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Going deeper: How levels of service and lifecycle costing inform long-term financial planning

GUIDE

This resource was produced by the Municipal Asset Management Program (MAMP), which is delivered by the Federation of Canadian Municipalities and funded by the Government of Canada.

This document complements and builds on the guidebook How to Write a Long-Term Financial Plan for Asset Management, developed by Asset Management BC in collaboration with the Union of BC Municipalities and the BC Ministry of Municipal Affairs.

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INTRODUCTION

Local governments are responsible for stewarding the service-providing assets that residents and businesses rely on. The quality of these services and the extent to which they are provided are referred to as the level of service (LOS). Each LOS carries different benefits and costs, the latter for both ongoing maintenance and renewal costs as well as the addition of new infrastructure. As a result, LOS drives local governments' long-term expenditures. Long-term costs are also impacted by local governments' decisions throughout their assets' entire lifecycle.

Local governments must determine LOS, manage risks to the community and identify the lifecycle costs of assets to develop an effective and beneficial long-term financial plan.

Long-term financial plans containing expenditure and revenue forecasting along with funding strategies help local governments allocate funding more efficiently, safeguard quality of service and reduce the risk of burdening future generations.

This document complements and builds on the guidebook How to Write a Long-Term Financial Plan for Asset Management, developed by Asset Management BC in collaboration with the Union of BC Municipalities and the BC Ministry of Municipal Affairs. In it you will learn how LOS and lifecycle costing inform long-term financial planning, and some ways that social equity and climate resilience goals can be embedded into this process.

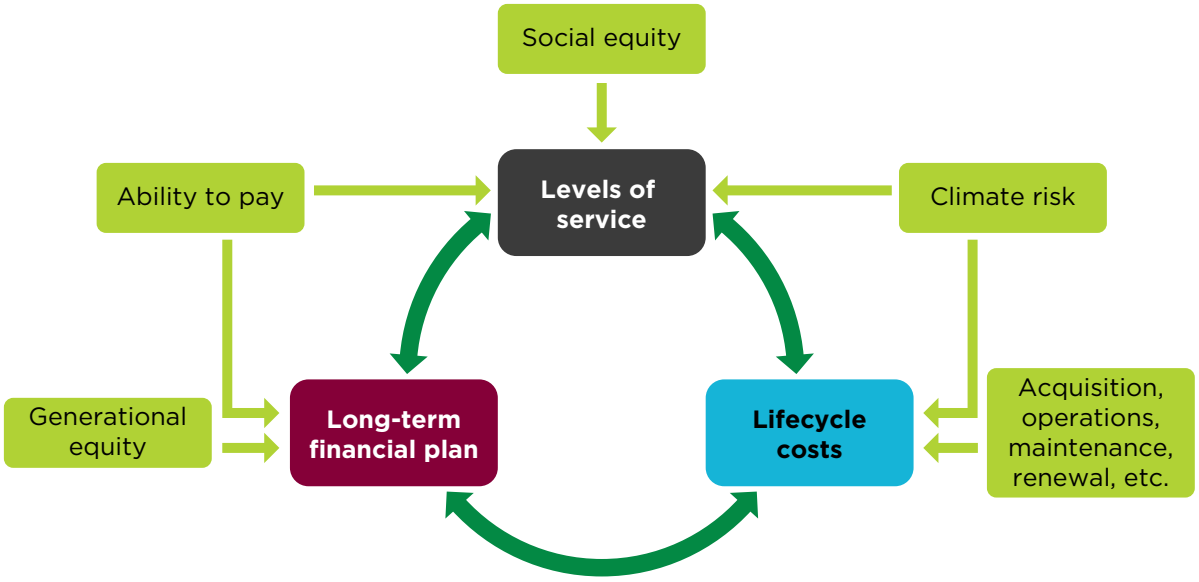
WHAT DOES AN EFFECTIVE LONG-TERM FINANCIAL PLAN LOOK LIKE FOR ASSET MANAGEMENT?

The International Infrastructure Financial Management Manual states: "The long-term financial plan should accommodate the organization's cash flow needs to enable it to carry out the asset operations and maintenance activities and renewal of assets...".

SOCIAL EQUITY AND CLIMATE RESILIENCE

Local governments are increasingly considering social equity and climate resilience in their decision-making, and LOS and lifecycle costing are no exception. In order to ensure these values are represented and accounted for in a long-term financial plan, they should be considered and embedded directly into processes around LOS and lifecycle costing.

