An Integrated Investment Appraisal of a Water Projects in Zimbabwe

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Abstract

Public resources are finite and, as such, should be employed efficiently. There is an opportunity cost in the use of resources in one project over another. Hence, there is a need to ensure that resources are put to their best use, given that the same resources can be allocated to alternative uses. The Water Supply Projects Appraisal Manual (WSPAM) serves to scrutinize proposed water supply projects to ensure that public expenditure in the development of water supply infrastructure in Zimbabwe leads to the achievement of development objectives and socio-economic growth. The WSPAM provides guidance on the methodology and best practices employed in the development and appraisal of water supply projects.

Keywords: Cost Benefit Analysis, Water, Public Investment, Zimbabwe

JEL Classification: D61, I38, L95, O55, Q25

1. INTRODUCTION

1.1. Purpose of the Manual and its Relationship with the PIM Guidelines

Public resources are finite and, as such, should be employed efficiently. There is an opportunity cost in the use of resources in one project over another. Hence, there is a need to ensure that resources are put to their best use, given that the same resources can be allocated to alternative uses. The Water Supply Projects Appraisal Manual (WSPAM) serves to scrutinize proposed water supply projects to ensure that public expenditure in the development of water supply infrastructure in Zimbabwe leads to the achievement of development objectives and socio-economic growth.

The WSPAM is an instructive tool in the origination of water supply projects. The WSPAM was designed to provide guidance and strengthen the institutional and technical capacity of Contracting Authorities (CAs) and Sanctioning Authorities (SAs) who play a role in the formulation, planning, appraisal, selection, budgeting, and implementation of water supply projects.

The WSPAM provides guidance on the methodology and best practices employed in the development and appraisal of water supply projects. The WSPAM describes how projects are formulated using the Logical Framework Approach (LFA). Furthermore, it outlines the steps required in preparing a project through the development of a Project Concept Note (PCN). The WSPAM then successively expounds on the two stages of the appraisal process that come after the PCN: the Pre-Feasibility Study (PFS) and Feasibility Study (FS). Furthermore, the manual outlines the processes and procedures undertaken in selecting and budgeting for projects that have been earmarked for implementation.

An illustrative example has been used throughout this manual to demonstrate the principles, concepts, and issues specific to water supply projects discussed in various sections of this manual.

1.2. Relationship of the Manual to the Public Investment Management Guidelines

The WSPAM supplements the Public Investment Management (PIM) Guidelines. The PIM Guidelines provide guidance on:

i. A standardised approach to PIM, to facilitate and streamline the development, appraisal, selection and implementation of proposed Public Investment Projects (PIPs);
ii. The roles and responsibilities of various institutions involved in the PIM System (PIMS);
iii. The processes and procedures of the PIMS; and

iv. The sequencing, timing and linkages of various activities are required for the smooth function of the PIMS.

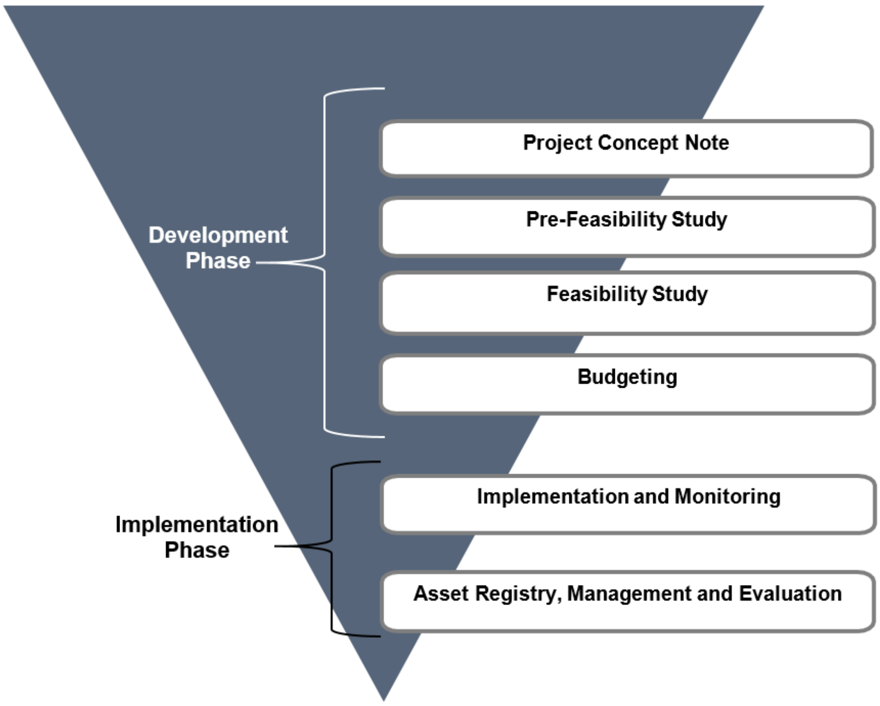
1.2.1. The Public Investment Management System (PIMS)

The PIMS encompasses how PIPs should be prepared and developed from inception to implementation and includes all the institutional processes, procedures and approvals required to get projects financed and executed.

1.2.1.1. Project Cycle

The PIMS provides a framework/system that governs the identification, formulation, appraisal, selection, budgeting, and implementation of proposed PIPs; this framework is known as the 'Project Cycle', which is presented in Figure 1. The project cycle was created to optimize the use of public resources and ensure value for money; it consists of two distinct phases; the development phase and the implementation phase. Each phase comprises several different stages, which are carried out sequentially.

Figure 1. Project Cycle



To operationalise the PIMS, the WSPAM has been developed as a practical guide on how to undertake the project development phase of the project cycle. Hence, the WSPAM mainly focuses on how CAs should identify, formulate and appraise water supply projects.

1.2.1.2. Institutional Framework

The efficient and effective management of public resources with regards to PIPs requires the harmonious coordination of a broad range of institutions. Key institutions in the water sector involved in the development, selection and budgeting of water supply projects as are as follows:

A. Contracting Authorities:

i. Zimbabwe National Water Authority (ZINWA)
ii. Catchment Councils
iii. Rural District Councils
iv. Urban Councils
v. District Development Fund

B. Sanctioning Authorities:

i. Ministry of Lands, Agriculture, Water, Climate, and Rural Resettlement (MoLAWCRR)
ii. Ministry of Health and Child Care (MoHCC)
iii. Ministry of Transport and Infrastructural Development (MoTID)
iv. Environmental Management Agency
v. Zimbabwe Investment and Development Agency (ZIDA)

1.2.1.3. PIM Calendar

In undertaking the development phase of the project cycle, CAs should keep in mind the key dates of the PIM Calendar. Figure 2 outlines the PIM Calendar, which merges project activities, PIM activities and the budgeting activities and outlines the sequencing and linkages of these various activities and their timelines in order to facilitate the smooth functioning of the PIMS. The PIM Calendar allows for the seamless coordination of the processes and procedures undertaken by various institutions involved at various stages of the project development phase of the project cycle.

Figure 2. PIM Calendar

		March – April	May - June	July	August - September	October	December	January – February
Treasury	Budget Activities	Budget Consultations	Preparation of Macroeconomic Fiscal and Expenditure Framework for the next 3 years	Issues Budget Call Circular		Draft Budget Estimates are prepared	Budget Approval	
	PIM Activities		Decision on Pre-Feasibility Studies		Decision on Feasibility Studies			Decision on Project Concept Notes
LMs	Budget Activities	Development or updating (on a rolling basis) of strategic plans, expenditures, and revenues for the next three years	Revised strategic priorities and expenditures	Prepare Budget submissions			Preparation of Budget Implementation Plans	
	PIM Activities	Submission of Pre-Feasibility Studies		Submission of Feasibility Studies		Submission of Project Concept Notes		

2. PROJECT CONCEPT NOTE (PCN)

2.1. Introduction

A Project Concept Note (PCN) entails transforming a project idea/proposal into a business case that can be considered for implementation. The objective of the PCN is to present justification of the worthwhileness of a proposed project and assess its consistency with the Government's strategic goals. A PCN is a presentation drawn up to outline why a proposed project should be undertaken and if it is to be funded through the Government's budget why this project, over all other projects, should be allocated financial resources.

