

# GUIDE TO ASSET MANAGEMENT PLANS



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The purpose of this Guide is to provide a general overview of the requirements and steps involved in the development of an Asset Management Plan. It is intended to help the reader understand the inputs, outputs and challenges at a high level in the practice of asset management planning.

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- (a) Association of Local Government Engineers of New Zealand., & Institute of Public Works Engineering Australia. (2020). International Infrastructure Management Manual 6<sup>th</sup> Edition. Wellington, N.Z: National Asset Management Steering (NAMS) Group. Citations will appear as (IIMM Sec. X).

The Corporate Asset Management Office has adopted the Institute of Asset Management’s framework (Figure 1) as the basis for the City of Hamilton’s Program. Starting with the top level requirements (e.g. our customers and legislative requirements), the City’s Asset Management Program, ensures that City objectives and other strategic documents are recognized and included where necessary in the Asset Management process.

Figure 1: Asset Management Framework

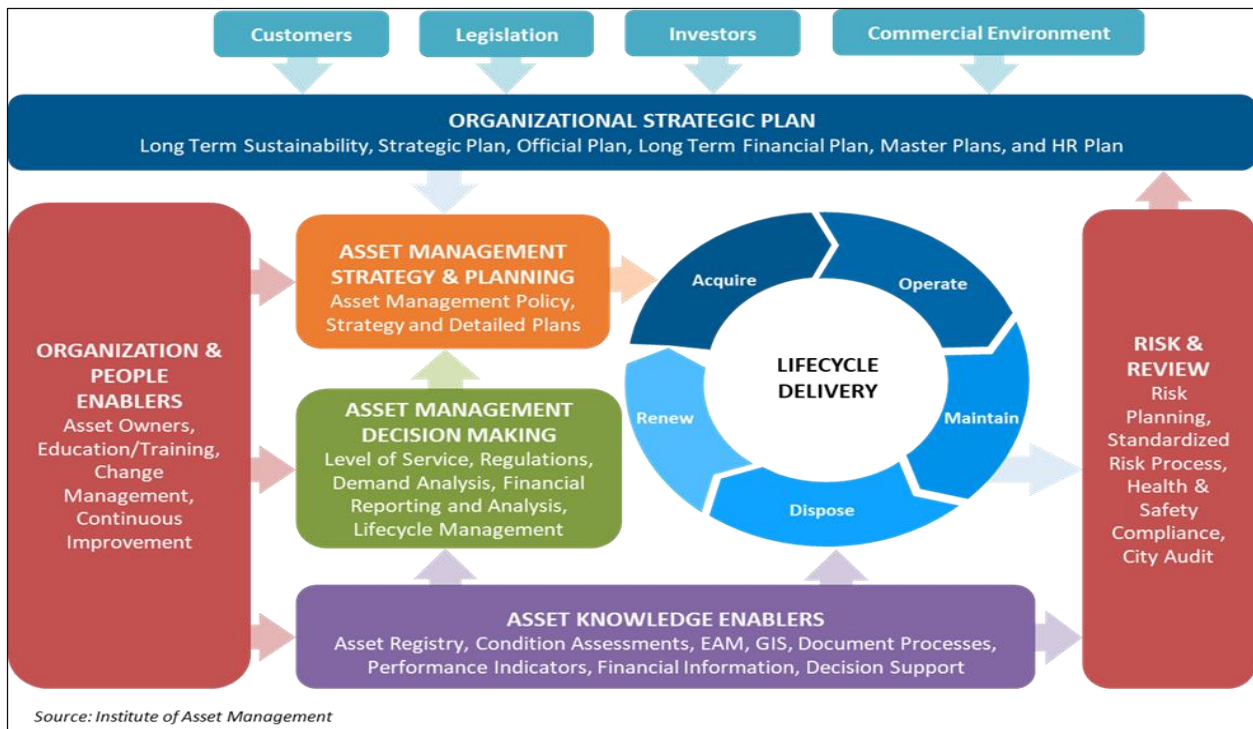


Figure 1 above illustrates the many aspects involved in asset management. As the City of Hamilton resets the conversation around asset management and begins taking next steps in the journey in the development of asset management plans, the focus is on all aspects in Figure 1, which have been summarized into the three (3) key areas below:

- (1) **UNDERSTANDING REQUIREMENTS:** The necessary requirements for an asset management plan (e.g. strategic direction, levels of service, forecast of future demand and current asset performance);
- (2) **LIFECYCLE MANAGEMENT:** How asset lifecycle management occurs (e.g. managing risk and resilience, including equity; operational, capital and financial planning); and,
- (3) **ASSET MANAGEMENT ENABLERS:** The required enablers of asset management (e.g. people, data, tools and processes).