Figure 1: Components that inform a long-term financial plan



Inspired by the International Infrastructure Management Manual (IIMM) – Institute of Public Works Engineering Australasia (ipwea.org)

Local governments can identify vulnerabilities exacerbated by climate change and lessen negative impacts by undertaking actions related to LOS and lifecycle costing such as:

- Adjusting LOS to ensure infrastructure meets the needs of the entire community
- Adapting operations and maintenance activities
- Applying a climate lens to asset renewal decisions
- Designing climate-resilient infrastructure

LEVELS OF SERVICE

LOS are a set of specific parameters that describe the extent and quality of services that a local government provides to its users[1]. There are two classes of LOS: community and technical. Community LOS describe how the community experiences the service or what they can expect, while technical LOS are measurable or quantifiable criteria used to evaluate the performance or quality of services or infrastructure. In addition, an organization might integrate provincial or federal regulatory requirements into their LOS, such as minimum maintenance standards.

When it comes to LOS, it's important to acknowledge inequities in service delivery. For example, research has demonstrated that neighbourhoods with higher proportions of racialized, marginalized and lower-income populations tend to have less access to urban parks and tree cover, both of which offer a number of benefits including resilience to extreme weather and improved mental and physical health[2]. In other cases, some communities may have a higher amount of aging and failing infrastructure than others. To address inequities like these, local governments should first understand the unique vulnerable populations and equity-deserving groups that they deliver services to, and how those services are being received. From there, they can establish minimum acceptable levels of service across the entire community.

A local government's LOS are also impacted by the climate hazards they are facing, which might be increasing the risk of infrastructure failure and service disruptions. For example, many communities are experiencing more frequent and intense rain events, which can overwhelm drainage infrastructure and lead to washed-out roads and basement backups. Local governments can adjust their LOS to minimize the impacts of climate hazards.

USEFUL STEPS AND TIPS

For more about embedding equity into operations and maintenance practices, refer to Strategy 4 in FCM's handbook "Operations & maintenance for climate resilience: Six strategies for your municipality," which outlines useful steps and tips to follow.

1 Developing Levels of Service: A best practice by the National Guide to Sustainable Municipal Infrastructure (National Research Council, Federation of Canadian Municipalities, 2003)

2 Urban Parks and Forests Are Missing in Racialized and Marginalized Neighbourhoods (Nature Canada, 2022)

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TABLE 1: EXAMPLE LEVELS OF SERVICE BY ASSET CLASS

Asset class	LOS type	LOS example	Adaptation (adjusting LOS for social equity and climate change adaptation)
Water	Community	Proportion of assets in fair or better condition is 80% or higher.	Increase frequency of road inspections and maintenance to reduce impacts of climate change.
Water	Technical	Annual number of water main breaks is 12 or fewer.	Conduct inspections of accessible infrastructure to identify assets likely to fail because of climate impacts and adjust maintenance accordingly.
Water	Regulatory	Drinking water complies with provincial quality standards.	Upgrade water treatment processes or technology and implement water protection measures.

Local governments may not always have established LOS. In such cases, staff often choose to implement the highest LOS that existing funding will permit. However, it's important to note that LOS is a governance decision. For example, council may want to establish a very low tolerance for the risk of water main breaks.

Table 2 demonstrates a local government's ability to set different LOS. You can see the comparison between two LOS options, where option 2 offers a LOS with less risk than option 1. To reduce the risk of water main breaks, increased funding is needed to maintain a high LOS.

TABLE 2: COST COMPARISON OF TWO LOS OPTIONS FOR WATER MAINS

	LOS option 1 Risk of a water main break is less than 5% after 90 years	**LOS option 2** Risk of a water main break is less than 1% after 90 years
Construction costs	$2,000,000	$2,000,000
Annual operating and maintenance costs	$100,000	$120,000
Total lifecycle costs	$11,000,000	$12,800,000
Average annual cost	$122,222	$142,222

To reduce the risk of a water main break (LOS option 2), the local government must engage in proactive acoustic inspections of the infrastructure. This increases annual maintenance costs by $20,000 (from $100,000 to $120,000). Water mains can last up to 90 years, however an increase in maintenance can result in extended useful life.

The key takeaway is that a community can adopt various LOS, each with distinct associated costs. Consequently, a long-term financial plan should incorporate lifecycle costs and be regularly updated to reflect any changes in LOS over time. Addressing future risks, such as climate change or new regulations, are important factors that can impact LOS and replacement costs.

LIFECYCLE COSTING

Lifecycle costing is a process that helps us understand the total cost of owning and maintaining an asset over its lifetime. The objective is to maintain the asset in a state of good repair while meeting service level targets.