2.2. Preamble on Water Supply Projects

Water is an extremely precious commodity. It is a vital input for various social and economic activities. Water projects such as those that provide a clean, safe and reliable supply of water to urban and rural households and/or commercial enterprises generate significant socio-economic benefits. Maximizing the benefits derived from water projects requires that they are well planned, appraised and executed to ensure that water and capital resources are efficiently utilized, given that both have opportunity costs of employing them in a particular project versus another.

What is important at the PCN stage is planning and designing water supply projects centered around meeting the needs or addressing the problems faced by society. The appraisal of a proposed project regarding the feasibility, viability, and sustainability of the proposed project is addressed at the Pre-Feasibility and Feasibility Study stages of the project development cycle. Hence, the subsequent sections in this chapter of the manual focus on planning, formulating and designing a water supply project.

2.3. Developing Water Supply Projects using the Logical Framework Approach

As the aim of public investment projects is to address socio-economic problems, the first step in preparing a water supply project is identifying the prevailing needs or challenges faced by society as a whole or a specific group within society. Problem identification should include an assessment of who is affected by the prevailing problem, how they are affected, and what kind of an impact the project will have in its quest to improve the beneficiaries' socio-economic conditions.

Such an analysis enables project planners and developers to design various strategies for addressing the identified problems or needs. Furthermore, it is the basis upon which the project's impact(s), outcome and outputs are established.

To this end, the Logical Framework Approach (LFA) can be used for formulating and planning projects. The LFA enables project planners and developers to identify and analyse prevailing problems and design the appropriate interventions that should be undertaken.

The LFA analytical process is undertaken in two phases, namely:

i. **Problem Identification Phase:** The existing situation is analysed to develop a vision of the 'future desired situation'. This phase covers problem analysis, stakeholder analysis, and objectives analysis.
ii. **Project Formulation Phase:** Various strategies/options for addressing the problem will be developed and assessed in operational detail. This phase covers the design and analysis of project alternatives, the development of the logical framework matrix, and activity and resource scheduling.

2.3.1. Problem Identification Phase

Clearly understanding the prevailing problems and challenges faced by either; households and/or commercial enterprises with respect to accessing and using water for their various purposes and needs is critical in the planning and design of a water supply project. Therefore, a CA must clearly identify the problems that give rise to the idea of a given project.

The problem identification phase consists of three sequential steps:

i. **Problem analysis:** this involves the identification of the main problems faced by project beneficiaries, as well as the establishment of the cause and effect relationships of the identified problems.
ii. **Stakeholder analysis:** once the prevailing problems are identified, further consideration is given to whom these problems impact most and the roles and interests of various parties in addressing the identified problems.
iii. **Analysis of Objectives:** builds an image of an improved situation after project implementation. Furthermore, the analysis is aimed at defining the anticipated impact, outcome and outputs of the project.

To illustrate how to conduct both the problem identification and project formulation phases using the LFA. This same case study will be utilized throughout the remainder of this manual as an aide to explain other useful tools utilized in the planning, development, and appraisal of water supply projects. Box 1 provides some background information on this illustrative case study.

Box 1. Introduction to the Illustrative Case Study[1]

Prevailing Problem:

"For every drop of water you waste, you must know that somewhere on earth, someone is desperately looking for a drop of water!" Novelist and thinker Mehmet Ildan's warning could be referring to the likes of 39-year old Mercy Chimusoro of Zengeza 3 Extension D, Chitungwiza and her family.

Chimusoro and her family only experienced reliable water supply in the first two years after moving to their new home in 2001. Since then, their stay has been marked by serious water shortages; sometimes, the taps are completely dry for an entire month. Such a situation is unbearable as water is life. For Mercy and her family to do laundry, cook, clean, and practice good hygiene, they need water.

The water supply system in Chitungwiza is in a state of collapse due to insufficient maintenance, aging and corrosion. This has led to inadequate and irregular water supplies to the residents of Chitungwiza. Furthermore, the water supplied is of poor quality and puts the residents at risk of contracting water-borne diseases. To cope with the unreliable water supply from the Chitungwiza Municipality, Mercy and other residents have had to wake up early in the morning to fetch water from wells or pay exorbitant prices to purchase water from vendors.

Proposed Project:

The municipality of Chitungwiza is planning on implementing a water supply project to address the residents' needs and challenges by rehabilitating the existing water supply system.

Project Name: Chitungwiza Water Supply Project

2.3.1.1. Problem Analysis

Problem analysis involves the following steps:

A. Identification of the beneficiaries who will be impacted by the project and the problems they face. An illustrative example is shown in Table 1 and Boxes 1 and 2.
B. The development of a problem tree to establish the causes and effects of the problems.

2.3.1.2. Identification of Project Beneficiaries and the Problems they face

An analysis of how households and/or commercial enterprises currently access and use water enables the identification of the key problems, challenges, and constraints they face. An assessment of the issues faced by the project beneficiaries should be made along the following lines:

a. Firstly, it should be determined for what purpose the beneficiaries use water and whether the current means of access to water is adequate for their requirements and

[1] This case was adopted from an AFDB project and modified to illustrate the concepts and tools of planning, developing and appraising water supply projects.

intended use (both in terms of the quantity and quality of water). In theory, there are two main uses of water no matter the category of water users (households and/or commercial enterprises), that is:

i. **Potable water**: used for drinking, food preparation, and personal hygiene.
ii. **Non-Potable water:** used for a myriad of purposes such as; waste disposal in households and industries.

Though there are a myriad of water-related problems faced by households and/or commercial enterprises; the main challenges faced by water users, whether they require potable or non-potable water, are limited or lack of access to safe and clean water (quality) and inadequate water supply given their daily consumption/requirements (quantity).

b. Secondly, in addressing the identified problems, challenges or constraints, the project should provide water services that are of a superior level to those "without" the project. In other words, since the only way to address problems faced by water users is to provide water of improved quality and/or quantity, it is important to assess whether the resulting output (water) that the project will provide will be incremental or non-incremental. From the water users' perspective, an incremental output refers to the additional water produced by a project over and above what would have been available to them without the project. A non-incremental output is the water produced by the project that displaces an existing water supply because the prevailing water has high coping costs or is unreliable, such that users no longer access that amount of water from the previous source.

Hence, when assessing the problems, challenges and constraints faced by the project's beneficiaries, the assessment should be made, taking into consideration whether the project will address:

i. A potable or non-potable water problem, and;
ii. Whether the project's output (water) will displace or increase the existing water sources or supply channels.

The matrix shown in Table 1 can be used to identify the problems faced by water supply project beneficiaries. The matrix consists of four quadrants, quadrants A, B, and C; each quadrant lists common problems faced by beneficiaries taking into account the purposes that they use water for and the kind of output that the project would generate to address their particular problem(s). It should be noted that a project may lie in one or all of the quadrants depending on the nature and scope of the project in relation to the problems it is trying to ameliorate.

Table 1. Problem Identification Matrix: Water Supply Projects

	Common Problems Addressed by Water Supply Projects	
	Potable Water	**Non-Potable Water**
Incremental Water	*Quadrant A* **Limited access to potable water:** i. Prevalence of waterborne diseases ii. Increase in time spent collecting water iii. High cost of purchasing water from vendors iv. High cost of water treatment at the individual household level	*Quadrant B*[2] **Limited access to non-potable water:** i. Reduced water consumption ii. Increase in time spent collecting water iii. High cost of purchasing water from vendors iv. High cost of water storage v. Water losses from leaking pipes vi. Illegal water connections
Non-incremental Water	*Quadrant C* **Water supplied is of poor quality:** i. Prevalence of waterborne diseases ii. High cost of water treatment at the individual household level iii. High cost of purchasing water from vendors **Unreliable access to safe potable water:** i. Increase in time spent collecting water ii. High cost of water storage iii. Water losses from leaking pipes iv. Illegal water connections	*Quadrant D* **Inadequate water supply:** i. Increase in time spent collecting water ii. High cost of purchasing water from vendors iii. High cost of water storage iv. Water losses from leaking pipes v. Illegal water connections

Box 2 shows an illustrative example of the problem identification matrix developed for the Chitungwiza Water Supply Project.

