

Municipal Asset Valuation Guidelines

**Municipal Finance and Management Component
Bhutan Second Urban Development Project (BUDP-2)**

Table of Contents

DEFINITIONS.....	i
ABBREVIATIONS	iii
PREFACE.....	iv
1 Introduction to Asset Management	1
1.1 Background	1
1.2 National Challenges	2
1.3 Asset Management Concept.....	3
1.4 Legislative Framework	4
1.4.1 Constitution	4
1.4.2 Public Finance Act	4
1.4.3 Local Government Act	4
1.4.4 Financial Management Manual	4
1.4.5 Accounting Standards.....	5
2 Strategic Framework for Asset Management.....	6
2.1 Introduction.....	6
2.2 Asset Management Framework	6
2.3 Asset Management Policy.....	7
2.4 Asset Management Strategy.....	7
2.5 Asset Management Plan.....	7
2.6 Comprehensive Municipal Infrastructure Plan	8
2.7 Approaches for Asset Management	8
2.8 Success Factor.....	9
3 Asset Management Plan	11
3.1 Approach.....	11
3.2 Methodology	11
3.3 Documentation	13
4 Comprehensive Municipal Infrastructure Plan.....	16
4.1 Purpose.....	16
4.2 Providing robust infrastructure inputs to Five Year Plans.....	16
4.3 Supporting more Informed Decision Making.....	17
4.4 Process for developing the CMIP	17
4.5 Sample Format for CMIP.....	19
4.6 Summary	21
5 Basic Asset Management Tool.....	22
5.1 Information and Data Collection.....	22
5.1.1 Digitized Asset Register	22
5.1.2 Asset Management Information System	23
5.1.3 Expected Useful Lives of Assets	23
5.1.4 Asset Valuation	24
5.2 Asset Knowledge	25
5.3 Level of Service	25
5.4 Demand	25
5.5 Risk Management	26
5.5.1 Risk Identification	26
5.5.2 Consequences of Risk Events.....	27
5.5.3 Probability of Risk Events.....	29
5.6 Lifecycle Plan	29
5.7 Financial Planning	34

5.7.1 Detailed assessment of projects: preparation of financial forecasts	34
5.7.2 Tariff Setting	35
5.8 Asset Management Practice Improvement Plan	36
5.8.1 Approach to Improvement Planning	36
5.9 Asset Management Plan Adoption.....	38
5.10 Consolidating Asset Information and Strategies for the CMIP	38
BIBLIOGRAPHY	40

List of Figures

Figure 1 Comprehensive Municipal Infrastructure Plan.....	2
Figure 2 Lifecycle Asset Management	3
Figure 3 Approach for Asset Management Programme	9
Figure 4 Approach for Asset Management Programme	11
Figure 5 Format of Asset Management Plan	14
Figure 6 Integration of Asset Management Plans.....	16
Figure 7 Infrastructure Input of Five-Year Plans.....	17
Figure 8 Format for CMIP	20
Figure 9 Asset Status	22
Figure 10 Asset Functions under Thromde DAR	23
Figure 11 Example of Data Presentation: Nature and Extent	25
Figure 12 Example of Life Cycle Plan	31

List of Tables

Table 1 Methodology for Preparation of Asset Management Plan.....	12
Table 2 Process of Developing CMIP	18
Table 3 Expected Useful Life under PMM.....	23
Table 4 Expected Useful Life of other assets not listed under PMM	24
Table 5 Factors influencing Demand.....	26
Table 6 Schedule of Commonly Encountered Risk.....	27
Table 7 Sample Risk Consequence Table.....	28
Table 8 Risk Probability Rating.....	29
Table 9 Sample Calculation of Lifecycle Cost: Modular Wastewater Treatment Plant.....	33
Table 10 Asset Management Improvement Milestones (Source: World Bank Advisory Note)	37

DEFINITIONS

Accrual principle: Transactions and events that influence the financial position of an organization must be recognised when they occur and not when the cash resulting from the transaction or event is received or paid.

Asset: are resources controlled by an entity as a result of past events and from which future economic benefits or service potential are expected to flow to the entity.

Asset Management: The process of decision-making, planning and control over the acquisition, use, safeguarding and disposal of assets to maximize their service delivery potential and benefits, and to minimize their related risks and costs over their entire life.

Asset Management Plan: A plan developed for the management of Infrastructure Assets with the aim of providing specified levels of service in a cost-effective manner, now and in the future.

Asset Management Policy: A formal statement adopted by Thromde Tshogde that indicates the Thromde's policy objective, the policy principles, and how these will be pursued.

Asset Management Strategy: A document that defines key AM processes and targets including:

Asset Management Team: A multi-disciplinary team appointed by the Thromde to initiate, monitor and review the asset management practices improvement program.

Asset Management Information System: A combination of processes, data and software applied to provide outputs required for effective asset management.

Asset Performance: The performance of an asset that is measured in line with the applicable Level of Service.

Asset Register: A record of information on each asset that supports effective financial and technical management of the assets, and meets statutory requirements.

Cashflow: The stream of costs and/or benefits over time resulting from a project investment or ownership of an asset.

Community Facilities: Discrete assets that provide a service directly to the community (such as parks, sports facilities, cemeteries, landfill sites etc.)

Components: Elements of an asset.

Comprehensive Municipal Infrastructure Plan: A plan that provides a holistic overview of existing service performance, a vision of future performance scenarios, the risks, priorities, funding and tariff implications, as a strategic input to the Five-Year Planning process.

Critical Assets: Assets for which the consequences of failure are sufficiently severe to justify pro-active inspection, maintenance and renewal.

Current Replacement Cost: A measure of replacement value – the cost of replacing an existing asset with a modern asset of equivalent capacity.

Demand Management: Active intervention to change the pattern of demand for a service e.g. to minimise or eliminate the need to upgrade assets, to address a limitation on bulk supply capacity, or minimize losses.

Depreciation: The wearing out, consumption or other loss of value of an asset whether arising from use, passing of time or obsolescence through technological and market changes.

Depreciable Amount: The cost of an asset, or another amount that replaces the cost price in the financial statements, less its residual value.

Depreciated Replacement Cost: A measure of current value of an asset, based on its current replacement cost less an allowance for deterioration of condition to date.

Disposal: The actions required effectively dispose, decommission, or transfer assets in terms of legal or organisational requirements.

Expected Useful Life: The extent of life of an asset over which it can be expected to meet the required performance given its operational environment, and over which it will be productively used.

Expense: Loss in economic benefits during the accounting period in the form of outflows or depletions of assets or incurrence of liabilities that result in decreases in equity, other than those relating to distributions to equity participants.

Infrastructure Assets: All core assets which are integral to the delivery of Thromde services, including water supply, sanitation, road transport and storm-water drainage, solid waste removal, and community facilities.

Investment Costs: The upfront capital investment costs as well as any subsequent cost to extend the useful life of the asset improve its efficiency or increase its output.

Level of Service: The defined parameters that characterise essential service delivery requirements for a particular service, against which performance may be measured. Criteria can relate to availability of the service, quality/condition, quantity, reliability, responsiveness, environmental acceptability and financial implications.

Liability: A present obligation of the enterprise arising from past events, the settlement of which is expected to result in an outflow from the enterprise of resources embodying economic benefits or sacrifices of service potential.

Lifecycle: The cycle of activities that an asset goes through – including planning and design, initial acquisition and construction, cycles of operation and maintenance and capital renewal, and finally disposal.

Maintenance: The actions required for an asset to achieve its expected useful life.

Recoverable amount: The amount the entity expects to recover from the future use of an asset, including residual value on disposal.

Rehabilitation: Works to rebuild or replace parts of an asset to enable it to the original capacity and performance, and materially extend its useful life (which may be a full or partial extension of life).

Renewal: The replacement or rehabilitation of an asset.

Remaining Useful Life: The time remaining until an asset ceases to provide the required standard of performance or economic usefulness.

Replacement: The complete replacement or reconstruction of an asset with one that performs to a similar standard of performance, as a result of which the asset life can be considered to have re-commenced.

Residual value: The net amount which the entity expects to obtain for an asset at the end of its useful life after deducting the expected costs of disposal.

Revenue: An increase in economic benefits during an accounting period through an enhancement of an asset or through a decrease in a liability.

Risk Management: The application of a formal process that identifies the exposure of a Thromdes to service performance risk and determines appropriate responses.

Upgrading: The augmentation or alteration of an asset that results in a material improvement to capacity or performance. Expenses on upgrading works are considered capital expenditure.

ABBREVIATIONS

AMIS	Asset Management Information System
AM	Asset Management
AMP	Asset Management Plan
CRC	Current Replacement Cost
CMIP	Comprehensive Municipal Infrastructure Plan
DAR	Digitized Asset Register
DMP	Disaster Management Plan
DRC	Depreciated Replacement Cost
IIMM	International Infrastructure Management Manual
FYP	Five Year Plan
O&M	Operation and Maintenance

PREFACE

The Royal Government of Bhutan (RGoB) has secured an IDA credit to:

- a. strengthen municipal management systems
- b. improve infrastructure services in northern Thimphu. Under the Additional Financing for BUDP II, technical assistance support is intended to be provided to two Thromdes of Gelephu and Samdrup Jongkhar to strengthen their municipal financial management systems.

For strategic, operational and financial reason, asset management is becoming an increasingly important area for decision making for Thromdes. The assets can be managed directly or indirectly. Municipal Asset management is process of inventory, valuation, use, strategic portfolio reviews, reporting and auditing of municipal assets.

The objective of this document is to support improvement in the strategic management of municipal infrastructure assets. A framework is described that will facilitate the preparation of sector-specific infrastructure Asset Management Plans (AMPs) and the aggregation of these into a Comprehensive Municipal Infrastructure Management Plan (CMIP). The processes aim to improve strategic and tactical planning of infrastructure, performance management, risk management, financial management and capacity building, and are aligned with existing statutory municipal processes.

Guidelines are provided on the core principles, methodology and basic techniques that can be adopted in compiling both the AMPs and CMIPs.

Asset management requires a multidisciplinary approach, drawing on knowledge from disciplines such as the management and social sciences, engineering and accounting. Thromde officials from different disciplines such as engineering, finance and planning are encouraged to join hands in solving the complex asset management challenges facing local government. The techniques described are appropriate for smaller Thromdes, though the principles and approach are applicable more widely.

1 INTRODUCTION TO ASSET MANAGEMENT

1.1 BACKGROUND

Asset management is an evolving principle of good governance. The overall idea of asset management as a discipline and operational instrument is to function as an approach to monitor, operate, maintain, upgrade and dispose public asset cost-effectively. In a long run it ensures to meet the desired level of service improving the overall business performance. It allows decision makers in Thromdes to focus on what is best for the community in providing services.