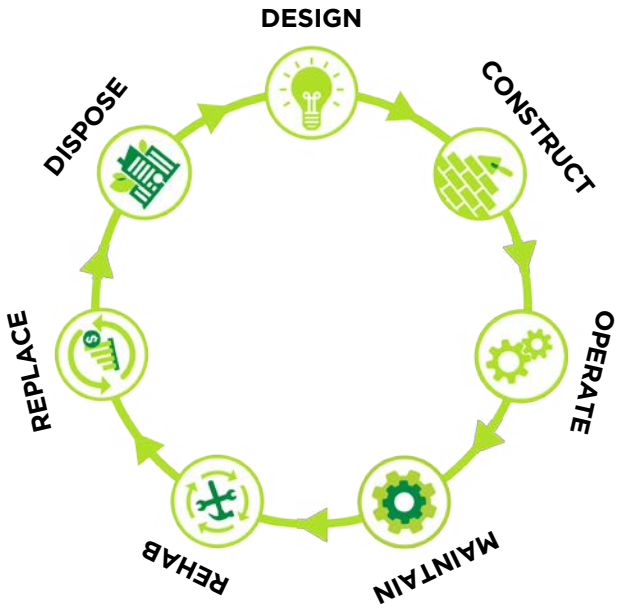
Local governments are responsible for building and maintaining infrastructure that lasts for decades. We need to be mindful of the long-term costs associated with infrastructure and ensure that all stakeholders are aware of these costs from the outset. By doing so, we can make better resource allocation decisions and ensure that our infrastructure is sustainable for generations to come.

Lifecycle costing examines all costs incurred over the lifecycle of an asset: design, construction, operation, maintenance, capital renewal and disposal.

The impacts of climate change are putting significant strain on municipal infrastructure, increasing the risk of failure and service disruption. There are opportunities throughout an asset's entire lifecycle to incorporate climate adaptation measures. For example:

- At the design and planning stage, a local government could prioritize a location that's less susceptible to wildfires
- During the construction and acquisition stage, they could select fire-resistant materials
- During the operation and maintenance stages, they could consider annual fire prevention measures on surrounding sites
- During the renew and replace stage, they could reexamine the likelihood and frequency of wildfires near the site

Figure 2: Lifecycle stages of an asset



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LIFECYCLE COSTING FOR EXISTING ASSETS

Local governments can reduce the total cost of owning and maintaining an asset over its lifetime by investing in proactive planning and maintenance. The alternative is to fund only reactive maintenance costs, which can be less expensive in the short term but may end up increasing the total lifecycle costs and being more expensive in the long run. Good maintenance practices can increase an asset's useful life, which in turn decreases the lifecycle costs. Additionally, proactive planning and maintenance supports intergenerational equity by ensuring that consumers pay an equitable share over the asset's useful life. By prioritizing proactive planning and maintenance, we can ensure that our infrastructure is sustainable and cost-effective.

Let's look at a hypothetical lifecycle costing example to see the difference that long-term planning and proactive maintenance can make.

In this example, a community operates a stormwater utility that provides essential drainage services. Staff have prepared a lifecycle costing analysis of two different maintenance options for council to consider. Option 1 is a reactive maintenance model whereby sewer inspections and flushing are conducted on a complaint-only basis. Option 2 is a proactive maintenance model whereby sewer inspections and flushing are conducted according to an established maintenance schedule. While proactive maintenance will cost more per year, staff estimate it will extend the system's useful life by 25 years.

TABLE 3: HYPOTHETICAL LIFECYCLE ANALYSIS: REACTIVE VS. PROACTIVE MAINTENANCE

	Stormwater utility	Option 1: reactive maintenance	Option 2: proactive maintenance
A	Annual operating costs	$200,000	$200,000
B	Annual maintenance costs	$25,000	$50,000
C	Total annual O&M costs	$225,000	$250,000
D	Useful life*	75 years	100 years
E	Construction cost	$20,000,000	$20,000,000
F	Lifecycle costs (C*D) + E	$36,875,000	$45,000,000
G	Annualized lifecycle costs (F/D)	$491,666	$450,000

1. The proactive maintenance model appears more expensive at first glance, due to the higher annual costs (rows A, B and C).

2. However, proactive maintenance increases the asset's life span (row D).

3. Which reduces the average annual cost (row G).

4. Assets that are only reactively maintained often incur higher costs over time due to accelerated deterioration and more frequent major repairs or replacement.