These three (3) areas will each be discussed in more detail.

## 1.0 UNDERSTANDING REQUIREMENTS

This section of the guide assists the reader with confirming the current and future requirements for infrastructure assets and services and with understanding the current ability to meet these requirements. It includes several sections as discussed below.

### 1.1 Review Strategic Direction

Asset management plans are considered tactical in nature with the purpose of translating community outcomes and organizational objectives into the operational delivery of asset-based services. It is imperative that the organization's objectives, the external environment (e.g. legislation), the internal environment (e.g. funding ability), customer and stakeholder requirements and asset portfolio capability are understood in order to inform the asset management plan (IIMM Sec. 2.1).

### 1.2 Establish Levels of Service (LOS)

Levels of service are the means of defining the outcomes and outputs that customers can expect from asset-based activities, measured through a combination of customer values, customer performance measures (LOS) and technical performance measures (LOS).

Customer Values indicate what is important to the customer about a service and if customers currently see value in the service being provided. This area also reviews trends based on the planned budget.

Customer Levels of Service (LOS) communicate statement of facts in three categories about the assets and attempt to determine service performance in relation to customer expectations:

- Condition: How good is the service (i.e. what is the condition or quality of the service)?
- Function: Is it suitable for its intended purpose (i.e. is it the right service)? and,
- Capacity/Use: Is the service over or under used (i.e. do we need more or less of these assets)?

Technical Levels of Service measure the activities completed to provide the services and can be adjusted to increase or decrease the level of service. The technical measures relate to the activities and allocation of resources to best achieve the desired customer outcomes and demonstrate effective performance. Technical service measures are linked to the level of activity and the budgets for both the current and future situations.

The following example uses Recreation to assist with understanding LOS:

- Customer values: our recreation facilities are clean, modern and open when desired
- Customer LOS: how satisfied are customers with the cleanliness of our facilities? and,
- Technical LOS: how often is the facility cleaned?

It is important that good information is provided on the trade-offs between levels of service, risks and costs to enable decision-makers to make informed decisions when evaluating level of service options. Effective customer and stakeholder engagement use a variety of consultation methods to understand customer priorities and willingness-to-pay for different level of service options (IIMM Sec 2.2).

### 1.3 Forecast Future Demand

Predicting future demand for services enables asset managers to plan and determine the best way for demand to be met. It is important that key demand drivers be understood, such as changes in the population size, climate change, land use changes, economic and tourist activity etc., which are all important considerations. It is in this section of the asset management plan that the future of the service is translated into an asset future i.e. how many assets are required to be added or removed in order to meet service requirements (IIMM Sec 2.3).

### 1.4 Assess Asset Performance

Asset condition and performance are both imperative in order to understand how current assets can meet service requirements. While both condition and performance

are vital inputs to asset management, programs to collect and analyse this information can be costly and resource intensive. It is therefore important to be selective when choosing a performance monitoring method and determining appropriate frequencies of assessment. Where possible, use accepted condition rating and performance rating systems rather than creating something new (IIMM Sec. 2.4).

Assessing asset condition is a key element of asset management. Many condition monitoring processes can result in the production of highly detailed technical data however in order to create a common language, detailed assessment information will be translated into a common 5-point scale of very poor, poor, fair, good, very good (see Table 1) in order to compare across the city and to inform trade-off decisions between different asset classes. It’s important that where possible, asset specific technical standards be employed which can then be easily converted to the consistent scale.