Effective management of infrastructure is vital to Thromdes providing an acceptable standard of services to the residents. Infrastructure, certainly has great impacts on the quality of our living environment and opportunities to succeed.

While the Thromdes have requirement to be effective, they manner in which they discharge their duties and responsibilities as public entities is also important. Thromdes should demonstrate good governance and customer care, and the processes adopted must be efficient and sustainable.

There are growing concerns over poor service performance and unnecessary loss of asset value. There is a need to direct limited resources to address the most critical needs, to achieve a balance between maintaining and renewing existing infrastructure whilst also addressing backlogs in basic services and facing ongoing changes in demand. Making effective decisions on service delivery priorities requires a team effort, with inputs provided by officials from a number of sections of the Thromde, including infrastructure, community services, financial, planning, and corporate services.

In line with international practice, these guidelines propose that an Asset Management Plan (AMP) is prepared for each sector (such as water, wastewater, roads etc.) These plans are used as inputs into the Comprehensive Municipal Infrastructure Plan (CMIP) that presents an integrated plan for the Thromde covering all infrastructures.

The CMIP provides a capital works programme and operations and maintenance strategies, risks and priorities, required budgets, funding arrangements and tariff implications now and into the future, and how management practice can be improved. Figure 1-1 illustrates how the CMIP provides the infrastructure inputs for the Five-Year Plans.



Figure 1 Comprehensive Municipal Infrastructure Plan

The preparation of these plans will enable Thromdes to:

- a. rank projects and determine budgets based on a holistic view of local needs and priorities;
- b. assess optimum funding arrangements; and
- c. demonstrate their ability to effectively manage and maintain infrastructure investments.

1.2 NATIONAL CHALLENGES

Four major Thromdes, are one of the fast-growing cities however it is crumbling under its own growth. But growth is not always progress or development. Road, water supply and waste management are among the main issues that continue to pressure the Thromdes.

Deteriorating conditions of the infrastructure, poor maintenance schedule, inability to access required fund for rehabilitation and enhancement of existing infrastructure, inability to access required fund for construction of new infrastructure are few of the many problems that is being faced by local governments, especially the Thromdes.

In Bhutan, Financial Management Manual (FMM), Finance and Accounting Manual (FAM) and Property Management Manual (PMM), are few documents which is remotely relates to asset management. As a proprietary of Ministry of Finance, both of these documents are focused more towards financial aspects.

In absence of national asset management policy, asset management in the country and the Thromde is based on need of the hour rather than long term planning. All of the Thromdes are basing their development on respective Structure Plans however, these Thromdes do not have sector specific Masterplan such as Thromde Water Masterplan, Thromde Road Master Plan etc.

For the Five-Year Plans, infrastructure development project should adopt a process that is implementation-orientated and based on stakeholder consultation. One of the main challenges

in managing infrastructure is to balance the competing demands for infrastructure construction, operations and maintenance, and renewal within each service, as well as across the various Thromde services. The strategic and tactical planning processes in Thromdes need to be strengthened, supported by staged improvements to management practices and organizational capacity that will translate to perceptible improvements to service delivery. These interventions need to be structured to take account of the financial, skills and capacity constraints that exist in Thromdes.

1.3 ASSET MANAGEMENT CONCEPT

Asset Management as defined in International Infrastructure Management Manual is “*The systematic and coordinated activities and practices of an organisation to optimally and sustainably deliver on its objectives through the cost-effective lifecycle management of assets*”. And the asset management objective is often stated as “to provide affordable levels of service that have been agreed with customers in the most cost-effective way for present and future customers”.

It is a common misunderstanding among many to state asset management as just maintenance of existing assets. On contrary, asset management should begin from requirement and inception of infrastructure until it is defunct and replaced with a new one.

An asset’s lifecycle begins when a need is identified. From there the asset is planned, created or acquired, operated and maintained, monitored, and replaced or upgraded when it reaches the end of its life. Asset management is how we plan for and prioritize our infrastructure needs to achieve the greatest benefit to our community.

Effective asset management aims to realize value from assets in a way that balances levels of service, risk, and cost effectiveness throughout the entire asset lifecycle. Figure 2 below the range of activities encompassed in ‘lifecycle asset management’.

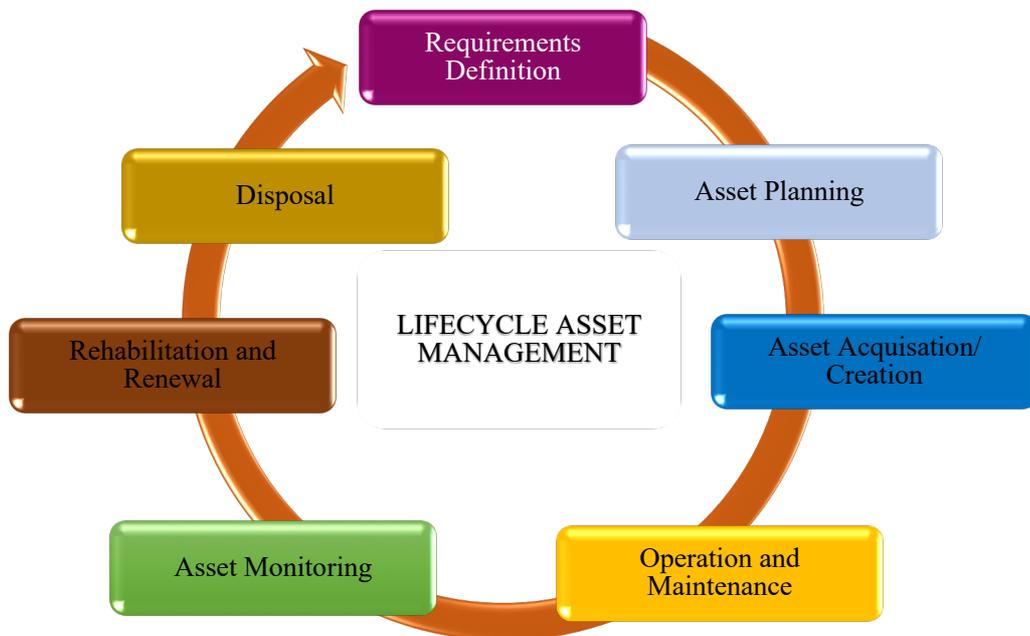


Figure 2 Lifecycle Asset Management

1.4 LEGISLATIVE FRAMEWORK

1.4.1 Constitution

In accordance with the Constitution of Kingdom of Bhutan, Local Governments shall ensure that local interests are taken into account in the national sphere of governance by providing a forum for public consideration on issues affecting the local territory.

Thromdes have the objective to ensure the provision of services to communities in a sustainable manner, within its financial and administrative capacity. Furthermore, Thromdes have the following provision:

- a. Entitled to levy, collect, and appropriate taxes, duties, tolls, and fees in accordance with such procedure and subject to limitations as may be provided for by Parliament by law;
- b. Entitled to adequate financial resources from the Government in the form of annual grants;
- c. Allocated a proportion of national revenue to ensure self-reliant and self-sustaining units of local self-government;
- d. Supported by the Government to promote holistic and integrated area-based development planning; and
- e. Entitled to own assets and incur liabilities by borrowing on their own account subject to such limitations as may be provided for by Parliament by law.

1.4.2 Public Finance Act

In accordance with the act, chief executing officer of any budgetary body is responsible for managing the financial and related matters including the procurement and disposal of assets of his organization. Furthermore, officials of budgetary bodies are responsible for management, including the safeguarding of the assets and the management of liabilities within that official's area of responsibility.

1.4.3 Local Government Act

Local Governments are mandated to manage their revenues, expenses, assets and liabilities prudently and in a manner that promotes the immediate and future interests of the community. The management of assets and funds are to be in accordance with provisions of the Public Finance Act and rules and regulations made thereunder. Every official of Local Government whose duties permit or require the possession or custody of local funds shall be accountable and responsible for the said funds and safekeeping thereof in conformity with the provisions of law.

1.4.4 Financial Management Manual

Under the purview of Financial Management Manual, the objective of asset management is to ensure proper upkeep of ownership records and economic use of the assets for the genuine purposes of the Government. The following aspects are taken into consideration to achieve this objective:

- a. Assignment of responsibility for maintenance of updated inventories of assets and ensuring their economic use for the genuine purposes of the Government at all levels of operation;
- b. Availability of a central inventory of all non-consumable assets of the Government;
- c. Establishment of Government ownership and confirmation on physical existence of assets at regular intervals;
- d. A proper system for disposal of obsolete, uneconomical or unnecessary assets.

1.4.5 Accounting Standards

There is a transition in the accounting standards that apply to Thromdes. In line with Thromde Finance Policy, Thromdes are migrating to accrual accounting from Double Entry Cash Accounting. The adoption of accrual accounting by Thromdes will improve both the quality and comparability of financial information reported by public sector entities around the world.

The changes represent a shift from an “historic cost” to an “accrual” basis of accounting. Under this new accounting standard for Thromdes, assets are set for:

Recognition

- a. All Fixed Assets are carried at cost less accumulated depreciation. The cost of fixed assets includes cost incurred/money spent in acquiring or installing or constructing the fixed asset, interest on borrowings directly attributable to acquisition or construction of qualifying fixed Assets up to the date of commissioning of the assets and other incidental and indirect expenses incurred up to that date;
- b. All assets costing less than Nu. 5,000/- would be expensed/charged to Income & Expenditure Account in the year of purchase; and
- c. Any Fixed Asset, which has been acquired free of cost or in respect of which no payment has been made, is recorded at nominal value of Nu. 1.

Depreciation

- a. Depreciation is provided on Straight Line Method.

Revaluation of Fixed Assets

- a. Revaluation of fixed assets is undertaken either at the time of issue of Thromde bonds or when commercial development/lease of properties are made;
- b. Increase in net book value arising on revaluation is credited to ‘Revaluation Reserve Account’. Decrease in net book value is charged to Income and Expenditure account; and
- c. Revaluation reserve is amortized by equivalent amount of depreciation charged on the revalued portion of the cost of the fixed assets.

Inventories

Inventories are valued as follows:

- a. Raw materials are valued at Cost based on first in first out method; and
- b. Finished goods are valued at lower of the cost or market value.

2 STRATEGIC FRAMEWORK FOR ASSET MANAGEMENT

2.1 INTRODUCTION

Thromdes have the objective to ensure the provision of services to communities in a sustainable manner, within its financial and administrative capacity. The Local Government Act has clearly mandated the Thromdes to manage their revenues, expenses, assets and liabilities prudently and in a manner that promotes the immediate and future interests of the community.