*Sewer inspections and flushing help extend the useful life of drainage systems, as they lessen the accumulation of debris and minimize blockages.

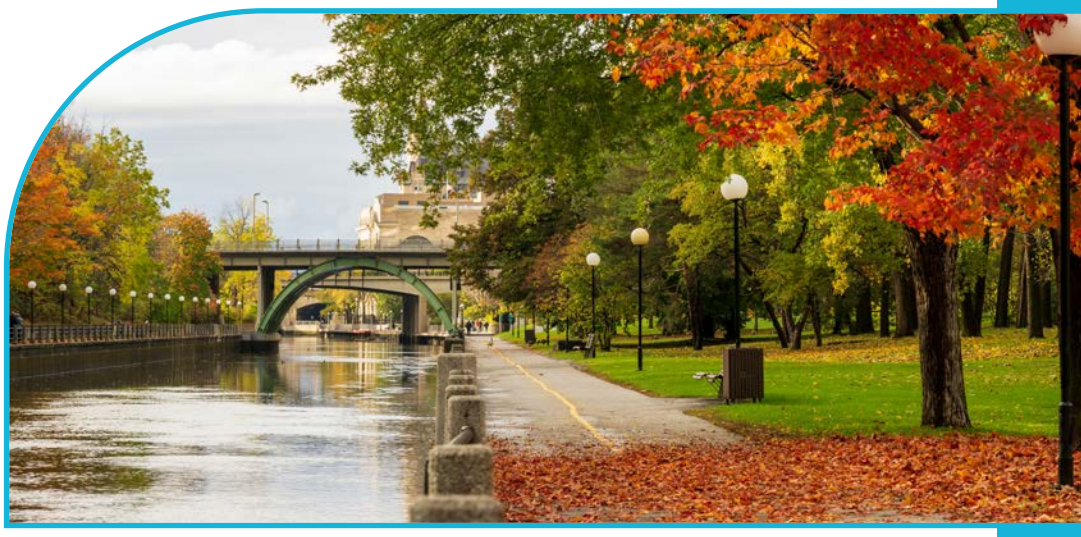
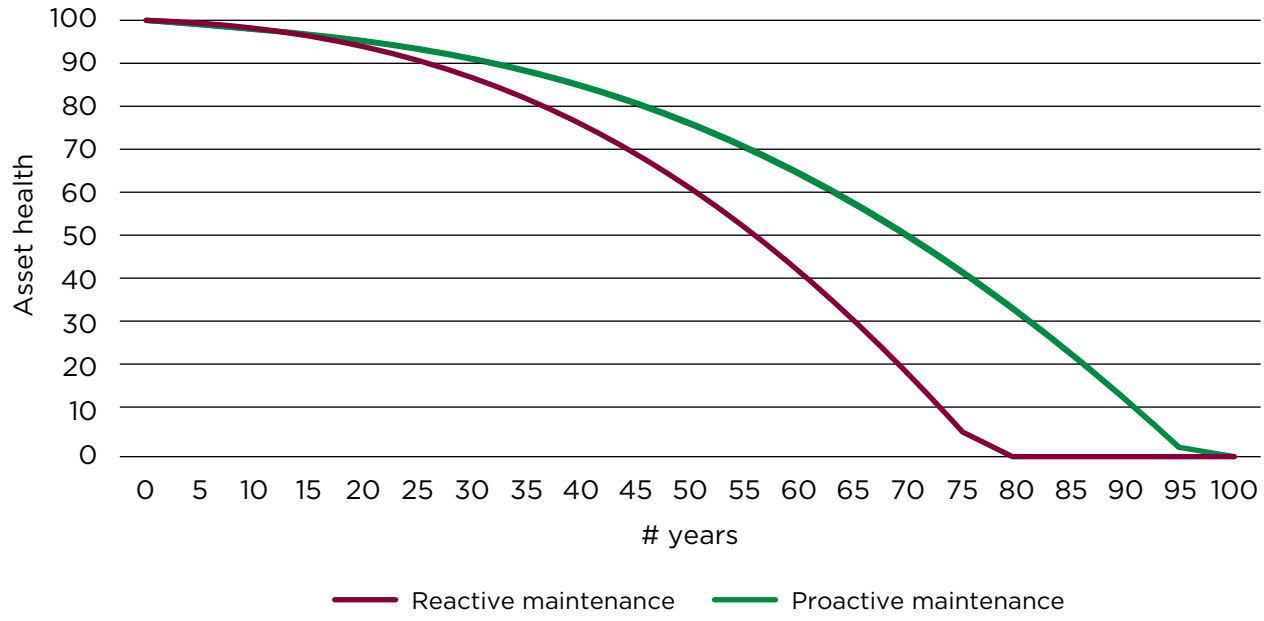


Figure 3: Comparing the impact of proactive and reactive maintenance on asset health over time



Lifecycle analysis is relevant to decision-making at all stages of an asset's lifespan. For example, suppose a local government conducts a lifecycle costing analysis on a piece of infrastructure that is estimated to be 75% of the way through its useful life. The analysis may support shifting from reactive to proactive maintenance on that particular asset so that it will last longer or better. Conversely, it may demonstrate that increased maintenance will not extend the asset's useful life.