Box 2. Example of the Problem Identification Matrix of the Chitungwiza Water Supply Project

	Problems faced by the residents of Chitungwiza	
	Potable Water	**Non-Potable Water**
Incremental Output	*Quadrant A*	*Quadrant B*
Non-incremental Output	*Quadrant C* **Unreliable access to safe potable water:** i. Increase in time spent collecting water ii. High cost of purchasing water from vendors iii. High cost of water storage iv. Water losses from leaking pipes	*Quadrant D* **Inadequate water supply:** i. Increase in time spent collecting water ii. High cost of purchasing water from vendors iii. High cost of water storage Water losses from leaking pipes

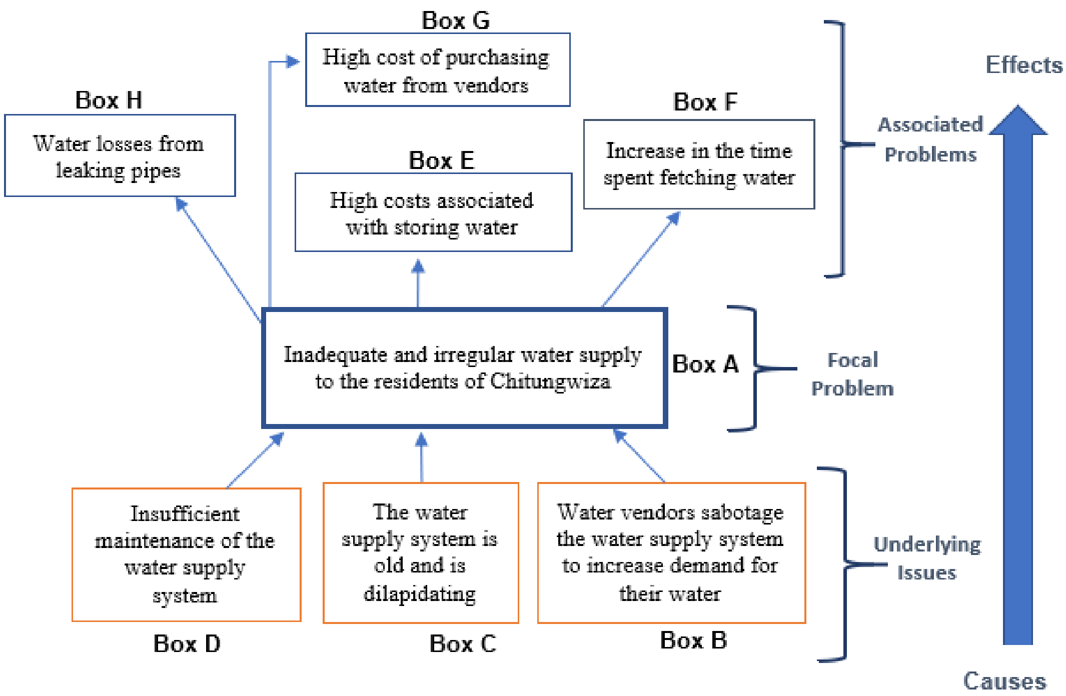
Note: When completed, the project is expected to meet demand fully, and as a result, it will replace the water obtained from wells and private vendors. Therefore the project's output is considered to be non-incremental. The project will address both potable and non-potable water needs of the residents of Chitungwiza. Hence the project lies in quadrants [C+D]. If the project cannot fully satisfy demand, water vendors will continue to supply some of the water. Therefore, the water supplied by the project will become an incremental output. Hence, the project would lie in quadrants [A+B].

[2] While the nature of the problems described in Quadrant B and D are the same. The magnitude of the coping cost would be very different. Quadrant B refers to households storing water in jerry cans for example, while Quadrant D would refer to houses digging boreholes or caging rainwater for instance.

2.3.1.3. Identification of the Causes and Effects of a Problem

Once the problems to be addressed by the project have been identified, the next step of the problem analysis stage is the identification of all the causes of the problem and their likely effects. The identification is carried out by constructing a problem tree. A problem tree is simply a representation of the problem, its causes and likely effects set out in hierarchical order, as shown in Figure 3.

Figure 3. Illustrative Problem Tree



The steps of creating a problem tree are as follows:

a. Start by defining the focal problem faced by project beneficiaries; this should be a negative statement, as shown in Box A in Figure 3.
b. Identify all the other problems associated with the focal problem (i.e., the effects of the focal problem) as shown in Boxes E, F, G and H in Figure 3.
c. Identify the causes of the focal and associated problems faced by the project beneficiaries, as shown in Boxes B, C and D in Figure 3.

2.3.1.4. Stakeholder Analysis

Stakeholders are the people who will benefit from the project. However, stakeholders also refer to the people or institutions directly involved in the project's implementation or those that are likely to be affected by the project in some way (both positively and negatively). Lastly, stakeholders are people or institutions who can influence/affect the outcome of the project. Stakeholder analysis is the process of identifying the project's stakeholders, analysing their interests, and determining their role within the project. The process includes an assessment of each stakeholder's level of interest in the project and their ability or power to either positively or negatively influence the success of the project.

Stakeholder analysis is undertaken as follows:

a. Identify project stakeholders.
b. Determine the relative importance and influence of each stakeholder.
c. Profile each of the stakeholders in terms of what is important to the stakeholder, how could the stakeholder contribute to the project, how could the stakeholder jeopardize the project and what strategy can be used to engage the stakeholder.

The first step of stakeholder analysis is to establish who your stakeholders are. For example, in assessing the individuals, groups of people, organizations, or firms affected by the Chitungwiza Water Supply Project, a stakeholder matrix could be used, such as the one presented in Table 2.

The identification of project stakeholders should be followed by an assessment of each stakeholder's level of interest in the resolution of the problem at hand and their potential to influence the project. The assessment serves as a basis for determining the kind of engagement to be adopted for each stakeholder. Table 2 illustrates how stakeholders could be profiled depending on their interests and level of influence on the project and the possible methods of engagement that could be adopted to ensure smooth project implementation and delivery.

The stakeholder analysis should also include an assessment of gender-based interests, needs, roles and responsibilities of the project's stakeholders; this is of particular importance for the beneficiaries of the project's output. The demand for water services is not generic and differs for men, women and children. Understanding the composition of households, the different uses of water by householders and the division of tasks when it comes to the collection, use and management of water resources is of vital importance. For instance, inadequate water supplies for domestic urban households mainly affect women and girls as they are the ones who are the custodians of water resources for domestic uses. In situations where there are inadequate water supplies, mainly women and girls fetch and carry water for use by the household. Therefore, the formulation of water supply projects should assess gender-based needs and aim to involve men, women, and children in the project's design to better meet their needs and optimize its outcome. Gender-based stakeholder engagement is crucial to the success and overall impact of the project. Furthermore, the stakeholder analysis should also assess other relevant issues such as equality and equity regarding access to water resources to ensure that poorer households will not be marginalized or underserved but would rather be prioritized to maximize the projects outcome and impacts.

