal and reinvestment costs calculated by the AMP are the: total general, waste disposal engineering and capital, total waste diversion, and total waste disposal (O&M) costs from the solid waste business plan. Capital reinvestment costs have been fully removed from the business plan forecast so as not to duplicate values. All reinvestment is now captured within the Annual Capital Reinvestment values.

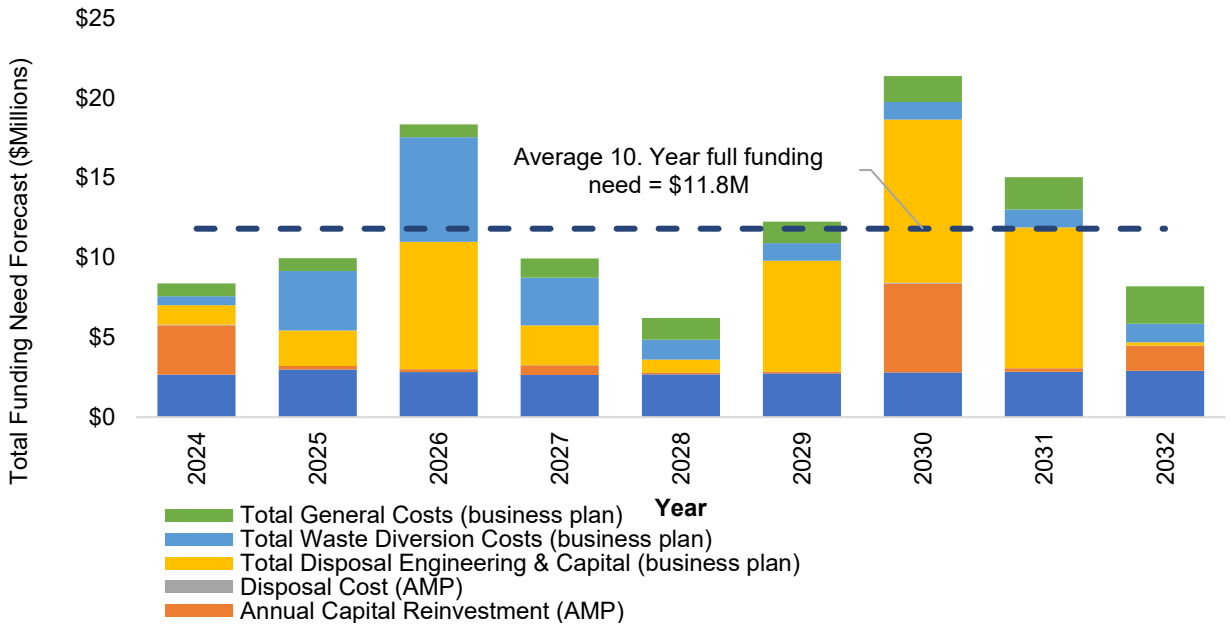

Figure 5-6: Solid Waste Full Funding Need Profile

It should be noted that total Engineering and Capital figure includes the following costs as they are forecast in the business plan. Annual Engineering costs are forecast on an inflationary basis after the end of the business plan coverage. Diversion and collection capital projects are as follows:

- Construction of the new Biosolids (SSO) Facility. This is apportioned 20% to Solid Waste over 2024 to 2027 as follows:
  - 2024 - $61 thousand
  - 2025 - $3.20 million
  - 2026 - $6.0 million
  - 2027 - $1.77 million

Waste Collection and Disposal capital projects are as follows:

- 2024 - Land Acquisition ($1.0 million), preliminary design of the new landfill pump station ($10 thousand), and annual Engineering ($160 thousand). Presumed EA submission and approvals are also accounted for ($50 thousand).

- 2025 – Design, tender and construction of Cell 1 ($1.6 million). The detail design, tender and construction of the landfill pump station ($432 thousand). Annual engineering budget ($165 thousand), and an RFP for Waste Collection ($50 thousand).
- 2026 - Construction of Cell 1 ($6.6 million), construction of the landfill pump station ($1.180 million), and the annual engineering budget ($170 thousand).
- 2027 – Finalization of landfill pump station ($112 thousand), finalize Cell 1 construction ($2.2 million) and an annual engineering budget ($170 thousand).
- 2028 – Detailed design and tender of Cell 1A ($643 thousand) and an annual engineering budget ($175 thousand).
- 2029 - Construction of Cell 1A ($6.8 million) and an annual engineering budget ($180 thousand).
- 2030 - Construction of Cell 1A ($10.032 million) and an annual engineering budget ($185 thousand).
- 2031 - Finalize Cell 1A construction ($8.6 million) and an annual engineering budget ($190 thousand).