Table 1: Asset Condition Assessment

Rank	Description of Condition
1	<b>Very Good Condition - New or Like New, Fit for the Future</b> The infrastructure in the system or network is generally in very good condition, typically new or recently rehabilitated. A few elements show general signs of deterioration that require attention.
2	<b>Good Condition – Minor Defects Only / Adequate for Now</b> In a good state of repair with possible minor non-critical defects The infrastructure in the system or network is in good condition; some elements show general signs of deterioration that require attention. A few elements exhibit significant deficiencies.
3	<b>Fair Condition – Maintenance Required to Return to Accepted Level of Service</b> Some non-critical defects are apparent. The infrastructure in the system or network is in fair condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies.
4	<b>Poor Condition – Consider Renewal / At Risk</b> Some critical defects are apparent. Some repairs to critical defects/assets required in the short term (<5 years). The infrastructure in the network is in poor condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the network exhibits significant deterioration.
5	<b>Very Poor Condition – Approaching Unserviceable / Unfit for Sustained Service</b> Many critical defects/deficiencies are apparent and in immediate need of repair/replacement. Functional failure and/or failure to deliver service is immanent in the short term (<5 years).
	<b>Not Assessed</b> This category is reserved for assets where data is either missing or has not been updated.

More granular approaches are available that are supported by more technical and detailed information. Preference is to always use an approach specific to the asset class and reliant on data if available and cost effective. Many asset-specific condition ratings exist within the asset management profession. Examples include parks/gardens, sports fields, pipes, bridges, roads, buildings and property. Where possible, existing rating systems will be used to assist in bringing greater clarity to a specific asset category (IIMM Sec. 2.4.5).

### 1.5 Using Asset Age and Remaining Life as a Proxy for Condition

In the case where actual condition information is not available, too expensive or too difficult to obtain, asset age is sometimes used as a surrogate for condition (i.e. the physical deterioration of the asset). Caution is required when using this approach as it can be difficult to assess the remaining useful life of long-life assets and can be highly subjective. Expert input is required in this situation.

### 1.6 Predicting Future Condition and Performance

Assessing the condition and performance of an asset at a single point in time can be useful in determining the likelihood of its failure due to physical deterioration. In order to understand the best time to intervene with maintenance, rehabilitation to extend asset life or replacement of the asset requires that condition and performance both be assessed over time. This is typically completed using either a deterministic modelling methodology such as straight-line extrapolation, regression or curve-fitting approaches or a probabilistic approach that incorporates variables to help better understand circumstances with high degrees of uncertainty.

## 2. LIFECYCLE MANAGEMENT

This section of the guide assists the reader in determining the best operational and capital investment strategies to deliver levels of service and uses these as the basis for long-term financial forecasts and asset management plans.

The lifecycle of an asset starts with the identification of the potential need for an asset and ends with its disposal or replacement. Lifecycle asset management embraces two key concepts:

- (a) That attention needs to be given to managing assets across all phases of the lifecycle, not just a "build it and forget it till it falls apart" approach; and,
- (b) That there are opportunities to optimise activities across lifecycle stages, for example, by increasing expenditure on planned maintenance in order to extend life and therefore spend less on renewals.

## 2.1 Lifecycle Decision Techniques

There are many frameworks and methodologies that can be used to support asset management decisions and most of these are based on economic evaluation methods e.g. benefit-cost analysis, multi-criteria evaluation methods or a combination of these. The range of techniques available can be applied to many different types of decisions from determining the best time and option to rehabilitate or replace the asset to minimize lifecycle costs to more complex decisions involving a trade-off between performance, risk and lifecycle cost. Always note that decisions must continue to align with the city’s asset management and level of service objectives (IIMM Sec. 3.1.2).

## 2.2 Managing Risk and Resilience

The traditional steps of managing risk which include, identifying, assessing, evaluating, treating and monitoring the risk, are applied to asset risks in a methodical process to ensure that risks are well managed and understood. A solid risk management approach to infrastructure services and assets can help them be more resilient and sustainable, absorb and adapt to disruptive events and rapidly recover and meet intergenerational needs in the most cost-effective manner.