Table 2. Stakeholder Analysis Matrix

Stakeholder Name	Impact *How much does the project impact them? (Low, Medium, High)*	Influence *How much influence do they have over the project? (Low, Medium, High)*	What is important to the Stakeholder?	How could the stakeholder contribute to the project?	How could the stakeholder jeopardize the project or individual component of the project?	Strategy for engaging the stakeholder
Residents of Chitungwiza	High	Low	Access to reliable and safe water supply at an affordable price	Responsibly utilizing water resources	i. Using water wastefully ii. Failing to pay tariffs	Educational awareness campaigns on the importance of using and conserving water as well as paying tariffs
Chitungwiza Municipality	High	High	Providing adequate water supply services to the residents of Chitungwiza in line with their needs and requirements	As the CA, the municipality is responsible for rehabilitating and maintaining the water supply network	i. Failing to provide water at an affordable tariff to residents ii. Failing to Maintain water supply infrastructure after the project is implemented	As the CA, it will be the one with the responsibility of engaging all the other stakeholders
Water Vendors	High	High	Generating revenue from selling water	N/A	Vandalizing water supply infrastructure to create business opportunities to sell water to the residents of Chitungwiza	The CA should engage with them to: i. find alternative markets or business ventures in the case that the project is able to meet water demand fully ii. Recognize that the project may still leave an opportunity for continued business if its supply is not sufficient to meet demand

2.3.1.5. Objectives Analysis

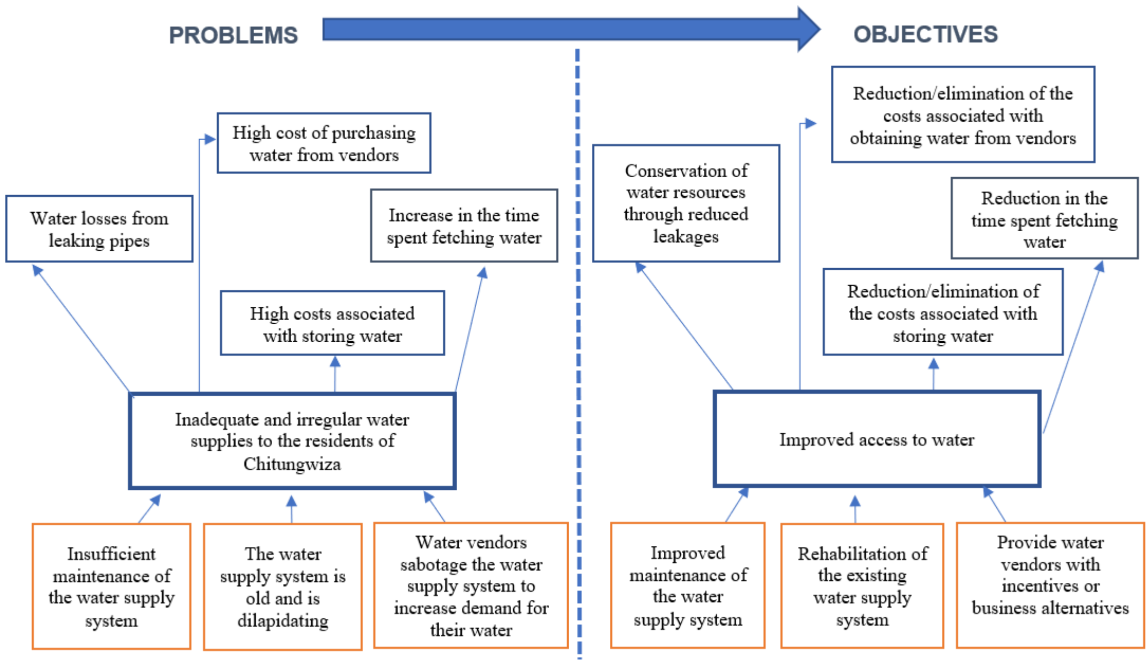
Once the stakeholders and the problems that affect them (which the project seeks to eliminate) have been identified, an objectives tree should be developed. While the problem analysis looks at the negative aspects of the prevailing situation, the objectives analysis looks at the positive aspects of the desired future situation. This involves the reformulation of problems into objectives by translating a problem tree into an objectives tree. Therefore, the objectives tree can be conceptualized as the positive mirror image of the problem tree, and the "cause and effect" relationships become "means to ends" relationships.

The construction of an objectives tree involves the following steps:

a. Reformulate all negative situations of the problem analysis into positive situations that are desirable and realistically achievable.
b. The causes and effects of the problem tree are transformed into means and ends, while the focal problem is transformed into the overall goal the project must accomplish. In this way, the project's objectives are established.

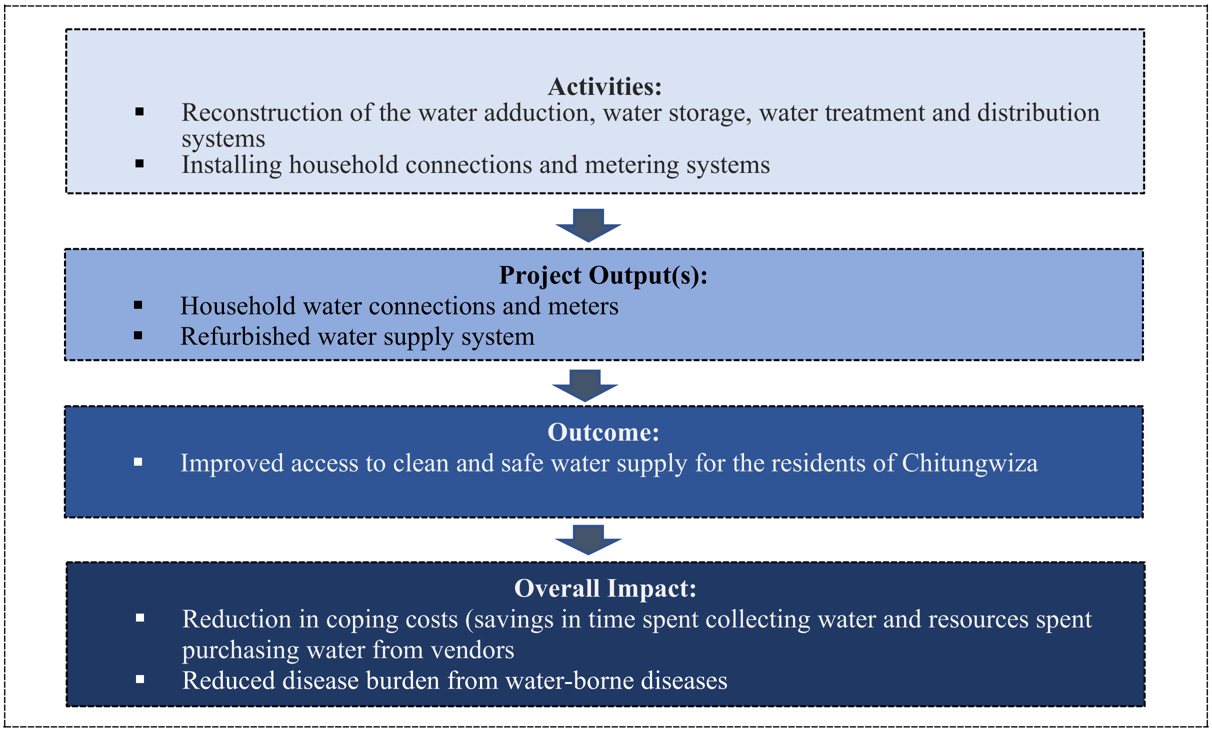
An illustrative example of an objectives tree is presented in Figure 4.

Figure 4. Illustrative Objectives Tree



Once the project's objectives have been identified, the next step is to outline the activities that will be undertaken by the project pursuant to the delivery of the project's output and the achievement of its objectives. Furthermore, the expected outcome generated as a result of the project's output should be defined together with the overall impact on stakeholders. Where possible, the project's outcome should be disaggregated by gender. For instance, as women and girls are the ones who are mainly involved in fetching and carrying water for household use, a project that addresses water shortages is more likely to impact women and girls as opposed to men and boys. The project's impact, outcome and outputs are derived by reformulating the objectives tree. An illustrative example of the Chitungwiza Water Supply Project's activities, outputs, outcome and impact are presented in Figure 5.

Figure 5. Illustrative Example of a Project's Impact, Outcome, Outputs and Activities Tree[3]



2.3.2. Project Formulation Phase

The project formulation phase consists of four sequential steps:

1. Designing and assessing project alternatives.
2. Assessment of preliminary costs and sources of funds.
3. Development of the Logical Framework Matrix.
4. Development of an Implementation Plan.

[3] **Project Activities:** are the specific tasks that will be carried out towards delivering the project's outputs.

Project Outputs: are the tangible products produced or services delivered toward producing desired outcome.

Project Outcome: A positive or negative effect of carrying out a project.

Project Impact: the overall long-term effect of a project which can only be realized if the project's outcome materialize.