With the introduction of internationally accepted standard of Asset Management, Thromdes will have the potential to add tremendous value in a range of management areas, as follows:

- a. **Strategic Planning** - by providing improved information into the Five-Year Plan process on current levels of service, risks and future demand, costed strategic options with tariff implications, and coordinated programs;
- b. **Performance Management** – by determining more effective and holistic criteria and measures for service delivery, and applying these consistently to monitoring, reporting, and risk management;
- c. **Risk Management** – by introducing a focus on assessing service delivery risk at network and asset level, and identifying appropriate responses;
- d. **Financial Management** – by determining budget needs based on defined levels of service now and in the future, assessing long-term affordability to the Thromde, identifying tariff implications, and establishing realistic valuation of the infrastructure assets; and
- e. **Capacity Building** – by crafting prioritized interventions to steadily improve asset management practice.

2.2 ASSET MANAGEMENT FRAMEWORK

These guidelines propose a framework which includes the following key asset management documents and systems:

- a. A policy statement which provides the over-arching principles and organisational objectives for managing the Thromde's infrastructure to give effect to its vision.
- b. An asset management strategy which indicates the processes the organisation will use to put the policy into effect, providing specific criteria, measures and goals. The strategy should also indicate the approach to be taken to manage risk, and the Thromde's appetite for risk. When commencing with a process of AM, Thromde may not have sufficient information to prepare a strategy – in this case, a Thromde may elect to commence with the preparation and updating of Infrastructure Asset Management Plans until sufficient information is available to prepare a strategy.
- c. An Asset Management Plan which sets out the sector needs and priorities, levels of service, future demand, capital works and O&M programmes and strategies, and funding plans. This plan will be updated on an annual basis.
- d. A Comprehensive Municipal Infrastructure Plan which considers cross-sector priorities and issues, and presents a holistic long-term plan for the Thromde's infrastructure assets. This plan will be updated on an annual basis, and will be integrated with other management strategies and plans, such as Human Resources, Information Systems and Finances.

2.3 ASSET MANAGEMENT POLICY

It is very important for all Thomdes to have an over-arching financial policy to deal with the financial management of assets. Usually, it is a requirement of the financial policy to draft an Asset Management Policy which focuses specifically on the management of infrastructure assets. This focus is justified in view of the critical importance of infrastructure assets to service delivery, their substantial value, and relatively long expected lives. The appropriate **Policy Objective** should be *“The Thomde is committed to providing services for which the Thomde is responsible, at an appropriate level, and in a transparent, accountable and sustainable manner, according to certain core principles”*.

2.4 ASSET MANAGEMENT STRATEGY

Asset Management Strategy is an important document that shall guide the overall asset management activities within the Thomde. Being a strategy, it is meant to explore long term issues and ensure that the overall plan is linked to key "strategic" issues of the organisation.

Asset Management Strategy should address issues such as the following, as appropriate to the capacity, functions, and practice of the Thomde:

- a. defines criteria and measures for the levels and standards of service for each service and recording existing levels and standards of service;
- b. states a policy on target levels and standards of service based on an assessment of long-term affordability to the Thomde;
- c. charts a course for the development of infrastructure in line with the entity’s vision;
- d. defines a funding strategy;
- e. defines the project prioritisation and budget allocation process;
- f. defines key infrastructure management processes and standardized procedures including:
 - i. the establishment Digitized Asset Register (DAR); and
 - ii. the preparation of an Operations and Maintenance Plan for each service;
- g. defines coordination measures for infrastructure planning and implementation;
- h. describes the functionality of a central asset management system and define data standards;
- i. defines the process to be adopted in managing physical risk of networks and the entity’s risk appetite;
- j. commits to a process of continuous improvement of infrastructure management and planning practice and states the methodology to be used; and
- k. allocates responsibility for infrastructure asset management to specific individuals.

2.5 ASSET MANAGEMENT PLAN

An Asset Management Plan for each service sector like water supply, roads and bridges, should:

- a. document the nature, extent, age, utilisation, condition, performance and value of the infrastructure network;

- b. identify existing and proposed levels of service to be achieved over the report period, as well as the expected changes in demand;
- c. outline the strategies of how the gap in the levels of service will be met through a combination of demand management and asset lifecycle management tactics (development, renewal, operations and maintenance and any disposal) over the planning period;
- d. introduce a risk management process;
- e. assess capital and operational budget needs and funding implications; and
- f. assess the prevailing infrastructure asset management practice and identify improvements.

2.6 COMPREHENSIVE MUNICIPAL INFRASTRUCTURE PLAN

When all the individual sector Asset Management Plan is consolidated, it is known as Comprehensive Municipal Infrastructure Plan. The CMIP will contain summarised key information from the individual AMPs and in ideal situation, will provide the core inputs to drafting of Five-Year Plans.

There are several reasons for consolidating the individual AMPs. Firstly, the CMIP will provide a big picture view of the state of infrastructure in the Thromde and the key issues and strategic options. It is difficult to make level of service and funding decisions on one sector in isolation from the others as small level of service improvements may seem affordable until they are all added together.

The CMIP also provides an opportunity to demonstrate that the Thromde is considering the priorities for infrastructure development between sectors as well as within sectors for example the opportunity to review whether limited funds may be better spent augmenting water treatment plants versus building a new playground.

2.7 APPROACHES FOR ASSET MANAGEMENT

The Thromdes, till date has not implemented a holistic asset management programme. The reasons for these Thromdes to embark on an asset management programme are:

- a. the need to comply with Thromde Finance Policy and associated regulations
- b. reacting to a visible deterioration in the condition of infrastructure and service delivery failures;
- c. the need for robust planning in response to possible exponential economic growth;
or
- d. the pursuit of excellence in infrastructure management.

The Figure 3 below shows the proven approach to a sustainable asset management programme:

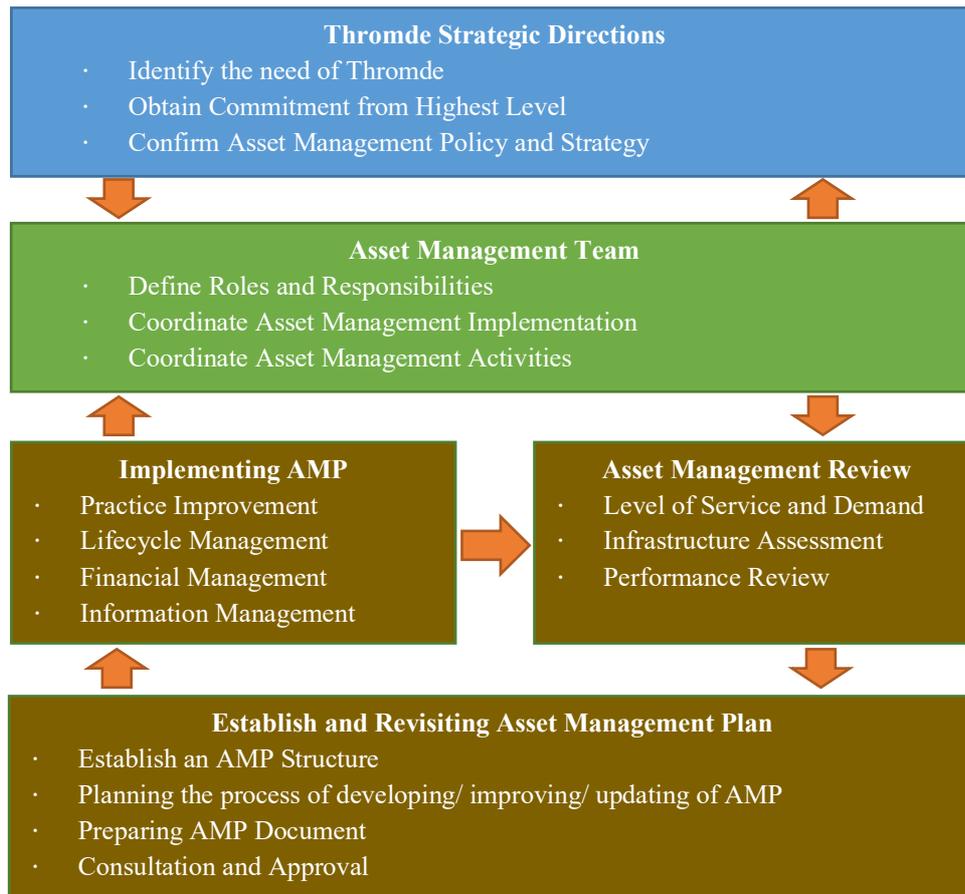


Figure 3 Approach for Asset Management Programme

2.8 SUCCESS FACTOR

In order to make the Asset Management Programme successful, there are some essential things that must be done early on in the process. The following are essential initial activities:

- a. securing the support and involvement of senior management
- b. establishing an asset management team with representation across the Thromde to steer the overall program. Ideally, the team should be led by either the Thrompon or the Executive Secretary
- c. allocating responsibility for overall coordination and supporting staff with dedicated time allocated for them to carry out this work; and
- d. awareness and training: training particularly for staff who will be involved in undertaking AM planning and/or providing inputs to the plan.

An asset management team led by the highest authority of the local government has proven to be most efficient in most of the countries. And with formal adoption of Asset Management Plan, annual budgeting processes will become much easier. However, to develop a successful AMP would require:

- a. Dedicated people managing the AM planning process that do not have a role in day-to-day infrastructure operations.

- b. A continuous improvement process which includes a specific improvement programme with allocated resources and timeframes, actively monitored by senior management.
- c. A strong change management culture that ensures that processes and data, once developed, become embedded as 'business-as-usual' rather than a one-off compliance exercise to produce an AMP.

On the other hand, the Thromdes should be aware and careful not to set unrealistic goals in the improvement strategy. And the selection of people to undertaking the AM planning should have the right skills, have other 'jobs' to do as it usually hampers the process of planning.

3 ASSET MANAGEMENT PLAN

3.1 APPROACH

The process of asset management begins with initial collection of data and other important information, to understand status of the existing infrastructure and existing levels of service. Since the Thromdes are embarking on asset management programme for the first time, the Thromdes will have to development Asset Management strategy to define the target level of services for individual sectors. After that, an analysis of the gap between current and target levels of service will recognize the development needs as required to meet the target level of service.

The next step is to identify changes in demand for the service over the planning period (which should be a minimum of 10 years) and the impact this has on infrastructure needs. This will be influenced by the population growth, housing growth, commercial growth and many more. This follows risk analysis which is contemplate in a structured way, the things that can go wrong and what can be done to avoid or reduce the risk of such events taking place.

All the preceding steps are then used to identify the gaps and issues that need to be addressed in the AMP. This will be done through a combination of asset management strategies like new construction, upgrading, renewal, operations and maintenance, and disposal needs, and demand management over the planning period. A financial assessment of the AMP is in is necessary to fund the budget needs in a sustainable way, either through government subsidy or identify the tariff implications.