Local governments are facing the evolving impacts of climate change on their existing

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infrastructure. Table 4 offers examples of proactive maintenance and adaptation actions related to increased rainfall during the operations and maintenance stages of an asset's lifecycle.

The key takeaway is to understand how choices made today affect an asset's remaining useful life and any associated costs.

TABLE 4: VULNERABILITY OF INFRASTRUCTURE DUE TO INCREASED RAINFALL, AND POTENTIAL ADAPTATION ACTIONS DURING THE OPERATIONS AND MAINTENANCE STAGES

Infrastructure	Impact to assets	Impact to levels of service	Adaptation (operations and maintenance)
Wastewater	Increased flow	More incidents of basement backup	Install backflow prevention devices
Transportation	Road flooding	More frequent road closures	Increase frequency of crack sealing
Drainage	Increased flow	Increased frequency of flooding	Design and manage safe overland flow paths, and increase capacity for new developments

LIFECYCLE COSTING FOR NEW ASSETS

Local governments have limited resources and need to understand the full financial impact of their decisions. Lifecycle costing provides this information. For instance, suppose that a local government is considering building a new recreation centre. In such a scenario, it is likely that operating and maintenance costs will significantly dwarf initial construction costs as a proportion of total lifecycle costs. It is also important to note that vertical assets often consist of major components, each with its own lifecycle activities. Therefore, the costs of these components also need to be considered in lifecycle costing analysis.

In Table 5, you can see that operating and maintenance costs make up 90.5% of the total lifecycle costs.

TABLE 5: PROPORTIONS OF LIFECYCLE COSTS FOR A HYPOTHETICAL NEW RECREATION CENTRE

	Estimated cost	Proportion of total lifecycle costs
Construction costs	$10M	9.5%
Operating costs ($1M per year x 75 years)	$75M	71.4%
Asset component capital renewal costs	$20M	19.1%
Total lifecycle costs	**$105M**	

When faced with the opportunity to build or renew infrastructure, local governments can also consider climate change impacts and service equity across all groups and locations within the community from the outset.

Table 6 offers examples of proactive climate adaptation strategies related to increased rainfall that can be implemented at the design or renewal stage of an asset's lifecycle.

TABLE 6: VULNERABILITY OF INFRASTRUCTURE DUE TO INCREASED RAINFALL, AND POTENTIAL ADAPTATION ACTIONS DURING THE DESIGN OR RENEWAL STAGE

Infrastructure	Impact to assets	Impact to levels of service	Adaptation (asset design or renewal)
Wastewater	Increased flow	More incidents of basement backup	Design new infrastructure with increased capacity
Transportation	Road flooding	More frequent road closures	Select pavement grade that can withstand conditions
Drainage	Increased flow	Increased frequency of flooding	Design and manage safe overland flow paths, and increase capacity for new development

USEFUL STEPS AND TIPS

For more about adapting your operations and maintenance practices and applying a climate lens to asset renewal decisions, refer to Strategies 5 and 6 in FCM's handbook "Operations & maintenance for climate resilience: Six strategies for your municipality," which outlines useful steps and tips to follow.

The key takeaway is that understanding the long-term lifecycle costs associated with new assets will better equip local governments to make informed decisions and account for holistic costs in their long-term financial plan.

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BRINGING IT ALL TOGETHER

Long-term financial planning, like asset management in general, is an incremental process of continuous improvement. Organizations can integrate lifecycle costing into daily operations gradually. Similarly, levels of service may be developed step by step, asset class by asset class. Prepare your long-term financial plan using the best information you have, and set goals for incremental improvement.

This resource has highlighted several key factors to consider when developing a long-term financial plan:

- Levels of service
- Lifecycle costing
- Social equity and climate resilience

By proactively addressing these key factors, local governments can make informed decisions that lead to sustainable and accessible services and pave the way for a more equitable, resilient and cost-effective future for all.

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