After 2031 there is an annual engineering budget that increases $5 thousand annually from 2031 values.

5.3.1 Asset Retirement Obligations

The public sector accounting board (PSAB) approved changes to the asset retirement obligations for solid waste landfills in 2020. These changes replaced PS-3270: Solid Waste Landfill Closure with PS-3280: Asset Retiral Obligations. This impacts the timing of expense recognition by those responsible for accounting as PS-3280 recognizes expenses earlier in a landfill's operational life.

In the case of the City the liability for post closure costs are now recognized at the start of operation as the licensing obligations are incurred as soon as the landfill was put into service. Previously they were recognized incrementally as the landfill capacity is used.

This should be considered for all expansions of landfill capacity but does not have a material effect on the AMP or financial forecast.

5.4 Funding Strategies

The City's funding for solid waste assets relies significantly on user fees, constituting approximately 30% of the total revenue. User fees encompass charges for tipping, sewage sludge (indirect from sanitary), waste tags, and household waste. The remaining funding is subsidized through the property tax levy, which is forecasted to increase by 7.45% annually. Discussions are underway regarding the allocation of funds across departments, specifically between sanitary and solid waste. Notably, certain facilities, like biosolids/SSO facilities, already have funding divided between sanitary and landfill departments due to their service to separate waste processing streams. A notable concern for the City is the limited revenue from industrial or commercial sectors, with the residential sector being the primary contributor to the majority of its funding. In light of this concern, AECOM encourages the City to actively seek alternative funding sources to address potential challenges. This section introduces the following funding options, acknowledging that the City's eligibility for these funds is contingent upon specific criteria:

- TD Friends of the Environment Foundation Grant (TD FEF. etc.)
- Green Municipal Fund (GMF)
- Ontario Community Infrastructure Fund (OCIF)
- Municipal Asset Management Program (MAMP)

5.4.1 TD Friends of the Environment Foundation Grant (TD FEF)

The TD FEF is a national charity dedicated to supporting environmental initiatives in Canada. The foundation provides grants, typically ranging between $2,000 and $8,000, for projects with a primary focus on environmental

education and green space programs[8]. While the TD FEF primarily awards grants to communities and educational institutions, municipalities are also considered eligible applicants.

5.4.2 Green Municipal Fund (GMF)

The GMF is a financial initiative in Canada dedicated to supporting sustainability and environmental projects at the municipal level. Managed by the Federation of Canadian Municipalities (FCM), the GMF provides funding and resources to assist municipalities across the country in undertaking projects that contribute to environmental sustainability, energy efficiency, and the reduction of greenhouse gas (GHG) emissions. In the waste sector, the GMF offers combined loan and grant funding for business cases, feasibility studies, and capital projects related to organic waste-to-energy systems. To be eligible, these systems must use organic feedstocks for energy generation, employing methods such as landfill gas utilization, anaerobic digestion, or aerobic composting with heat recovery. Moreover, they should result in a net GHG emissions reduction compared to the current baseline[9].

5.4.3 Ontario Community Infrastructure Fund (OCIF)

The OCIF is a program designed to support municipalities with small populations (less than 100,000), along with those situated in northern and rural areas. Its primary objective is to aid communities in overcoming challenges related to infrastructure maintenance and improvement while facilitating the development and updating of their asset management plans. Eligible communities receive annual allocations and have the option to accumulate these grants for up to five years to address substantial infrastructure projects. The fund is an essential component of the provincial government's commitment to fostering strong, resilient, and well-equipped communities across Ontario[10].

5.4.4 Municipal Asset Management Program (MAMP)

The MAMP is aimed at improving AM practices within municipalities. Designed to assist municipalities in gaining a better understanding, planning, and efficient and sustainable management of their infrastructure assets, the program may offer funding to support the development or improvement of AM plans. This financial support is intended to incentivize municipalities to adopt and implement sustainable AM practices[11].

[8] TD Friends of the Environment Foundation Grant. (n.d.). TD Canada. FEF Grant (td.com). Retrieved on February 22nd, 2024.

[9] Funding opportunities. (n.d.). Green Municipal Fund. Funding opportunities | Green Municipal Fund. Retrieved on February 22nd, 2024.