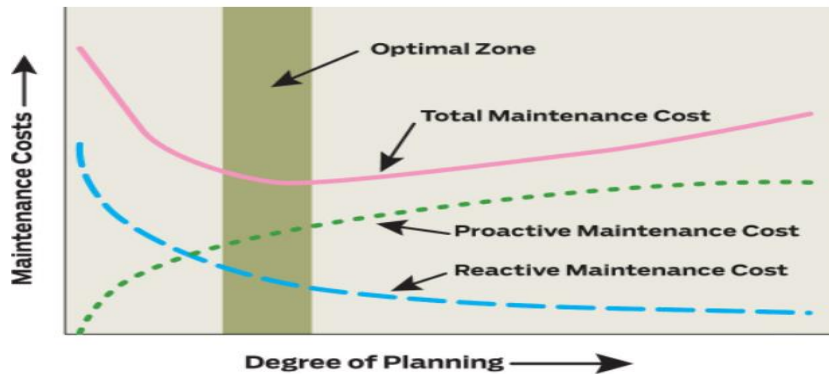
Resilient infrastructure is the combined result of physical robustness and redundancy within the asset network. There are many opportunities across the lifecycle to build resilience such as considering resilient and adaptive design philosophies and sustainable infrastructure with a low carbon footprint when creating and replacing assets. Operational activities, which can also generate high carbon consumption can also be the focus of carbon reduction initiatives (IIMM Sec. 3.2.1).

## 2.3 Operational Planning

The development of optimal operations and maintenance programs is a critical part of asset management. This involves determining the best balance of planned and unplanned maintenance and renewals to minimize long term costs while achieving levels of service and managing risk to acceptable levels. This area includes maintenance plans as well as business continuity and emergency management plans as key operational documents that explain how the organization will reduce the likelihood of service outages and respond quickly when they occur. Figure 2 shows the optimal zone for maintenance given proactive and reactive options (IIMM Sec. 3.3).



Figure 2: Relationship between Planned and Reactive Maintenance Costs



## 2.4 Capital Investment Planning

Capital expenditure (CAPEX) includes renewals of existing assets (required to maintain service levels) and the upgrade, creation or purchase of new assets (usually to meet increased level of service requirements or address demand growth). The capital planning process includes the following six steps:

### 2.4.1 Identification of Potential Need

There are many potential sources for CAPEX needs including but not limited to requirements generated from a strategic goal, the identification of an asset performance deficiency, a response to a demand requirement or risk mitigation action, an escalated operational issue or a forecasted renewal requirement (IIMM Sec. 3.4.2).

### 2.4.2 Verification of Need

Prior to a need being recorded as a project, it should first be verified by the means of a simple checklist asking if the need has been specified (e.g. doesn't meet performance requirements, high risk identified, required to meet growth?) and has evidence been provided that the need exists (e.g. maintenance records) (IIMM Sec 3.4.2).

### 2.4.3 Project Scoping

Project scoping ensures that there is a good understanding of what is required before progressing to more detailed analysis. It will consider the overall purpose of the project, estimated lifecycle costs, expected benefits, risks, where and how it will be funded and managed and how it will be physically delivered (IIMM Sec. 3.4.2).

### 2.4.4 Options Evaluation

Note that some projects will not require the full CAPEX evaluation process e.g. small renewal projects may proceed without a full options analysis as standard solutions may be built into design codes. In most cases however, the options development process is



a critical step as considering the full range of options (see Table 2) ensures that the solution providing the most value is selected.