Finally, the process ends by assessing the way that infrastructure is managed at present, and determining what are the most appropriate steps to take next, in improving asset management practice. Once the plan has been drafted, it is essential that it is submitted and approved by Thromde Tshogde.

Figure 4 shows the approach identified for Asset Management Programme.

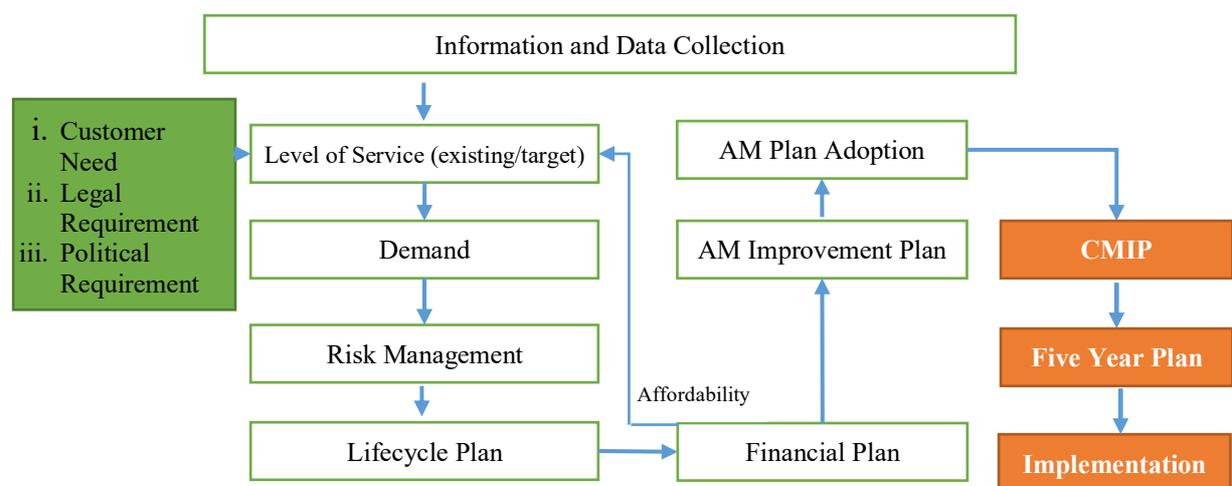


Figure 4 Approach for Asset Management Programme

3.2 METHODOLOGY

The Thromdes will be commencing the Asset Management programme for the first time. Thus, the first plan prepared for any service will be based only on existing available information established through the **Digitized Asset Register (DAR)**. Whilst the level of detail may be limited, the plan should cover all assets, and all the process steps. In drafting the first plan, it will become evident which elements of the plan need to be strengthened, and the ongoing iterative process of improvement will have commenced. The methodology adopted will be largely dictated by the availability of reliable and complete data, and information from available technical reports. The steps for initial asset management plan shall be as table below:

Table 1 Methodology for Preparation of Asset Management Plan

Step	Process	Activities
Step 1	Background and Context Information Collection	<ul style="list-style-type: none"> • Thromde mission, vision and functions • Structure Plan, Local Area Plan, etc. • Sectorial Master Plan • Thromde Budget, Financial Policy, • HR information • Existing performance • Socio-economic data
Step 2	Assessment of Level of Service	<ul style="list-style-type: none"> • Availability of present and target • Performance criteria, measures and targets, time frame
Step 3	Assessment of Future Demand	<ul style="list-style-type: none"> • Demand needs now and over planning period • How to address the gap
Step 4	Digitization of Asset Register	<ul style="list-style-type: none"> • Identify existing data • Establish geographic hierarchy • Desktop iteration of asset grouping • Collect data and capture into the asset register • Collate, validate and summarize
Step 5	Risk Assessment	<ul style="list-style-type: none"> • Identify corporate risk management framework • Establish service delivery risk assessment approach • Identify credible risks to service delivery • Identify risks to critical and important risks • Identify appropriate responses • Monitoring arrangements • Collate and summarize
Step 6	Review Life Cycle Needs	<ul style="list-style-type: none"> • Existing capital (new/upgrading) projects, and identification additional projects required over the planning period • Assessment of existing maintenance and operations practice and

		<p>resources, benchmark to industry practice, assess future needs</p> <ul style="list-style-type: none"> • Assessment of periodic renewal needs, existing plans and flag other needs in the planning period, with budget estimates • Assessment of any de-commissioning or disposal of infrastructure required
Step 7	Determine Financial Needs	<ul style="list-style-type: none"> • Overall financial performance of Thromde • Historic budget and expenditure relating to this service • Tariff structures and debt collection performance • Budget requirements over planning period • Funding plan and tariff implications
Step 8	Assessment of Asset Management Practice	<ul style="list-style-type: none"> • Assessment of existing practice (systems, processes, data, organizational arrangements) • Compliance with legal requirements • Identify priority areas for improvement of management practice
Step 9	Adoption of Asset Management Plan	<ul style="list-style-type: none"> • Submission to and Approval by Thromde Tshogde

3.3 DOCUMENTATION

International Infrastructure Management Manual (IIMM) has proposed a model format for documentation of Asset Management Plan. While it is possible to adopt other formats, this structure has a good flow from establishing future need thorough to strategies to meet the needs and finance. Figure 5 shows the proposed format of Asset Management Plan.

EXECUTIVE SUMMARY

(Summarizes the key issues in the plan)

1. Purpose
2. Thromde context
3. Asset description
4. Levels of service
5. Growth
6. Lifecycle Management Plan
7. Financial summary
8. Asset Management practice

SECTION 1: INTRODUCTION

(Outlines the purpose and scope of plan, socio-economic context, legal framework and the approach adopted in preparing the plan)

1. Background
2. Approach
3. Description of the network
4. Statutory framework
5. Relationship with other documents
6. Document format

SECTION 2: LEVELS OF SERVICE

(Identifies current and target level of service and performance measures)

1. Targets for provision of basic services
2. Customer expectations
3. Thromde's AM strategy
4. Current levels and standards of service
5. Gap analysis

SECTION 3: FUTURE DEMAND

(Identifies key factors influencing future demand, predicts future changes in demand and degree of certainty and considers demand management initiatives)

1. Current supply and demand
2. Assessment of future demand
3. Demand management
4. Projected demand
5. Supply ceiling

Figure 5 Format of Asset Management Plan

SECTION 4: RISK MANAGEMENT

(Outlines risk management approach, identifies critical assets, assesses risks and identifies appropriate responses)

1. Risk Management Framework
2. Asset Criticality
3. Network risk exposure
4. Asset and network level risks
5. Risk register
6. Insurance
7. Monitoring and review

SECTION 5: LIFE-CYCLE MANAGEMENT PLAN

(Assesses long-term development, renewal and routine operations and maintenance needs)

1. Replacement cost
2. Asset utilization and criticality
3. Development Plan
4. Renewal [Rehabilitation/Replacement] Plan
5. Operations and Maintenance Plan
6. Disposal plan

SECTION 6: FINANCIAL PLAN

(Identifies long-term financial forecasts and budget/funding issues and assesses risk)

1. Financial performance of Thromde
2. Operating activity
3. Projected capital and operational funding requirements
4. Analysis of funding requirements
5. Funding Plan

SECTION 7: ASSET MANAGEMENT PRACTICE

(Describes current IAM practices and identifies proposed enhancements)

1. Description of current practice
2. Gap analysis
3. Improvement Program
4. AM Plan adoption, review and monitoring

ANNEXURES

Maps
Summary of data
Practice assessment

4 COMPREHENSIVE MUNICIPAL INFRASTRUCTURE PLAN

4.1 PURPOSE

Comprehensive Municipal Infrastructure Plan provides a big picture view of the state of infrastructure in the Thromde and the key issues and strategic options. It is difficult to make level of service and funding decisions on one sector in isolation from the others as small level of service improvements may seem affordable until they are all added together.

With a CMIP, it provides an opportunity to Thromde in considering the priorities for infrastructure development between sectors as well as within sectors.

Figure 6 exemplifies how typical sector AMP will feed into the CMIP.

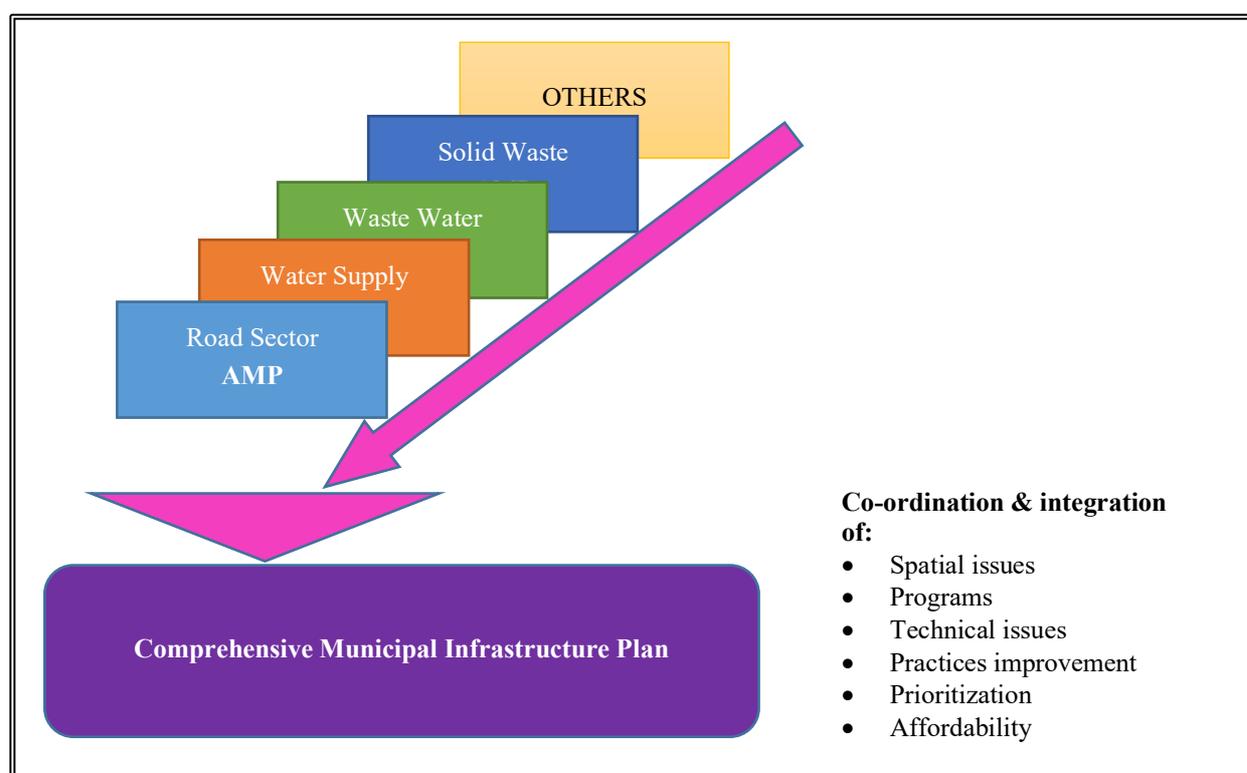


Figure 6 Integration of Asset Management Plans

4.2 PROVIDING ROBUST INFRASTRUCTURE INPUTS TO FIVE YEAR PLANS

The first 5 Year Plan set Bhutan on the way to planned national development. Since then, all the agencies have been developing their sectorial plans for formulation of National Level Five Year Plans. Thromdes, as a part of government agency, has also been developing Five Year Plan as principal strategic planning mechanism. However, the Five-Year Plan needs to be formulated based on robust information relating to the long-term management of the Thromde's infrastructure. The CMIP is the document, which will provide Thromde with confidence in the infrastructure inputs to the Five-Year plan as given in Figure 7