[10] Ontario Community Infrastructure Fund. (2023). Ministry of Infrastructure, Ontario. Ontario Community Infrastructure Fund | ontario.ca. Retrieved on February 22nd, 2024.

[11] Municipal Asset Management Program. (n.d.). Federation of Canadian Municipalities. Municipal Asset Management Program | FCM. Retrieved on February 22nd, 2024.

6. Implementation Plan and Continuous Improvement

Continuous improvement is an important component of any AM program and is achieved through the implementation of recommended improvement initiatives which support sustainable service delivery. AECOM has identified a set of activities that represents the next stage of AM planning and implementation within the City, as shown in **Table 6-1**.

Table 6-1: Recommended AM Improvement Initiatives

Index	Improvement Initiative	Description
1.	Refine the asset hierarchy and inventory.	• Continue to refine the asset inventory and close existing data gaps, so as to have a more accurate representation of the current state of the solid waste assets; and, ultimately, to make more informed and defensible decisions. • A site validation exercise should be undertaken to confirm the site inventory. The site inventory for this AMP was created using desktop sources available to AECOM and are should therefore be validated.
2.	Develop a formalized solid waste assets condition assessment process and use consistent condition grading schemes for these assets.	• The grading system should include a description directly tied to each condition grade, along with details about the asset's performance and the necessary level of corrective and preventive maintenance required for assets falling within a certain condition rating category. This process will enable the City to keep track of and better forecast asset renewal needs. • Perform condition assessments on the most critical assets first. This ensures that assets are assessed using the same methodology and prioritized based on their criticality. It facilitates a more defensible business case when addressing issues of asset degradation with senior management and the Council. • A specific approach for usage of landfill capacity should be used when treating the land as an asset. In all other AMPs the land value is not treated as a capital asset that requires replacing as typically land can be re-used or replaced for a similar cost to that achieved in sale. Landfills and cemeteries by their nature treat land as a consumable asset, and therefore the condition and remaining ESL should be tied directly to the forecast remaining capacity and life expectancy.
3.	Refine the LoS Framework.	• Collect current asset performance data for key performance indicators (KPIs) that are not currently being tracked. • Analyze asset performance data to identify trends and establish annual performance benchmarks. • Engage in discussions with key stakeholders to establish service level targets and identify associated costs to meet those targets. • Once LoS targets have been decided upon, the City should develop strategies on how to meet service level targets, considering its existing operating environment (i.e., staff availability, current funding, resources, etc.). • Develop a Customer Consultation Plan to engage the public and other stakeholders on the LoS framework and better understand customers' willingness to pay for enhanced service levels.
4.	Incorporate risk assessment for future iterations of the AM plan, and use the risk assessment results to drive future condition assessments and financial needs forecasting	• Conduct a comprehensive criticality and risk assessment of assets to inform work prioritization. • Review risk attribute values periodically to ensure alignment with business objectives and risk appetite. • Overlay the risk model with the current state of the assets (i.e., condition) and the financial forecast. Using this approach, the City could focus its monitoring, maintenance, and renewal and replacement budget and activities on high-risk assets. Medium-risk infrastructure could be addressed through the mitigation of failure via regular monitoring, while low-risk assets could be accepted with caution.
5.	Funding Need	• The financial model is based on several assumptions previously outlined. It is recommended the City address each area to improve accuracy of the funding need projection. – The funding needs and gap are reported in **Sections 5.2.1** and **5.3** • Enhanced forecasting on the future demand is critical to financial planning. An understanding of the future growth of the City in relation to single family homes and multi family homes is required to accurately forecast the demand on waste collection services.

Index	Improvement Initiative	Description
6.	Business plan update	At the next business plan update: • Include a full allowance for all assets within the equipment and infrastructure budgets. The outstanding costs not included within the current business plan are discussed within **Section 5.2.1**. • Account for forecasted growth within the City and consider the true impact of that particular growth (single family homes vs multi-family) on the demand for solid waste services. • Use a true reflection of inflation, interest and financing rates.
7.	Continue to find ways to improve AM initiatives across the City by maintaining a high level of AM awareness through training, communication, and knowledge sharing.	• Conduct an AM Software Assessment to identify future system requirements, which may involve enhancing existing software, adding new features, or replacing the current system. • Develop a Knowledge Retention Strategy and Internal Communications Plan to document staff AM knowledge and experience for reporting and succession planning purposes. Communicate AM improvement initiatives and enhance AM awareness internally through internal communication.

Appendix A – Solid Waste MS Excel Lifecycle Model and Inventory