2.3.2.1. Designing and Assessing Project Alternatives

Several different project interventions can be designed through which the identified problems will be addressed. The project interventions should be modeled around finding the best method of delivering the project's output (water) to consumers, as well as attaining the project's outcome and the desired impact. Key considerations when designing project alternatives that can be used to address the prevailing problems are:

i. Appropriateness of technology to be used as well as the cost of each alternative (the aim is to find the least cost alternative of addressing the problem);
ii. Advantages and disadvantages of each intervention; and,
iii. The demand for the project's output, which will guide the scale and scope of the project.
iv. In certain instances, the full scope of the project's outcome and impact can only be realized if the project's interventions are blended with non-water supply specific interventions such as sanitation and hygiene.

At the PCN stage, a qualitative assessment of each of the project alternatives should be made. The analysis is used to assess and compare the identified project alternatives and ensure the best alternative is adopted pursuant to the project's objectives. It is advised that no more than five project alternatives be assessed at the PCN stage to avoid complexity.

An example of the formulation and assessment of project alternatives is shown in Box 3 using the case of the Chitungwiza Water Supply Project.

Box 3. Example of Designing and Assessing Project Alternatives

Demand for the Project's Output:

- The aim of the project is to refurbish the water supply system (water adduction, water storage, water treatment and distribution system). The refurbished system will have a capacity to supply 25,000 m^3 of water per day.

- The average amount of water required per person per day is estimated to be 60 litres.

  A population growth rate of 1.5% per annum means that additional investments will be required to provide additional water supply halfway through the project's life, as the utility's water production capacity will not be sufficient to meet demand. One of the key issues that needs to be addressed is whether the utility should invest in additional water supply capacity when the existing water supply system is refurbished or when demand outstrips supply.

- The advantage of postponing the investment in the additional water supply until demand outstrips supply is that the project will have a lower Capital and O&M cost, however, the disadvantage is that as the population grows, demand will outstrip supply and further investments will be required down the line.

- Investing in additional water supply at the start of the project will require a larger capital outlay and will result in additional 0&M expenditures. However, it will result in additional water supply capacity, which will come in handy when demand surges. Additionally, any excess water can be sold to other city councils which are facing shortages; hence, the additional capacity will not lie idle.

Note: when making determinations about timing of an investment, an in depth analysis should be conducted to determine the optimal time to make such an investment. Guidance on conducting an analysis of investment timing is provided by *Jenkins, G.P., Kuo, C.Y., and Harberger, A.C., "Chapter 5: Scale, Timing, Length and Inter-Dependencies in Project Selection", Cost – Benefit Analysis for Investment Decisions, (2014).*

Water supply project alternatives can be broadly categorized into two main classes, infrastructure alternatives and non-infrastructure alternatives.

Infrastructure projects consist of:

i. **The construction of new water supply infrastructure:** Constructing new infrastructure is mostly aimed at meeting the growing demand for water by households and/or businesses. For example, a growth in demand for household water supply services may arise due to population growth. Hence, projects that will increase the capacity to supply water by augmenting existing infrastructure components would be required, especially when water demand outstrips water supply capacity. The types of investment in water supply infrastructure are discussed in Annex A.

ii. **The rehabilitation of existing water supply infrastructure:** The objective of these kinds of projects is to partially or completely replace existing water supply infrastructure. Such projects are necessary when infrastructure systems/components have reached the end of their service life and must be replaced. If the old infrastructure is not replaced, water services would be provided at suboptimal levels as the water supply system will not work effectively and efficiently due to the bottlenecks that may result from old and faulty components. The rehabilitation of existing infrastructure can also entail improving service quality through, for example, an intervention to decrease physical losses by addressing infrastructure problems such as leaking pipes. Tackling such problems can, for instance, increase water pressure and reduce financial losses to the utility.

Non-infrastructure projects entail the improvement of the water supply system. The improvements can be through the optimization of operation and maintenance costs, as well as promoting efficiencies in the management of water utilities, most especially in critical areas such as tariff collection, reducing unaccounted-for water (UFW) and ensuring that tariffs are cost reflect to ensure the sustainable delivery of services.[4]

2.3.2.2. Assessment of Preliminary Costs and Sources of Funds

Once the project alternatives have been designed, the next step is to outline the costs of undertaking each of the alternatives. As at the PCN stage, the project is still in its infancy, the cost estimates should be preliminary and can be based on proxies of projects of a similar nature and scope constructed in the recent past. The cost estimates should include capital costs and operating and maintenance costs. In cases where proxy costs are used, an adjustment should be made to reflect the real and inflationary changes in costs over time. An important aspect to consider is how the project costs will be financed. An outline of the proposed sources of funding should be included, along with the project's cost estimates. Funding for capital expenditure can be garnered from various sources such as the national or local budget, equity, debt, development partners and/or private sector parties.

2.3.2.3. Development of the Logical Framework Matrix

The Logical Framework Matrix (LFM) is used to summarize the key elements of a project, such as the project's impact, outcome, outputs, activities, and the proposed budget based on the project's outputs. Good practice in project planning and preparation indicates that in order to keep the project simple and straightforward, the LFM should only have a few possible

[4] According to the World Bank, 2013. Unaccounted for Water (UFW) is the difference between water supplied and water actually used by consumers. UFW has two components;

a. Physical losses due to leakages from pipes
b. Administrative losses due to illegal connections and under registration of water meters.

impacts and a single outcome; if these components exceed these recommendations, the project sponsor should consider rethinking the project.[5]

The LFM is also a useful tool to display and organize the project's concept. Columns of the matrix identify what the project intends to do and how, outlining the casual relationships, specifying the important assumptions, and how the inputs and outputs of the project will be monitored and evaluated. Rows of the Matrix relate to the measurement of the effects of and resources used by the project through the specification of key indicators of measurement and how the measurements will be verified. Table 3 presents an illustrative example of the LFM for the Chitungwiza Water Supply Project.[6]

Developing the LFM is a three-stage process. The first stage consists of the following steps:

a. Copy the impact of the project from the impact, outcomes and outputs tree to the impact section of the LFM.
b. Copy the outcome of the project to the outcomes section of the LFM.
c. List project outputs and specify which of the outcomes depend on the successful delivery of each output. There may be several outputs for each outcome.
d. List all the activities or tasks that are needed to deliver the project's outputs. There may be several activities for each output.

The second stage consists of the following steps:

a. List the SMART Indicators: Specific, Measurable, Achievable, Relevant, and Time-bound indicators. Starting from the top to the bottom of the hierarchy of the LFM (Impact – Outcomes – Outputs), identify the SMART Indicators for measuring the progress in terms of quantity, quality and time for each of the components of the LFM.
b. List the means of verification: the source of verification should be considered and specified simultaneously with the formulation of the indicators. This will help to test whether or not the indicators can be realistically measured at the expense of a reasonable amount of time, money and effort.
c. List key project risks: Identify and list the main risks that may jeopardize the expected outputs or outcomes of the project.

The third and final stage consists of the following steps:

[5] https://www.ukaiddirect.org/wp-content/uploads/2016/04/UKAD-Guidance-Logframes.pdf

[6] This example only illustrates the LFM for Option 1 of the Chitungwiza Water Supply Project.

a. List project assumptions: these are factors that can potentially influence (or even determine) the success or failure of a project and may lie outside the direct control of project managers. The assumptions are the conditions that must be satisfied in the row below in order to achieve the objective in the row above. Assumptions are usually identified during the analysis phase. The analysis of stakeholders, problems, objectives, and strategies will have highlighted several issues (i.e., policy, institutional, technical, social and/or economic issues) that will impact the project 'environment', but over which the project may have no direct control.