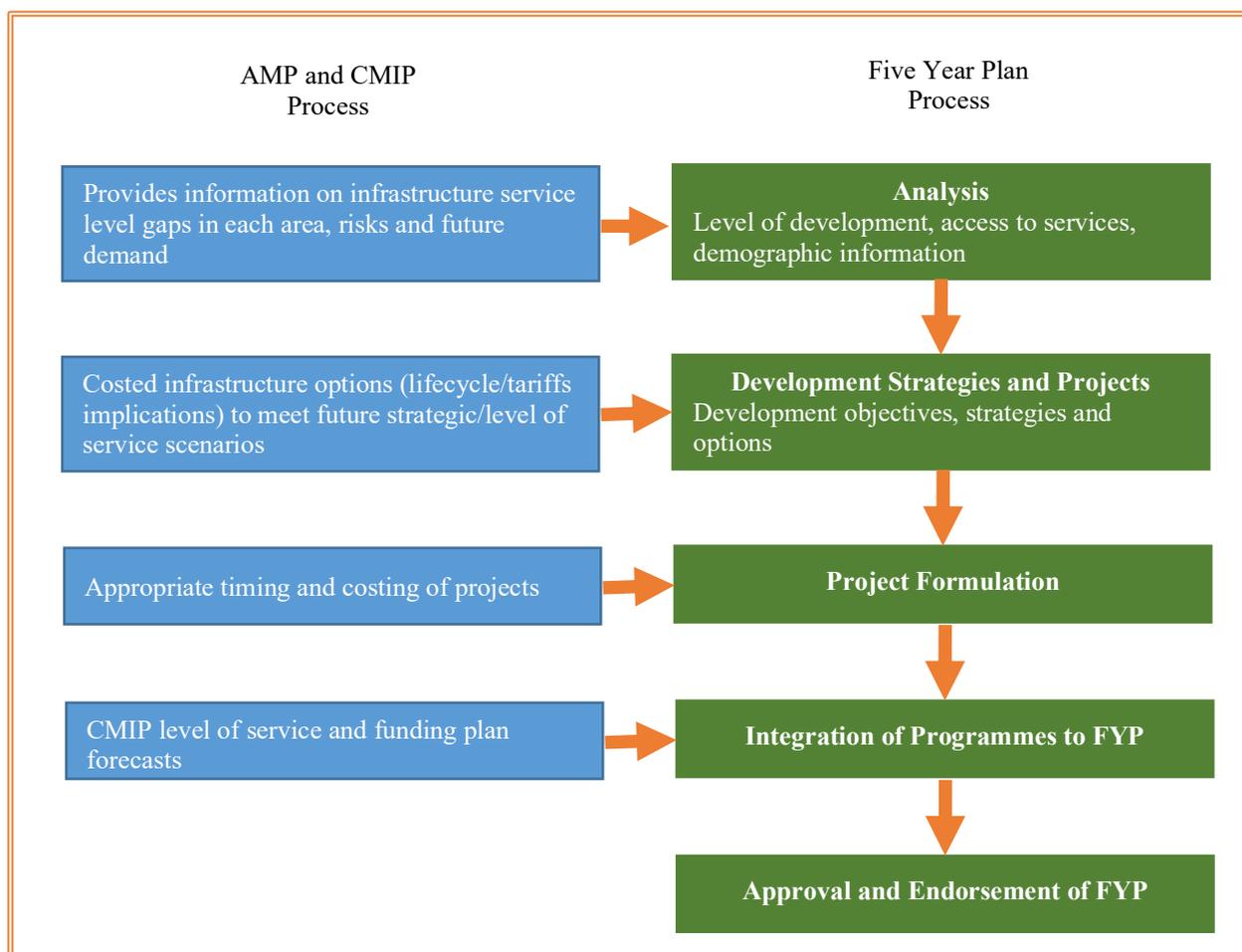


Figure 7 Infrastructure Input of Five-Year Plans

4.3 SUPPORTING MORE INFORMED DECISION MAKING

The CMIP should not be just a compilation of individual sector Asset Management Plan. Rather, it should draw out key information and strategic issues from each of the plans and present them in a way that enables decision makers to make informed decisions. The CMIP will enable these decisions to be made:

- a. with a clear understanding of the areas of needs and the community wants;
- b. with consideration of the long-term view and understanding of the lifecycle cost implications of investment decisions;
- c. with an understanding of the level of service implications of budget cuts;
- d. in a holistic way across sectors, so that trade-offs can be made both within sectors and between sectors;
- e. transparently, so that the rationale behind decisions is understood; and
- f. with confidence that proposed investments are sustainable and will achieve the benefits expected.

4.4 PROCESS FOR DEVELOPING THE CMIP

The Thromdes do not have existing mechanisms or structures to develop an asset management plan and has very little base asset data. Considering this situation, a timeline has been developed for formulation of CMIP.

Within two months of rolling out of Asset Management Programme, the Thromde should complete the awareness on importance of asset management and a proper AM policy should be developed. For successful implementation of the programme, Thromdes should institute a dedicated Asset Management Team.

By the end of fourth month, with the resources committed, the AM team will finalize their Thromdes asset management policy with a clear project plan for closing the necessary gaps in information and processes. A consistent structure and approach for individual sector AMPs will facilitate the compilation of the CMIP, and this can be done through the development of a pilot AMP of one of the sectors.

By the end of nine months, the DAR and individual sector AMPs should be completed.

After a year of roll-out, the CMIP should be in draft form and ready for consultation and finalisation. Figure 5-3 below illustrates the process for developing CMIP.

Table 2 Process of Developing CMIP

	Activity	Discussion
Start	Management commitment to proceed	The timeline indicated here starts after management are committed and resources are assigned to the process
Two Month	Awareness raising/training, AM policy developed and AM Team convened	Beginning of Asset Management Programme
Four Months	CMIP structure and process agreed.	The CMIP team should agree a common template for the AMP and the CMIP which has enough detail to show what information should be included and how it should be presented. For example, what prioritization frameworks should be applied and the financial forecast templates to be used
	Information and process gaps identified	This needs to be done early in the process to ensure that budget and time is allocated for information capture and analysis. A detailed ‘AM gap analysis’ is sometimes used. Plan and identify process and data shortcomings in going through that process.
	Project Plan developed	The CMIP needs to be managed as a formal project with budgets, timelines and responsibilities clearly allocated. The AM Team should get this developed and signed off by senior management.
	Resources confirmed	Staff time dedicated to project as outlined in project plan, service providers engaged (if required).

Nine Months	Development of ‘front-end’ information for CMIP.	Some information in the CMIP will be common to all sectors and is needed for the asset managers to compile AMP. Specifically, strategic objectives/vision, spatial development plans, population forecasts, demographic information and any other information relevant to all sectors should be developed and provided to asset managers
	Collation of asset registers.	Finalization of DAR
	Development of the AMPs	This process is described in detail in previous chapter
Twelve Months	AM Team reviews all the AMPs	A detailed review is carried out to ensure that the AMPs contain all the information required for the CMIP development.
	AMPs updated and finalised	To incorporate the gaps in information identified above.
	First cut CMIP collated and reviewed by AM team.	CMIP team to review the collated results and see if the projected forecasts and strategic scenarios are plausible and fit for submission to elected representatives and the community as a draft proposal.
	Reviews and finalisation of draft CMIP.	There will be a process of grouping each sector’s strategic scenario into one investment levels. Projects will be ranked according to the optimized decision making approach adopted.
End of Process	Community consultation	Consultation over strategic scenarios with Thromde tsogpas and residents.
	Agree outcomes	
	Finalise CMIP	For adoption by the Thromde and submission into the FYP process.

4.5 SAMPLE FORMAT FOR CMIP

SUMMARY

Easy to read summary of strategic issues and options and financial forecasts that can be read as a stand-alone document by a layperson.

ABOUT THE PLAN

What it contains, how it was developed, fit with other planning documents, how you can be involved in decisions.

SECTION 1: OVERVIEW OF THE THROMDE

- Strategic vision
- AM policy
- Key statistics – to give a big picture view of the scope and type of community and infrastructure involved (e.g.: population, demographics, infrastructure value and quantity, past expenditure)

SECTION 2: STRATEGIC ISSUES, OPTIONS and PRIORITIES

- national targets for infrastructure development
- strategic issues – gap between current infrastructure development and national targets.
- strategic level of service and budget scenarios
- major proposed projects in order of priority
- for final plan, should also include a discussion of community feedback on the options and the rationale for the
- adopted scenario

SECTION 3: SECTOR SUMMARIES

- For each sector area, provide an infrastructure overview, important sector issues, level of service targets for the preferred option with 2 alternatives proposed, key risk areas and financial forecasts.
- water supply, sanitation, solid waste, roads and storm water, etc.

SECTION 4: CONSOLIDATED FINANCIAL FORECASTS

- cash flow projections
- tariff implications, including subsidization requirement

SECTION 5: CONSOLIDATED IMPROVEMENT PLAN

- improvement projects, priorities, timeframes and costs

Figure 8 Format for CMIP

Figure 8 above is a suggestive format for development of CMIP. The format may be modified to suit the needs of Thromdes and in its final form to present the adopted solutions.

4.6 SUMMARY

Thromdes are presented with one budget call every year, that approved budget needs to address a wide range of competing needs. The objective of the CMIP is to communicate to decision-makers all relevant information relating to infrastructure in one brief document. It is based on an aggregation of the holistic and long-term needs of each sector, as identified in the AMPs, as well as an analysis of common themes, issues of alignment and priority.

5 BASIC ASSET MANAGEMENT TOOL

5.1 INFORMATION AND DATA COLLECTION

The first step towards for the preparation of an AM Plan and CMIP is to identify existing available information and assess its relevance, accuracy and compatibility with other information. It is advantageous to use as much existing information as possible; however, it is important to validate the information. Any shortcomings in information needs to be noted, and where necessary, reasonable assumptions made. If the information available does not suffice the data requirement, further exercise on data collection should be carried out.