Table 2: Developing Asset and Non-Asset Options

Type	Option
<b>Asset Based Solutions</b>	<b>Do Nothing:</b> The do-nothing options should be considered fully and the associated risk cost to the organization assessed against this base.
	<b>Operational Procedures:</b> Operational management changes such as modifying supply and re-routing can be implemented to reduce peak demand or stresses on the asset. Contingency plans could achieve improved recovery times.
	<b>Maintenance Procedures</b> (more, less or status quo): Consider a different maintenance regime to make the asset more reliable or to extend its life.
	<b>Asset Renewal:</b> Depending on where an asset is in its lifecycle, rehabilitation can be an economic treatment to maintain service levels. Where rehabilitation is impractical or uneconomic it may be necessary to replace the asset.
	<b>New Work:</b> Where lower cost options are impractical, investment may be required to create a new asset or augment the existing asset.
	<b>Asset Disposal/Rationalization:</b> Divestment of assets surplus to needs because a service is determined to be a non-core activity, or assets can be reconfigured to meet business needs better.
<b>Non-Asset Solutions</b>	<b>Reduce Demand for the Service:</b> This is completed through demand-side or supply-side demand management measures.
	<b>Reduce the Level of Service:</b> e.g. a pavement surface can be allowed to deteriorate to a condition below a current level of service to achieve a lower lifecycle cost or cash flow.
	<b>Educate Customers:</b> Education programs can assist with helping customers in their acceptance of appropriate asset failures.

The options evaluation process can range from individual judgment to facilitated workshops with subject matter experts to advanced economic analysis techniques. Once options have been identified, the evaluation should include confirming the criteria used to make the decision, evaluating the options against the criteria and selecting the preferred (best value) option (IIMM Sec. 3.4.3).

In order to better understand the process, consider a wastewater pump station that overflows when it rains. An initial reaction may be to view this as an under-capacity pump station that needs upgrading when in fact there are many options that should be considered before choosing an option.

These could include:

- Accept the current situation;
- Make minor modifications to ensure the overflow is safely discharged to a nearby stormwater system;
- Increase pump capacity;
- Increase pump station storage;
- Remediate upstream network to reduce inflow and infiltration;
- Provide system storage in the upstream network;
- Enforcement/remedy illegal connections/discharges to the wastewater network;and,
- Some combination of the above (IIMM Sec. 3.4.3).

Completion of the Project Charter and development of the business case continues from this point in the process.

#### 2.4.5 Developing Renewal Forecasts (Modelling) and Renewal Programmes

Renewal modelling is a practical way of forecasting renewals for a large number of assets. At the most basic level, renewal models use rules such as "replace at end of standard useful life", getting more sophisticated with use of performance deterioration curves and lifecycle cost information. The data requirements for these models can be intensive, and careful consideration of the cost versus the improved accuracy of the renewal forecasts should be considered before development. It is common to focus more advanced modelling on the highest value asset groups only (IIMM Sec. 3.4.4).

Predictive models can be used to provide a time-stream of benefits, costs and levels of service for both a single asset and a group of assets. The purpose is to model a range of different management and renewal intervention approaches to identify the most cost-effective means of delivering service levels over the long term.

There are a range of other renewal forecasting approaches other than the predictive models mentioned above. These range from extrapolation of historic spend (not recommended) to bottom up approaches based on inspections of all assets to derive a condition and performance grade and expected remaining life.

##### Age-Life Based Renewal Forecasts

High priority should be placed on establishing an asset register with the basic asset information required to calculate a remaining life and depreciated replacement cost valuation (age, replacement cost, expected asset life), which will enable a more accurate long-term renewal picture. Example: assume an asset has an estimated replacement cost of \$10,000, was built in 2015 and has an expected useful life of 20 years, then this asset will be reflected in the forecast as requiring renewal in 2035. This calculation can be applied to all similar assets with the total cost schedule for renewal each year summed to provide the annual renewal budget.

## Condition-Performance Based Renewal Forecasts

This method is generally used for above-ground assets that are relatively easy to visually assess condition and performance, though CCTV is used today to inspect underground assets enabling them to also be included in this type of renewal forecasting. In this approach, the condition or performance is assessed based on physical inspection results and a replacement date is either assessed directly by the assessor or derived from the condition and/or performance grades. (IIMM Sec. 3.4.5).

### 2.4.6 Compiling and Prioritising the CAPEX Pipeline

A CAPEX Program collated from the above processes will not always receive full funding when submitted as part of the budgeting process and for this reason it is important to prioritize the projects in the Capital Program as the next step. Previously discussed decision techniques can be used, such as multiple criteria to rank and prioritize projects.

Prioritization criteria generally reflect the following:

- Legislative non-compliance;
- Reduction in risk/improvements in safety;
- Financial efficiencies/lifecycle cost savings;
- Maintains existing performance network;
- Improvements to levels of service; and,
- Contribution to strategic objectives.