Table 3. Illustrative Logical Framework Matrix

Narrative Summary	Performance Indicators				Means of Verification	Assumptions	Risks
	Baseline 2015/16	Target 2017/18 (SMART)	Target 2018/19 (SMART)	Target 2019/20 (SMART)			
Impacts							
Impact 1: Reduction of coping costs associated with accessing water (the time and resources spent accessing water)	8% of the day spent fetching water Residents faced a 25% premium on water from vendors as compared to that from the water utility	No time spent fetching water as residents have direct access through household connections Residents pay 25% less for water provided by the utility	0% time spent fetching water 25% savings on water bill	0% time spent fetching water 25% savings on water bill	Household survey	The project will be able to provide reliable access to water such that residents will no longer need to fetch water or purchase it from vendors	If the project fails to provide reliable access to water, residents will still incur some coping costs, thereby reducing the benefits of the project to consumers
Impact 2: Reduction in the disease burden caused by water-borne diseases	The disease burden from water related diseases is 479 DALYs	Burden of disease reduces 20%	Burden of disease reduces 20%	Burden of disease reduces 20%	Health Impact and Evaluation Assessment	Unclean water is supplied to residents is the major cause of disease	There many be other factors causing disease such as poor hygiene, which if not address will result the benefits of clean water supply to be diminished
Outcome: Improved access to clean and safe water supply for the residents of Chitungwiza	Water Quality Index (WQI) of 44 Water was only available half of the day	WQI of 80 Water is available 24/7	WQI of 90 Water is available 24/7	WQI of 95 Water is available 24/7	Water quality assessment and household surveys	The utility will take the necessary steps to treat water to a portable standard before supplying households	If the water from the utility is not sufficient to meet demand households may continue to access water from other sources which might not be clean and safe for drinking purposes

Narrative Summary	Performance Indicators				Means of Verification	Assumptions	Risks
	Baseline 2015/16	Target 2017/18 (SMART)	Target 2018/19 (SMART)	Target 2019/20 (SMART)			
Outputs							
Output 1: Refurbishment of the water supply system	Due to dilapidation and lack of maintenance the water supply system capacity utilization is 60%	Once refurbished the capacity utilization is expected to be <95%	<95% capacity utilization	<95% capacity utilization	Water utility system performance report and M&E reports	The refurbished water supply system will be well maintained to ensure it operates efficiently and maximize it output capacity	Lack of adequate maintenance may lead to low capacity utilization and affect water supply to residents and negate the project's benefits
Output 2: Installation of household connections and meters	Household connections and meters will need replacing in order to withstand the volume and pressure of the refurbished water supply system	100% of household connections and meter replacements installed	100% of household connections and meter replacements installed	100% of household connections and meter replacements installed	Water utility system performance report and M&E reports	Household connections and meters will be frequently checked and maintained	Illegal connections maybe setup and meters maybe tempered with

Activities to achieve the outputs
O1: Refurbishment of the Water Supply System
1. Procurement of pipes, equipment and machinery that needs replacement within the existing water supply system 2. Repairing items that can be salvaged 3. Installation of new pipes, equipment and machinery
O2: Installation of household connections and meters
1. Procurement of household connections and meters 2. Installation of household connections and meters

Resource Considerations
Main implementation Components
1. Refurbishment of the water supply system 2. Installation of household connections and meters

Summary budget for at least 3 years

No.	Output	Baseline FY15/16 USD Million	FY 17/18 USD Million	FY 18/19 USD Million	FY 19/20 USD Million
1.	Water supply system	16.69	5.57	-	-
2.	Household connections and meters	5.58	1.83	-	-
	Total Project Cost	**22.27**	**7.40**	-	-

2.3.2.4. Development of an Implementation Plan

At the PCN stage, the project implementation plan should be indicative and propose an implementation strategy that is reasonable given the information available, timing, scale, and scope of the project. The various activities required to implement and deliver the project successfully should be scheduled using a Gantt chart, showing the timing, sequencing, and inter-dependencies among activities. Each of the activities to be carried out under the implementation plan should include the following components:

i. Activity name
ii. Activity scope
iii. A list of all the activities that must be completed before the initiation of the next activity
iv. The commencement and completion date of each activity
v. The cost of undertaking each activity

The resources required for the successful execution of each activity, including human resources, financial resources, physical resources and other resources, should be identified, and their procurement should be included as part of the implementation plan. An illustrative example of a project implementation plan for the Chitungwiza Water Supply Project is presented in Figure 6 and Table 4.

Figure 6. Indicative Gantt chart of Project Activities

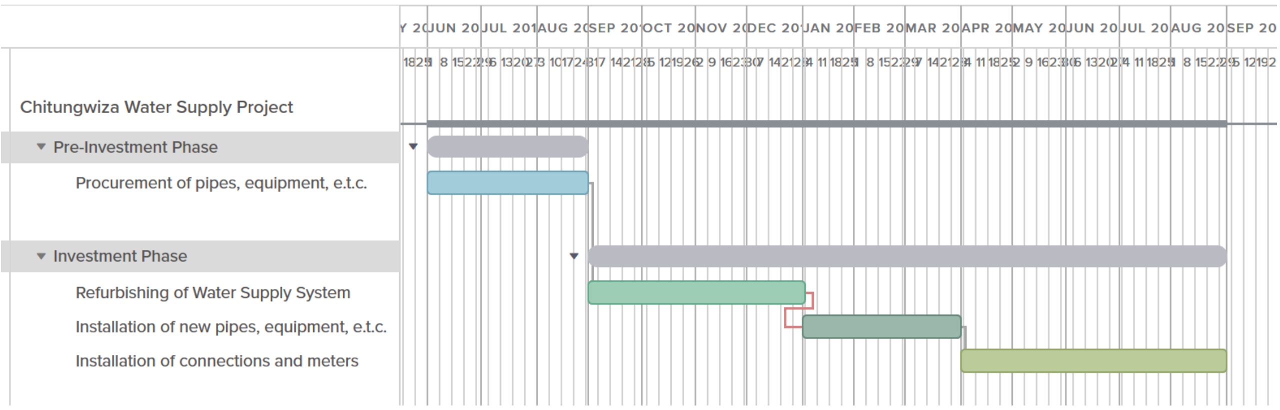


Table 4. Indicative Implementation Plan

Activity Name	Activity Summary and Scope	Precedent Activities	Activity Duration	Activity Expenses
Procurement	Procurement of pipes, equipment, machinery, connections and meters	none	June 2015 – June 2016	USD 16.69 million
Repairs	Repairing items within the water supply system that can be salvaged	Procurement of components required to carry out repairs	July – Dec 2016	USD 2.5 million
Refurbishing the water supply system	i. Installation of new pipes, equipment and machinery ii. Installation of household connections and meters	i. Repair of some of the items within the water supply system ii. Installation of new pipes, equipment and machinery	Jan 2017 – Jan 2018	USD 3.51 million

2.4. Assessing the Effectiveness of the Proposed Project

Once a project aimed at addressing the problems faced by stakeholders has been designed, the next step is to assess the project's effectiveness in addressing those problems. A qualitative assessment should be made of the project's financial and socio-economic effectiveness at the PCN stage. Furthermore, an indicative environmental and social impact assessment should be undertaken.

2.4.1. Financial Effectiveness

It is not uncommon to finance water supply projects through user fees (tariffs). In the case of water supply projects that generate revenues from tariffs levied on end-users, a qualitative assessment should be made to gauge if the expected financial revenues generated by the proposed project are sufficient to meet the life cycle costs of the project (capital and operation and maintenance expenditures). Projects that will levy a tariff are good candidates for possibly being procured under a Public-Private Partnership (PPP).

In cases where the proposed water supply project does not generate financial revenues, such as is the case with rural water supply projects, the financial effectiveness shall be based on finding the least-cost alternative of delivering the project's output. Furthermore, as there are no revenues to offset or recoup the investment, operating and maintenance costs over the expected life of the project; a financing gap analysis should be undertaken with respect to how much will be required to operate and maintain the project so that funds to sustain the project can be sourced from the central budget or from other sources. Without funding for operations and maintenance, the project will not deliver its output or attain its outcomes and overall objectives.

2.4.2. Socio-economic Effectiveness

List key/direct economic costs and benefits to the government and society. Consider the full impacts on Zimbabwean citizens over the full lifecycle of the assets that will be created. The main socio-economic benefits of water supply projects are as follows:

i. Time savings,
ii. Coping cost savings, and;
iii. Health benefits

When applicable, list and discuss the broader indirect effects of the proposed water supply project on the economy and society. Please specify if these indirect effects will result in quantifiable impacts, such as environmental costs.

Indicate and discuss the distributional impacts of the project. List all stakeholders and specify if they are expected to gain or lose because of the project. Specify how the benefits generated by the project, such as reducing coping costs and reducing disease burden, are distributed by gender. In most projects, the majority of benefits will likely accrue to women due to their significant involvement in sourcing, utilizing, and managing water resources for domestic purposes.