5.1.1 Digitized Asset Register

Property Management Manual covers the Inventory and Registration of Properties and prescribes procedures for Maintenance of Inventory of Properties and Maintenance of a Fixed Asset Register. In compliance with the Manual, the Thomdes have already prepared or are in the process of preparing DAR.

In most of the organizations, silos form around areas of knowledge or expertise. A digital asset register helps to bridge the gap between finance and engineering by offering financial and planning managers an integrated view based on asset life-cycle aspects.

Under DAR developed for Thomdes, each of the assets fall into either one of the 17 Asset Functions. These Asset Functions are assigned their Unique Function ID, Function Name, Function Description and Function Code as given in Figure 9.

Furthermore, each asset is also assigned the status as Figure 9.

Status ID	Asset Status	Status Description
1	In Service	In Service
2	Leased Out	Leased Out
3	Transferred	Transferred
4	Under Maintenance	Under Maintenance
5	Idle	Idle
6	Disposed	Disposed

Figure 9 Asset Status

Function ID	Function Name	Function Description	Function Code
1	Water Supply-Generation	Water Supply-Generation	WSGE
2	Water Supply-Transmission	Water Supply-Transmission	WSTR
3	Water Supply-Distribution	Water Supply-Distribution	WSDS
4	Sewerage-Collection	Sewerage-Collection	SECL
5	Sewerage-Treatment	Sewerage-Treatment	SETT
6	Roads and Bridges-Roads	Roads and Bridges-Roads	RBRO

7	Roads and Bridges-Bridges	Roads and Bridges-Bridges	RBBR
8	Land and Building-Land	Land and Building-Land	LBLN
9	Land and Building-Building	Land and Building-Building	LBBU
10	Solid Waste-Collection	Solid Waste-Collection	SWCL
11	Solid Waste-Treatment	Solid Waste-Treatment	SWTT
12	City Beautification	City Beautification	CUCB
13	Urban Forestry	Urban Forestry	CUUF
14	Electrical-Street Lighting	Electrical-Street Lighting	ELSL
15	Office Assets-Administration	Office Assets-Administration	OAAD
16	Office Assets-Operation	Office Assets-Operation	OAOP
17	Office Assets-Inventory	Office Assets-Inventory	OAIN

Figure 10 Asset Functions under Thromde DAR

5.1.2 Asset Management Information System

Asset Management Information System (AMIS) will support Thromde in managing its infrastructure assets. The functionality and degree of sophistication of the system needs to be appropriate to the nature, size, and complexity of assets, and the capacity of the Thromde. The sophistication of AMIS will depend on the Asset Management Policy of the Thromde. At present, the simplistic DAR could be adequate. However, with the growth of the Thromdes and availability of sophisticated (and relatively expensive) systems, Thromde may choose to migrate to newer system.

5.1.3 Expected Useful Lives of Assets

The Property Management Manual, as an appendix has determined that Expected Useful Lives of major assets. Table 3 below is the expected useful life extracted from the PMM. The tables need to be reviewed by each Thromdes omitting assets not applicable and adding new ones where necessary.

Table 3 Expected Useful Life under PMM

SI	ITEM	Expected Useful Life
1	Land	Infinite
2	Building Permanent	70 years
3	Building Semi-Permanent	25 years
4	Road Black Top	-
5	Road Forest	-
6	Bridge Permanent	70 years
7	Bridge Semi-permanent	20 years
8	Electrical Installation	10 years
9	Transmission line High Tension	50 years
10	Transmission line Low Tension	20 years
11	Sub-station equipment	20 years
12	Generators	6 years
13	Furniture, fixtures, fittings – Steel	12 years
14	Furniture, fixtures, fittings – Wooden	10 years

15	Office equipment	6 years
16	Vehicle – Heavy, medium, light and 2 wheelers)	6 years
17	Vehicle – Heavy, medium, light and 2 wheelers)	7 years
18	Earthmoving and other machinery – (heavy, medium and light)	6 years
19	ICT equipment	6 years
20	Tents/tarpaulin/linen etc.	6 years

Under the Property Management Manual, most of the infrastructure assets are not listed. Table 4 is a suggestive Expected Useful Life for other assets not listed under PMM. The Expected Useful Lives must also be checked to ensure that they are realistic in view of the standard of design and construction, the utilization and the operating environment.

Table 4 Expected Useful Life of other assets not listed under PMM

SI	ITEM	Expected Useful Life
1	Perimeter protection (Fencing, walls, gates)	15
2	Paved arterial and distributor roads	25
3	Paved collector and residential roads, and parking areas	50
4	Gravel roads and parking areas	25
5	Footpaths	10
6	Streetlights	25
7	Road signs	7
8	Guard rails and commuter shelters	15
9	Boreholes (Civil)	35
10	Springs (Civil)	35
11	Treatment Works (Civil)	50
12	Pump Stations (Civil)	50
13	Pump Stations (Electro-mechanical)	25
14	Storage Reservoir (Civil)	50
15	Transmission Pipelines	100
16	Distribution Pipelines	75
17	Water Meters	15
18	Mechanical Plant	15
19	Electrical Plant	15
20	Outfall sewer	60
21	Sewer reticulation	60
22	Erosion protection structures	15
23	Storm-water pipelines and lined channels	50
24	Landfill site (civil)	20
25	Solid Waste Disposal Vehicles	10
26	Sludge Disposal Vehicles	15

5.1.4 Asset Valuation

It is essential that monetary value be ascribed to the infrastructure for a number of reasons. For asset managers, one of the most important reasons is to understand the cost of asset depreciation and replacement and to make sure there is sufficient funding to maintain the network in the long term.

The figures in the financial statements are more than book entries, but are a financial representation of the potential service value of the assets to the community and their consumption over time. The approach recognizes that a range of factors may affect the life expectancy of an asset. Consequently, periodic re-assessment of actual remaining useful life is essential, particularly as the lives of infrastructure assets may span several decades. A Depreciated Replacement Cost (DRC) approach to valuation of infrastructure assets is proposed.

Also, **Asset Valuation Guidelines** has been prepared as a supplementary document to this manual.

5.2 ASSET KNOWLEDGE

The information and data collected needs to be summarized in a way that will inform asset management decision making. Data will need to be reported in a way that is easily understood, with summaries for asset types, and an area basis, as well as the ability to drill down to specific assets. Figure 6 exemplifies aggregated report outputs derived from the data in Digitized Asset Register that can be used to guide and inform tactics used in the AM Plan.

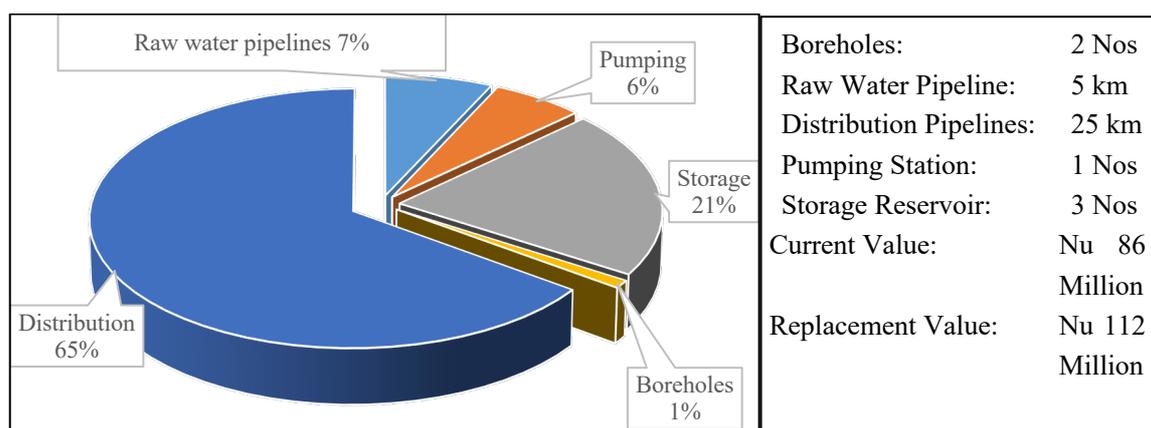


Figure 11 Example of Data Presentation: Nature and Extent

5.3 LEVEL OF SERVICE

One of the most important activity in asset management is to understand the service level gap, that is, the gap between the service that is currently being provided by the network and the service that is desired by customers and end users.

The detailed procedure for determining the existing Level of Service (LOS) is described in Performance Reporting System for Thromdes.

While the methodology to determine the existing LOS is prescribed, the Thromde, through its Asset Management Policy has to set the target level of service for its infrastructure.

5.4 DEMAND

The present nature and factors influencing the demand for the infrastructure has to be understood. Demand can, and often will, change over time depending on a number of factors, as summarized below in Table 5:

Table 5 Factors Influencing Demand

Factor	Examples
Basic increases/decreases in demand	<ul style="list-style-type: none"> • Population growth/decline and dispersion • Business/economic growth and changes • Land use changes, e.g. intensification
Changes in unit demand	These relate to higher consumption of infrastructure services by individual persons, households, businesses and institutional users over time
Changes in customer expectations	<ul style="list-style-type: none"> • Better safety, less delay, smoother travel • Cleaner water, higher pressure • Environmental consciousness

Having identified the key demand factors, and considered the impact of demand management interventions, a profile of future service demand can be quantified based on projected future scenario. This profile will dictate the nature, location, and extent of future infrastructure needs that need to be addressed in the Life-Cycle Plan.

5.5 RISK MANAGEMENT

All Thromdes and local governments are required to prepare a Disaster Management Plan (DMP) in accordance of the Disaster Management Act of Bhutan. Disasters are defined in the plan as events that cause death or disease, or damage to property, infrastructure or the environment, or disrupt community life, and “exceed the ability of those affected to cope with its effects using their own resources”. The plan focuses on preparedness for emergency response, and includes a mechanism to mobilize available local resources, and, where necessary, to escalate by referring incidents to a higher level. The DMP has to be included in the Thromde’s FYP and Thromde Tshogde is obliged to address all identified mitigation actions. The infrastructure risks identified in the AMP should inform the reviews of the DMP.

The risk management process needs to be tackled at two levels, as:

- a. at **infrastructure network level**, identify events that could impact on the performance of the service. Focus on identifying risk events that will have a major consequence and
- b. at **asset level**, identify the most significant events that could cause critical assets to fail

The approach risk management can be as follows:

- a. identify risk events;
- b. determine the Thromde’s exposure to each risk event; and
- c. determine an appropriate response to each risk event.

5.5.1 Risk Identification

Risk events should be identified by officials who are familiar with the assets and their operating environment. This can be done by an individual, but there are benefits in discussing potential

risk events on a collective basis. Below in Table 6, is a schedule of commonly encountered risks that can be used to stimulate discussion of potential risk events.