Some organizations are adopting a policy of prioritizing renewals of existing assets over creation of new assets, on the basis that they should look after what exists before dollars are spent on new assets. This only works in some situations, as in other cases there may be mandated requirements to upgrade assets (e.g. drinking water standards) and growth pressures that require new infrastructure (IIMM Sec. 3.4.6).

### 2.4.7 Optimizing CAPEX Across Activities

Once all CAPEX has been compiled, there are typically budget constraints where not all projects can be implemented. An analysis is required at this point that involves prioritizing projects with the greatest contributions first. It may be that the projects that have the greatest contributions or benefits can also have the greatest costs. It is also possible that projects are likely to contribute to more than one objective, at which point an optimization exercise becomes beneficial in order to find the best balance of cost and the achievement of objectives.

One approach is to use a very simple rating system, for example:

- **Must Do:** required for legislative compliance, to maintain existing functionality or a committee project;

- Should Do: Demonstrated reduction in lifecycle costs, required to mitigate growth impacts; and,
- Could Do: Level of service improvement.

Multi-criteria prioritization rating approaches also exist with several different approaches being available for consideration (IIMM Sec. 3.4.7). Prioritization also needs to consider economic growth, environmental protection and socio-cultural equity.

## 2.5 Asset Financial Forecasts and Valuations

Long-term financial forecasts are a key output from capital and operational planning and should include all lifecycle costs for existing and planned assets. Alignment between asset and financial management is also critical as evidenced in the following topics in this section of the guide:

### 2.5.1 Financial Management Principles and Standards

Asset-intensive organizations are generally where:

- The value of infrastructure assets is high in relation to total Balance Sheet assets;
- The assets are long-lived;
- The liabilities of the organization are predominantly to finance assets; and,
- The organization's income and expenditure is significantly asset based.

Good infrastructure financial management goes beyond regulatory compliance. Optimal investment in infrastructure assets requires that those assets be appropriately maintained, renewed, replaced, enhanced or disposed of to provide the levels of service now and into the future at the minimal life-cycle cost. Organizations will typically require much more financial information to properly manage their assets than might be required to comply with regulatory or accounting standards (IIMM Sec. 3.5.1).

### 2.5.2 Alignment of Asset Management and Financial Management

Preference is that finance and asset management activities complement each other rather than there being strong demarcation between activities. Outputs from asset management strategies and activities should flow into financial management processes and vice versa (IIMM Sec. 3.5.2).

Areas where asset and financial management should be particularly close include:

- Asset classifications and asset hierarchies;
- Categories of asset expenditure and capitalization rules;
- Financial forecasting;
- Asset revaluations and depreciation charges;

- Costing levels of service;
- Lifecycle costing and feasibility analysis; and,
- Financial reporting

### 2.5.3 Asset Lifecycle Costs and Revenues

Lifecycle costing (also known as whole-of-life costing) is a process to determine the sum of all expenses associated with a product or project, including acquisition, installation, operation, maintenance, refurbishment and disposal costs. Initial capital costs constitute a significant up-front cost and often dominate the decision-making process when acquiring new assets. However, the ongoing recurrent expenditures usually represent a high proportion of the total lifecycle costs of many assets. For example, a rule of thumb for building facilities is that the initial cost will comprise 30% of the total lifecycle costs and recurrent expenditure 70% of the total lifecycle costs.

The objective of lifecycle costing is therefore to determine the total costs of ownership in order to:

- Evaluate options for the procurement of new assets;
- Support ongoing management decision-making throughout the life of an asset;
- Benchmark the cost performance of the asset; and,
- Review the process for future design and acquisition decisions

Lifecycle Revenues should be considered where relevant. There will undoubtedly be funding gaps between lifecycle costs and revenues at various points over the asset's lifetime (IIMM Sec. 3.5.3).

### 2.5.4 Asset Valuation Approaches

Assets need to be accurately valued for many reasons. Financial reporting obligations require assets to be valued at “fair value”. Also, asset owners and financial managers need to understand how the assets will depreciate over their useful life in order to fairly allocate costs and set income streams and plan for asset renewal (IIMM Sec. 3.5.4).