The socio-economic effectiveness of the project should be focused on a qualitative assessment of the project's economic benefits and costs. While a quantitative assessment (CBA) is only required from the PFS onwards, an estimation of the project's socio-economic benefits weighed against the anticipated cost of resources required to implement the project is useful in assessing the potential viability of the proposed project. An example of the economic effectiveness of the Chitungwiza Water Supply Project at the PCN stage is illustrated in Box 4.

Box 4. Example of the Socio-economic Effectiveness of a Water Supply Project

- The project's anticipated benefits include the following:

  i. Time savings: due to residents no longer having to fetch some of the water they need from nearby wells, instead, household connections will supply a sufficient amount of water for the residents' total requirements.

  ii. Coping cost savings: "without" the project residents were purchasing some of the water they needed from vendors at a steep cost, furthermore they also faced the cost of storing water. "With" the project residents will no longer face these costs of coping with an unreliable and inadequate water supply from the utility.

  iii. Water resource savings: due to aged water infrastructure a significant amount of water was lost before it reached consumers as result of leaking pipes. The project will address this issue and significantly reduce water losses.

- The total value of the aggregate benefits are expected to be approximately 5 times greater than the total CAPEX

2.4.3. Environmental and Social Impact Assessment

2.4.3.1. Environmental Impacts

An Environmental Impact Assessment (EIA) is required for water projects at the PFS and FS stages of the project appraisal process. However, how the project impacts the environment is an important component of the decision-making process. The CA shall consider highlighting the potential environmental impacts that will result if the project is implemented and proposed measures of mitigating any negative effects.

2.4.3.2. Social Impacts

The CA may highlight any social impacts that may arise from the project. This may include increased productivity, improvements in health status and poverty reduction due to increased access to improved water supply and greater access to potable water.

2.4.3.3. Gender Analysis

Male and female roles are quite different in the household when it comes to chores. For example, most often in rural areas, it is most likely that women and girls bear the task of fetching the water required by the household. Wherever possible, the PCN should provide a starting point for gender analysis and discuss the socially constructed roles of men and women "without" the project and how "with" the project any social inequities will be addressed and how the project will improve the coping mechanisms of those marginalized by social constructs given project's outputs and outcomes.

2.4.3. Risk Analysis

Several factors can affect the project's performance and its intended outcomes. CA's should outline the project's key risks and their direct and indirect impact(s) on the project and its beneficiaries. In particular, CA's should assess how climate change may impact the project.

Water supply project that tackle climate change risk and its related impacts can be grouped into two categories:

a. **Adaptation Projects:** include climate-proofing components designed to reduce or minimize the physical and socio-economic impacts of anticipated climate change over a project's economic life. For instance, a water supply project exposed to the risk of reduced precipitation or drought can be climate proofed by incorporating additional water storage capacity to meet demand when water resources decline, thereby reducing the socio-economic impacts of insufficient water resources.

b. **Climate Resilience Projects:** their objective is to ensure that communities' can withstand current and future climatic conditions. An example is a project catering to farmers' needs in rainfed, drought-prone agricultural areas by providing them with irrigation infrastructure and drought-resistant crop varieties and capacity building to improve water use efficiency and soil moisture management techniques.

c. **Mitigation Projects:** projects with a primary objective or secondary benefits of reducing emissions that cause climate change, i.e., greenhouse gas emissions (GHGs). In the water sector such projects can include multipurpose dams that supply water for domestic, agricultural, and industrial needs as well as generate clean and renewable energy.

2.4.3.1. Climate Risk Screening

As with any other projects, water supply projects are prone to exposure and vulnerability to climate change. Changing weather conditions and patterns can adversely affect water supply projects and their beneficiaries. For instance, increasingly higher temperatures and warmer conditions may deplete surface water resources and reduce the water supply available to satisfy demand. Additionally, climate change can lead to water supply infrastructure damage due to climatic events such as floods. Table 5 highlights some of the known impacts on water supply projects associated with climate change.

Table 5. Potential Impacts of Climate Change on Water Supply Infrastructure and Operations

Changes in Climate	Impacts of Climate Change
Warmer temperatures	• Increased demand for water as a result of more frequent or more intense heat waves and dry spells. • Increased evaporation in surface sources of water. • Increasing biological and chemical degradation of water quality (impacting operating costs).
Flooding	• Increased risk of damage to water supply infrastructure and disruption of water supply services. • Increased loading of pathogenic bacteria and parasites into water storage infrastructure, e.g., reservoirs.
Droughts	• Reduced replenishment rates of groundwater resulting in declining water tables where the net recharge rate is exceeded.

Source: Asian Development Bank, Guidelines for Climate Proofing Investment in the Water Sector

Climate change does not only pose a risk to the damage of water supply infrastructure and the disruption of water supply services; it also impacts the quantity and quality of water available. Hence, CAs should screen projects for climate change related risks. Screening projects for climate risk at the PCN stage is a critical foundational step in managing climate risk. Climate risk screening entails answering the following questions:

a. Does climate change impose a high degree of risk to the project? For example, do rising temperatures significantly impact the project's output/service or the useful life of the project's infrastructure?
b. Is the project located in an area prone to climate change-related events? Do climate change scenarios suggest that these events' frequency and/or severity are likely to increases?
c. What will be the implications, including the cost of infrastructure rehabilitation, cost of service disruptions both to the project and service users?

In conducting climate risk screening, it is essential to determine how climatic conditions will possibly change in the area where the project will be located; this requires the expertise of a climate specialist and involves;

a. Establishing a baseline of the existing climatic conditions in the project's locale using historical weather data.
b. Projecting how climatic conditions will evolve over the project's economic life using General Circulation Models (GCM), i.e., climate change models.
c. Determining which weather variable(s) and their expected change will impact the project and its stakeholders.

d. Constructing the most likely scenario of how climatic conditions will change and how they will impact the project.

BOX 5: Illustrative Example of Preliminary Climate Risk Screening

Project Summary:

- The municipality of Chitungwiza is planning on implementing a water supply project to address the water needs as well as challenges faced by residents. Currently, due to water supply infrastructure that is old and poorly maintained, the residents experience.
  a. Intermittent water supplies, and,
  b. Poor water quality.
- Chitungwiza has approximately 360,000 residents with an estimated per capita water consumption of 60 liters per day.
- The population is anticipated to grow at a rate of 1.5% per annum.

Climate Change Risk:

- Chitungwiza is located in an area that is susceptible to droughts.
- Historical data shows that the chances of the occurrence of a drought are once every 10 years, i.e., 10%. Furthermore, each drought event leads to a decline in water supply capacity. It is estimated that on average the utility loses about 20% of its supply capacity during a drought.
- According to climate change models developed by climate specialists, the frequency of droughts in the area is likely to increase. It is anticipated that the probability of having a drought will increase to 15%, i.e., the risk of a drought will increase from once every 10 years to 1.5 times every 10 years. In addition, the severity of a drought is expected to increase, with the utility losing about 25% of its capacity on average in the event of a drought. Hence, the annual water production capacity of the utility is likely to decreased by 3.75% per annum.

Anticipated Service Disruptions as a Result of a Drought			
Average Annual Water Consumption in Chitungwiza "without a drought" (million m3) A	Probability of a Drought Occurring over the life of the Project (%) B	Proportion of Water Resources lost as result of a Drought (%) C	Decline in Annual Water Supply Capacity (million m3) D = A * B * C
9.25	**15%**	**25%**	**0.35**

- A more detailed assessment of the project's exposure and vulnerability to climate change should be undertaken at the PFS stage.

Climate risk screening is a preliminary assessment intended to identify if the project is exposed to and vulnerable to climate change risk. Various tools are available that can be used to conduct climate risk screening.[7] Detailed climate risk assessments should be conducted at the PFS stage

[7] Some the most widely use climate risk screening tools are:

a. The World Bank's Climate Change Knowledge Portal (CCKP). The CCKP is an online platform which provides global climate data and analytics. https://climateknowledgeportal.worldbank.org/

b. Acclimatize Aware is another online platform providing climate risk date sets and analytics.

for projects anticipated to be significantly impacted by climate change over their economic life, as indicated by the results of climate risk conducted at the PCN stage. If a detailed climate risk assessment will be undertaken at the PFS stage, CAs should draw up Terms of Reference (ToRs) for such an assessment, and its cost should be included as part of the cost of the PFS preparation.