Table 6 Schedule of Commonly Encountered Risk

Physical	<ul style="list-style-type: none"> • Condition-based failure • Vandalism • Theft/illegal connections • System losses
Operational	<ul style="list-style-type: none"> • Operator error • Misuse • Theft • Sabotage • Inadequate safety measures • Insufficient skills & capacity • Delays in contracts • Under or over utilization
Technical	<ul style="list-style-type: none"> • Inadequate planning • Inadequate data • Inadequate systems capability • Inadequate design • Fitness for purpose • Inadequate construction standards • Insufficient infrastructure capacity • Infrastructure obsolescence • Inadequate maintenance
Financial	<ul style="list-style-type: none"> • Inadequate CAPEX budget • Inadequate OPEX budget • Inefficient collection • Prohibitive O&M costs • Unforeseen budget cuts
Institutional	<ul style="list-style-type: none"> • Poor morale • Inadequate or cumbersome processes • Ineffective strategic leadership • Unclear targets/goals
Social	<ul style="list-style-type: none"> • Social Change in expectations • Change in demand
Natural Disaster	<ul style="list-style-type: none"> • Flood • Earthquake • Windstorm

5.5.2 Consequences of Risk Events

A consequence rating or Risk Rating has to be allocated to each risk event. Whilst sophisticated techniques exist that attempt to quantify these consequences, a more qualitative approach is often more practical, using a guide such as shown in Table 7. Consequence tables are very specific to the size and type of assets, and organizational needs – thus the table should be developed with inputs from senior management of the Thomde.

Table 7 Sample Risk Consequence Table

Consequence Rating	Qualitative Description	Direct Cost (repair, Lost Income, Third party Damage)	Service Delivery Performance	Effect of Public health Safety and Property	Environmental Damage
1. Insignificant	Is readily absorbed under normal operating conditions	< Nu 100,000	Less than 50 customers without potable water for up to 8 hours	No health or safety impact, minor property damage	Minor transient environmental damage, visual effects only
2. Minor	Can be managed under normal operating conditions	Nu 100,000 – NU 500,000	Less than 50 customers without water for up to 24 hours	Minor health impact on small number of people	Minor damage to environment, longer effect
3. Moderate	Can be managed but requires additional resources and management effort	Nu 500,000 – Nu. 1000,000	Less than 50 customers without potable water for up to 48 hours	Serious health impact on small number or minor impact on large number of people	Moderate environmental damage, local importance
4. Major	Will have a prolonged impact and extensive consequences	Nu 1,000,000 – Nu 5,000,000	More than 50 customers without potable water for a period of over 48 hours	Extensive injuries or significant health impacts, single fatality	Major long term environmental impact. Prosecution expected
5. Catastrophic	Irreversible and extensive impacts, or significantly undermining key business objectives	>Nu 5,000,000	More than 500 customers without potable water for a period of over 48 hours	Multiple fatalities	Serious damage of national importance and irreversible impact. Prosecution expected.

In asset management planning, a specific risk event that is central to decision-making is asset failure. It is important to determine for each asset by contemplating the consequence of failure of the asset aggregated across the following potential outcomes:

- health and safety;
- financial losses;
- service delivery performance; and

- environmental impacts.

5.5.3 Probability of Risk Events

A probability rating is allocated for each risk event. Whilst statistical probabilities may be used, Thomdes may find it more practical to use subjective criteria, as indicated in Table 8.

Table 8 Risk Probability Rating

Rating	Probability	Qualitative Description
A	Rare	May occur only in exceptional circumstances
B	Unlikely	Will probably not occur
C	Moderate	Could occur at some time
D	Likely	Will probably occur
E	Almost certain	Is expected to occur

5.6 LIFECYCLE PLAN

The life-cycle plan is a considered response to the needs identified in the preceding elements of the AM Plan i.e. the Thomde’s strategic vision, the Level of Service gaps, the pattern of future demand and demand management interventions, and service delivery risks.

The plan will indicate the approach adopted by the Thomdes in managing the lifecycle of each asset type, that is when replacement or renewal is done, how new projects are identified and prioritized, operation and management practice, contracted out or in-house resources, adopted standards, etc.). Initially this may mean simply documenting the way things are done at present and in later AM plans stating formally adopted strategies. One of the key outputs from the risk assessment will be the identification of priority needs for capital renewal. The plan will indicate currently committed capital projects, projects identified in the current FYP, and link these to the identified, making adjustments to the project scope and timing as may be necessary, and identifying the project needs over the balance of the planning period. The linkage of each project to each need will be documented in this section of the plan. The projects will include new construction, upgrading, and capital renewal.

Multi-term budget forecasts are prepared for the planning period using some form of financial model. Typically, a unit rates approach is used, though the level of sophistication can vary depending on the accuracy required by the Thomdes. The unit rates need to be appropriate to the particular local environment, and take into account that renewal costs may be materially different to new construction. Alternative asset solutions to addressing each need should be examined in the AMP and the optimum solutions reflected in the overall budgets. The detailed technical response to each need will be examined in more detail at project level.

There are numerous factors that can influence the level of operations and maintenance effort required. These include locality-specific issues such as geotechnical conditions, climatic conditions, social conditions, standards of design and construction, economy-of-scale, spatial distribution etc. The budget should be informed by an O&M Plan that is consistent with the performance criteria and risk assessment. Ideally it should point to the resource required to support the strategies determined for each asset type. It should cite any need for budget adjustment based on the assessed risk associated with current budget and O&M practices, and

motivate the need for the preparation of an O&M Plan. The Operation and Maintenance as a function of Current Cost is given in **Annexure 1**.

Figure 12 Example of Life Cycle Plan

Lifecycle Plan: Waste Water Treatment System

Asset Information

The mission of the Thromde is to serve the public by collecting, transporting, recycling and treating wastewater in a safe, reliable, efficient, cost effective and environmentally responsible manner, while providing excellent service to customers.

Key Issues:

- The waste water collection system has not been able to cater to the entire residents of the Thromde
- During rainfall, there are overflow from manholes
- There are foul odour generating from the treatment plant

The Thromde has a modular biological sewage treatment plant, which has been developed to meet the demands of the sized isolated sewage treatment applications. The treatment plant has a capacity to 10,000 users or approximate 0.8 million litres of wastewater per day. The reticulation system is comprised of 16 kilometres of 200 mm diameter HDPE pipes. There are 250 brick masonry manholes with cast iron manhole covers.

Maintenance Strategies

The maintenance strategy includes:

- Cleaning of motors and pumps
- Routine cleaning and maintenance of blowers, setting tanks, filter unit
- Replacement of filters
- Routing inspection of manholes

Work Program

1. Historical Expenditure

The modular treatment plant was installed in 2008 at a cost of Nu 15 million. The total cost for civil works to develop the plant amount to Nu. 4.8 million. During the first phase, 5 kilometres of reticulation network was developed at a cost of Nu. 9.0 million in year 2008. The second phase of network development was completed in 2010 at a cost of Nu. 11 million with an augmentation of 7 kilometres. The third phase of augmentation of network developed another 4 kilometres at a cost of Nu. 7.8 million, which was completed in year 2013.

2. Maintenance Forecast

The current maintenance budget allocated for Wastewater system is not able to cover all the required maintenance activities. In addition to the maintenance of the plant, the main holes and pipelines are in dire need of maintenance, which were not carried out due to shortfall in budget.

3. Renewal Forecast

More than 10 % of the manholes require major maintenance.

4. Development Forecast

In order to achieve 100% of wastewater treatment coverage, the Thromde will have to enhance reticulation network. In doing so, the treatment plant has to be augmented with another modular unit to enhance the capacity for additional 5,000 users. The cost in development will be:

- a. Cost of additional modular plant: Nu. 9 million
- b. Cost for civil works for the plant: Nu. 3 million
- c. Cost of addition 9 kilometres of reticulation network: Nu. 18 million

The unit rates, O&M estimates, and Expected Useful Life figures can be used to determine the life-cycle cost of infrastructure. Table 9 below is an illustrative example of Lifecycle cost calculation for the modular waste water treatment plant. Assessment of the life-cycle costs of specific assets can be used to inform decisions between alternative solutions for new infrastructure or replacement/rehabilitation options.

Table 9 Sample Calculation of Lifecycle Cost: Modular Wastewater Treatment Plant

	Cost Element	Calculation	Amount
a)	Development		
	Civil Works	Nu 4.5 million	Nu 4.5 million
	Treatment package plant	Nu 15 million	Nu 15 million
	Sub-total		Nu 19.5 million
b)	Annual Operation		
	Civil Works	0.1 % x Nu 4.5 million (Annexure 1)	Nu 4,500
	Treatment package plant	3% x Nu 15 million	Nu 450,000
	Sub-total		Nu 454,000
c)	Annual Maintenance		
	Civil Works		Nu 22,500
	Treatment package plant	3.3% x Nu 15 million	Nu 495,000
	Sub-total		Nu 517,500
d)	Renewal		
	Civil Works	No renewal for 50 year	0
	Treatment package plant	2 x Nu 15 million (useful life is 15 years)	Nu 30.00 million
	Sub-total		Nu 30.00 million
e)	Lifecycle Cost	over 50 years	
	Development	0	Nu 19.50 million
	Annual Operation	Nu 454,000 x 50	Nu 22.70 million
	Annual Maintenance	Nu 517,500 x 50	Nu 25.875 million
	Renewal	Nu 45,000,000	Nu 30.00 million
	Less Residual Life	15-year life remaining for plant (15/25 x Nu 15 million)	-Nu 9 million
Total			Nu 89.075 million

5.7 FINANCIAL PLANNING

Subsequent to the budget call from Ministry of Finance, Thromdes identify all their projects and prepare budget for the financial year. These capital projects have the purpose of enhancing the Thromde's ability to provide services, or to strengthen the Thromde's potential. This is done through the construction of new infrastructure or through infrastructure upgrades such as the widening of a road or a process improvement in a water treatment works.

Most of these projects will typically require a capital investment such as construction costs and cost of the mechanical plants, after which the asset will require operational and maintenance expenditure to protect the condition of the asset and to provide service benefits, as well as periodic renewals that require further capital injections. Some of these assets may provide the Thromde with a constant revenue stream like water and wastewater systems, whilst others will not. However, the Thromde needs to be sure that it can afford all the lifecycle costs that will be incurred by the asset, not just the up-front investment. For this purpose, every project proposal must be accompanied by a financial forecast to determine the financial sustainability of the asset.

A financial forecast will determine all the expenditure to be incurred during the asset's lifecycle, and all revenue that maybe realized as a result of the asset being operated. However not all assets or infrastructure services are self-sustaining. By combining the income and expenditure requirements of all infrastructure assets across the major services, Thromde can determine the subsidy requirement from the central government.