### 2.5.5 Long-Term Asset Financial Forecasts

A critical output from asset and financial management is a long-term assessment of financial needs and funding requirements. These forecasts should bring together all relevant data from asset management processes. The forecasts should be presented in the asset management plans with clearly stated assumptions and confidence factors for a forecast period of a least 10 years, preferably longer.

Historically there have been numerous issues related to Financial Planning that have seen resulting shocks and funding pressures from a combination of factors:

- Lack of basic information on past performance and condition of assets to be able to predict future performance and asset failures;
- Lack of detailed information on the past costs of maintaining and renewing assets;
- No robust assessment of maintenance or renewal gaps;
- Assets valued at historic cost thereby underestimating depreciation of assets;
- Short-term budgets that do not signal long-term funding issues;
- Ignoring the effect of increased assets on operating and maintenance forecasts; and,
- Funding allocated to new projects to the detriment of maintaining and renewing existing assets.

The long-term plan should encompass all lifecycle costs. Both CAPEX and OPEX budgets deserve focussed attention on ensuring that proper forecasting processes are utilized and do not just represent historical spending with an inflationary factor applied (IIMM Sec. 3.5.6).

There are two key indicators of sustainable service delivery that are considered within the Asset Management Plan:

- Asset renewal funding ratio (proposed renewal budget for the next 10 years / forecast renewal costs for next 10 years), and,
- Medium term forecast costs/proposed budget (over 10 years of the planning period).

#### 2.5.6 Developing Funding Plans

There are usually funding constraints to be addressed and decisions on how to allocate funds should be made in a transparent manner. Other key funding principles include ensuring that long term operational sustainability is considered, including consideration of funding required for asset renewals, equity and fair allocation of costs to show benefit (IIMM Sec. 3.5.7).

#### 2.5.7 Developing Asset Management Plans

An Asset Management Plan documents the organization's intended asset management programs for management of its assets and services based on the organization's understanding of service level requirements and the network's capability to meet those requirements. The Asset Management Plan can be considered as a business case for the long-term financial forecasts and should drive strategic thinking and planning and ensure the organization is operating in a financially sustainable manner.

Asset Management can also act as a vehicle for communication with customers and other parties on different funding scenarios and impacts on service levels and risk (IIMM Sec. 3.6.1).

### 3 ASSET MANAGEMENT ENABLERS

This section provides guidance on the asset management enablers that support effective planning and decision processes.

#### 3.1 Asset Management People

People are at the heart of asset management. There needs to be strong leadership to drive change and sufficient people with the mandate and capability to deliver asset management. Asset management is a cross-organizational function and requires an integrated and collaborative approach with asset owners, strategic planners, service planners, finance, IT and many others (IIMM Sec. 4.1).

#### 3.2 Asset Data, Information and Systems

Organizations need reliable and comprehensive asset information to support all the asset management functions described in this guide plus much more. Information needs to be carefully considered as the users of asset data across the organization will have different requirements. Practical and appropriate data collection and management processes are essential as this is potentially one of the costliest areas of asset management. Where large numbers of assets exist, an information system to record, analyse and report asset information is important. Work has already started on combining the existing 11 asset systems into one (the Enterprise Asset Management Project) in Public Works (IIMM Sec. 4.2 & 4.3).

#### 3.3 Asset Management Processes

Good process management ensures that the right things are being done and that the processes are repeatable and consistent when undertaken by different people. There is an 80% overlap between asset and quality management, and for this reason, areas that are down the path of quality management will benefit as they begin their asset management journey (IIMM Sec. 4.4).

#### 3.4 Service Delivery Models

Organizations should consider the most effective way to deliver asset management. This will include consideration of which core services and functions should be performed internally vs externally (IIMM Sec. 4.5).



### 3.5 Asset Management Improvement

An Asset Management Maturity assessment aims to identify the level of current maturity across the full range of asset management functions along with the appropriate level of maturity suitable for the organization. The resulting gaps should be prioritized and developed into an Asset Management Improvement Plan. As next steps are taken in determining organization maturity, discussions will be held with Senior Leadership and Council.