5.7.1 Detailed assessment of projects: preparation of financial forecasts

A financial forecast projects all revenue and expenditure associated with the project over the lifespan of the asset. The forecast will indicate whether the asset or service will realize surplus revenue or incur losses, that will indicate whether it will be financially sustainable or not. The following general guidelines apply to infrastructure projects' financial forecasting:

- a. **Lifecycle costs:** Any capital investment project should show an associated operating and maintenance cost and the depreciation expense associated with the new assets.
- b. **O&M forecasts:** As well as the commissioning of new assets, O&M forecasts need to give due consideration to possible increase in maintenance as assets age, how levels of service targets will be achieved (considering the service levels gaps) and the impact of changing the service delivery strategy.
- c. **Renewal forecasts:** These can often be one of the most complicated areas to assess, particularly for underground assets where condition and remaining life is not so easily assessed. The approach is often to rely on performance issues to occur to predict exact renewal timings, and these generally only occur very late in the lifecycle. Therefore, for underground assets, renewal projects may only be able to be accurately determined in the short term. For longer term predictions, these should as a minimum be based on the assumption that assets will be replaced at the end of their expected useful life. As long as the asset register contains:
 - the replacement cost
 - the age
 - the useful life

then the expected replacement date for each asset can be calculated and a longer renewal forecast prepared will give an indicative prediction of asset life.

- d. **The impact on individual rate payers** should always be shown.
- e. **Inflation is generally excluded** from financial forecasts.
- f. **All revenue relevant to the asset/service must be recorded.** It is considered prudent to present various revenue scenarios – where revenue is contingent on direct customer payments – based on varying levels of payment received.
- g. **Forecasts should be compiled for a period of 20 years**, unless it is expected that the probable revenue or benefits and expenditure or costs will be for a shorter period.

A key objective of asset management is the provision of levels of service that are affordable. For this purpose, it is appropriate to model various levels of service scenarios into financial forecasts, to assess the financial impact thereof. The following two figures present two scenarios, as follows:

- a. Scenario A: Base case (expenditure required to maintain existing service levels)—this may be higher than current funding levels because of past underfunding, often because of the short-term decision-making approach embedded through annual budget rounds—it is easy to make annual budget cuts and ignore the longer-term implications; and
- b. Scenario B: Moderate level of service improvements.

The Thromde may choose the most appropriate way to conduct their financial forecasting. Furthermore, it has to be realized that financial forecast provides a platform for Tariff setting of Thromde services.

5.7.2 Tariff Setting

Currently, there is no uniform and consistent process followed for the setting of tariffs for Thromde services. Although, Thromdes are collecting service fees for its water and wastewater services, heavy government subsidy is still required for sustenance of these services. Replacement of existing infrastructure and development of new infrastructure are entirely dependent on funding sources appropriated by the central government.

Local Government Act of Bhutan states that Thromdes shall be responsible for the provision of utility services, including roads, electricity, water supply, drainage, sewerage, garbage collection and disposal. Moreover, Local Governments shall be entitled to levy, collect and appropriate taxes, duties, tolls and fees in accordance with such procedure and subject to limitations as may be provided for by law. It is important that the Thromdes set their Tariff Policy for the benefit of both the Thromde and its customers.

Ministry of Economic Affairs has published the Domestic Electricity Tariff Policy in 2016, to provide guidelines for domestic tariff determination which will be applicable for all the customers. The guiding principle of tariff formulation includes:

- a. Gearing Ratio
- b. Cost of Equity
- c. Cost of Debt
- d. Operation & Maintenance (O&M) Expenses

- e. Depreciation
- f. Weighted Average Cost of Capital (WACC)
- g. Interest on Working Capital
- h. Regulatory Asset Base
- i. Treatment of Granted Assets
- j. Investment & Expansion Plans
- k. Allocation Factors of Transmission and Distribution Assets
- l. Accounting of Imported Energy
- m. Non-Tariff Revenues
- n. Tariff Structure
- o. Subsidy
- p. Allocation of Energy for Domestic Supply
- q. Treatment of Unutilized Demand Capacity
- r. Royalty Energy
- s. Tariff Revision Cycle

Thromdes, across the country, should draw and adopt a similar tariff formulation policy to ensure that tariff for Thromde services throughout the country are based on common principles.

5.8 ASSET MANAGEMENT PRACTICE IMPROVEMENT PLAN

Sound management practice is required to implement Thromde's asset management policy. Indeed, without appropriate management practices there is very little hope that the asset management policy and plans can be successfully implemented. Infrastructure asset management practice improvement therefore considers the practice associated with the total asset management process, from the strategy to the implementation practices.

5.8.1 Approach to Improvement Planning

Asset management is an evolving process that improves as the condition, performance and operational cost requirements of assets become better understood. To ensure that supporting activities are improved and incorporated into asset management plans, an improvement plan is required to accomplish this in a planned and progressive manner.

Improvement of asset management practice is not achieved through a single exercise, rather it is a continuous process that requires commitment at all levels. In planning for improvement, the Thromdes should pursue reasonable milestones that can be achieved. This means that these milestones should be coupled to reasonable timeframes, and has sufficient budget allocation, if there is a financial implication. Care also has to be taken of the Thromde's ability to absorb the impacts of changes or additional work load introduced through improvement actions.

Typical methodology for asset management planning involves:

- a. Review the current status and level of sophistication of asset management activities within the organization including:
 - Processes used in the implementation of asset management activities;
 - Asset data and knowledge its appropriateness, reliability and accessibility;
 - Information systems to support (and often replicate) asset management processes and store and manipulate data;

- Asset management plans to identify the optimum life-cycle management tactics and resources;
 - Implementation tactics including organizational, commercial and people issues.
- b. Identify a 'future vision' (10 years plus) and 'appropriate practice' (3-year target) for the organization in terms of asset management practices.
 - c. Complete a gap analysis by assessing the differences between 'current' and 'appropriate' asset management practice).
 - d. Determine options, costs and benefits to overcome identified gaps. c)
 - e. Adopt an achievable improvement program (2-3 years).
 - f. Determine a final long-term improvement program
 - g. Monitor and review the implementation program.
 - h. Complete regular reviews (continuous improvement monitoring).

Asset Management Improvement milestones are given in table 10.

Table 10 Asset Management Improvement Milestones (Source: World Bank Advisory Note)

Stage 1 Improvement Strategy Development	<ul style="list-style-type: none"> • Needs analysis / status assessment • Setting base strategy/asset management objectives • Asset data classification • Collection priorities confirmed • Asset management improvement program adopted
Stage 2 Basic Asset Register	<ul style="list-style-type: none"> • Set up basic asset register • Asset management information system • Identification of all assets • Basic data captured • Asset replacement cost determined • Asset replacement timetable determined • Initial asset management plans • Current levels of service identified • Basic valuations prepared
Stage 3 Basic Asset Management	<ul style="list-style-type: none"> • Improve attribute data • Introduce basic condition assessment • Valuation based on condition • Optimize data collection for critical assets • Maintenance history data identified • Second generation (basic) asset management plans prepared • Renewal decision-making processes documented • Determine target levels of service based on stakeholder consultation • Costs captured against assets
Stage 4 Improved Maintenance Management	<ul style="list-style-type: none"> • Review maintenance procedures • Apply improved procedures to assets • Schedule procedure intervals • Review maintenance plans for key assets • Begin to introduce asset criticality analysis and risk management
Stage 5 Introduce Advanced Asset	<ul style="list-style-type: none"> • Complete failure analysis on all key asset groups and critical facilities

Management Techniques	<ul style="list-style-type: none"> • Complete consequence of failure (risk management) analysis on all assets • Apply these findings to the life-cycle strategy and maintenance plans for assets • Valuations based on true economic lives
Stage 6 System Optimization	<ul style="list-style-type: none"> • Optimized life-cycle and economic decision making used for planning levels of service, based on ongoing stakeholder consultation • All options for overcoming failures analysed • Benefits for each option quantified • Costs for each option quantified • Most appropriate strategy for each asset, facility or system identified • Advanced asset management plans developed

5.9 ASSET MANAGEMENT PLAN ADOPTION

The AM Plan for each sector shall be drafted and to be submitted to Thromde Tshogde for information and formal adoption.

5.10 CONSOLIDATING ASSET INFORMATION AND STRATEGIES FOR THE CMIP

Chapter 4 has already provided the detail procedure for developing of Comprehensive Municipal Infrastructure Plan. This section intends to provide more detailed description on sector summaries that is vital for development of CMIP.

A typical sector summary shall contain the following four key information:

- infrastructure overview
- key sector issues and risks
- level of service targets/scenarios
- page financial forecasts

Below are illustrated examples of sector summary report.

a. Infrastructure Overview

Example: Wastewater Treatment System

	Land Use/ customer types	Asset quantities	Asset Value	Typical Age and Condition	Level of service currently provided
	Residential: 70% Commercial: 20% Institutional: 10%	Modular Treatment Plant 16 kms of collection network 250 masonry manholes	Current Value: Nu 40 Million Replacement Cost: Nu 65 million	Plant is 100% functional and 10 years old 5 kms of network is 10 years' old 7 kms of network is 8 years old	80% coverage of the Thromde has been achieved

				4 kms of network is 5 years old	
--	--	--	--	---------------------------------	--

The description in the table could be supported by a couple of key graphs such pictures to prove asset condition and other graphical illustration of the key statistics.

b. Key Sector Issue

Issues

- The waste water collection system has not been able to cater to the entire residents of the Thomde
- Illegal connect of rainwater draining to sewer network and During rainfall, there are overflow from manholes
- Condition of manholes are deteriorating
- There are foul odour generating from the treatment plant

Risk

- The treatment plant being next to the river, has potential risk of flooding which would lead to damage of infrastructure and contamination of the river
- Vandalism and theft of manhole cover is rampant
- Since the plant is imported from Europe, risk of mechanical part failure would lead to complete shut down

c. Level of Service Targets

It is important to keep focused on just a few key outcomes when selecting levels of service (performance standards) for the CMIP. These may well be supported by more technical and detailed levels of service in the AMP.

- To achieve 100% coverage in the Thomde jurisdiction

d. Financial Forecast

This section shall provide the detail financial forecast for the sector.

BIBLIOGRAPHY

1. International Infrastructure Management Manual, 5th Edition, Institute of Public Works Engineering Australia, National Asset Management Steering (NAMS) Group. New Zealand, 2015
2. Strategic Municipal Asset Management Advisory Note, Worley International Ltd., The World Bank, 2000
3. A Toolkit for Municipal Asset Management, RTI International, <https://communitywealth.org/sites/clone.communitywealth.org/files/downloads/tool-rti-asset-mgmt.pdf>