2.5. Presentation of the Project Idea using the PCN Form

Once the project idea has been formulated, it should be converted into a "business case" known as the Project Concept Note (PCN). The PCN provides key information about the project and justification for the project and its alignment with the Government's strategic objectives. The PCN should be presented in a structured format using a PCN form. The structure, format, and data requirements of the PCN form are provided in Annex B.

2.6. Assessment of the PCN

The assessment of the PCN consists of two phases. The first phase entails an internal assessment of the PCN by the Line Ministry. The internal assessment shall attempt to answer two questions:

1. Is the project consistent with National and Sectoral development strategies?
2. Do the expected socio-economic benefits of the project exceed its economic costs?

Once the PCN has passed the internal screening, it should be submitted to the IMC through the MoFED for the second phase of the screening process. It should be noted that PCN submissions are made in October, according to the Public Investment Management and Budgeting Calendar defined in the PIM Guidelines.

The external assessment of the PCN by the IMC is a three-step process aimed at assessing the project's alignment with the Government's objectives and priorities. It also entails an evaluation of resource availability to fund the project with consideration of resource allocation to projects from other sectors vying for the same pool of resources. The three steps carried out in assessing the PCN are as follows:

i. The first stage is to assess the compliance of the CA with the submission process and other procedural requirements stipulated in the PIM Guidelines and this Manual. In exceptional cases, the IMC may accept early or late PCNs submissions. CAs are required to submit PCNs in compliance with the PCN form outlined in the PIM Guidelines. In case of missing information, the IMC may postpone the PCN pending the submission of the complete information.
ii. At the second stage of the assessment, the IMC will assess the project's alignment with the National and Sectoral Strategic Objectives. Projects that are not in line with the

http://www.acclimatise.uk.com/analytics/applications/

National development strategies and sectoral development plans will get postponed. In exceptional cases, CAs may justify projects that are not directly aligned with the strategic development plans. Such cases, for instance, may include projects that are designed to mitigate force majeure situations, such as droughts, floods, earthquakes, Et cetera.

iii. The last stage involves the IMC assessing the project's affordability and the likelihood of the expected economic benefits of the project exceeding the cost of resources.

The IMC's decisions on PCNs shall be issued in January-February. Only projects whose PCNs pass both the internal assessment by the CA and the external assessment by the IMC should be allowed to progress to the PFS stage. PCNs approved by the IMC are valid for a period of three (3) years. Once a project's PCN expires, the project should be reappraised and resubmitted to the IMC for consideration, following the internal and external screening processes described above.

3. PRE-FEASIBILITY STUDY (PFS)

3.1. Introduction

The Pre-feasibility Study (PFS) phase involves the refinement of all elements of the PCN stage described in the previous chapter by providing information on different aspects of a project in greater detail. Wherever possible, data from the PCN should be updated with more accurate estimates in preparing the PFS. The PFS emphasises the technical, financial and socio-economic viability of various options through which the project can be undertaken in order to identify the preferred option. CAs shall undertake a PFS of the proposed project or outsource the preparation of the PFS to a third party in cases where, for instance, the CA does not have the technical capacity to do so.

3.2. Appraising Water Supply Projects

3.2.1. Methodology for Appraising a Proposed Project

Cost-Benefit Analysis (CBA) is an analytical tool that has been adopted in appraising a proposed project's financial and economic viability while considering the technical aspects and impacts on stakeholders and potential risks that may affect the project's viability and sustainability. Such a holistic approach to CBA, which includes a financial, socio-economic, and fiscal, as well as a risk assessment of the project, is known as Integrated Investment Appraisal (IIA).

It must be noted that when undertaking a PFS, CBA is used to appraise a number of options/alternatives through which a project's output can be delivered. Options analysis is further discussed in section 3.2.4.

3.2.2. Project Appraisal using Cost-Benefit Analysis

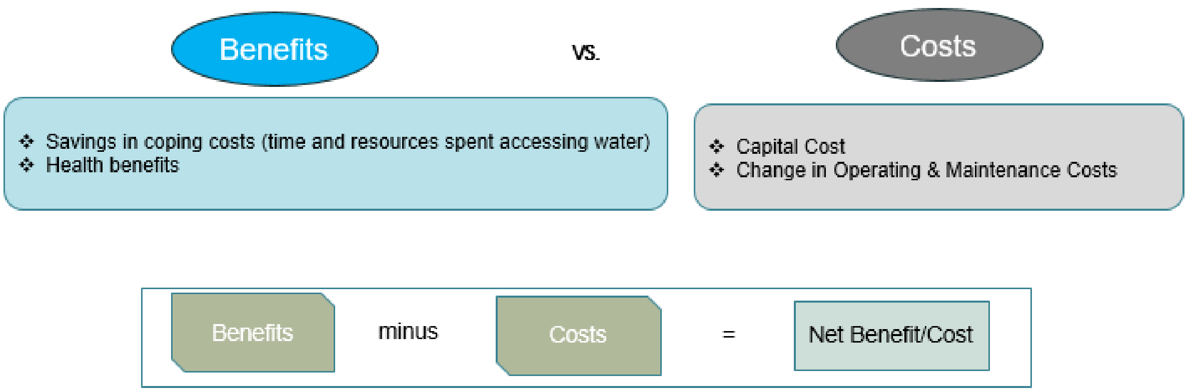
At the PFS stage, in contrast to the PCN, the emphasis is on estimating the monetary value of the project's benefits, which, together with the costs, are used to derive quantitative indicators such as Financial and Economic Net Present Value for decision making. The objective of CBA is to assist decision-makers in undertaking an informed decision on public investment projects based on quantitative evidence of the financial and economic returns of the project. This is consistent with the concept of efficiency in the allocation of public resources.

The efficient allocation of resources occurs when the most highly valued set of outputs is created, given the use of the least cost inputs. Hence, the core principle of CBA is to accept projects for which the net social benefits are positive (subject to the budget and other constraints). Therefore, for the efficient management of the public resources, the guiding principle is to invest scarce resources only in projects where economic benefits are more than the economic costs. Hence CBA entails;

i. The identification and valuation of a project's costs and benefits; and,
ii. A comparison of the costs versus the benefits of a given project (allowing for the determination of whether the project's benefits outweigh the costs or the costs outweigh the benefits).

Figure 7 shows an illustrative example of the process of undertaking a CBA of a water supply project.

Figure 7. Illustrative Example of Undertaking a CBA of a Water Supply Project



3.2.3. Incremental Project Analysis

Project benefits/outcomes and costs should be measured on an incremental basis. When appraising a project, two scenarios should be assessed, one that includes the project (that is, the "with" project scenario) and one that does not include the project (the "without" project scenario). Incremental analysis of a project entails the computation of the net benefits generated by the project over and above those that would have occurred in the absence of the project. The incremental net benefits are computed by subtracting the benefits and costs of a project in the "without project" scenario from those in the "with project" scenario. Incremental project analysis allows for the identification of the benefits and costs generated as a result of the project in question.

An important element of incremental analysis is to ensure that the "without project" scenario is properly defined. The "without project" scenario needs to be optimized to ensure that it is comparable to the "with project" scenario. In principle, the "without project" scenario is not static; it should be a dynamic projection of how the situation in the absence of the project would naturally evolve, with correct measures being taken, such as maintaining existing infrastructure to meet service requirements and standards. A simple "before" and "after" comparison of the project is not appropriate as these two scenarios represent static scenarios whose circumstances do not change to reflect measures that would be taken most, especially when the project is not implemented.

In the case of a water supply project, for instance, optimization of the existing water provision system ("without project scenario") includes accounting for the following activities that are likely to be undertaken to keep the system functioning optimally:

i. Incorporation of scheduled maintenance of the existing facility;
ii. Execution of marginal investments that provide for adequate operation of the existing facility;
iii. Application of modern administrative measures that improve the quality of service provided; and,
iv. An introduction of cost-reflective water tariffs.

In the water sector, the optimization of the performance of the existing infrastructure may prove to be the least costly solution to the existing problem in certain instances.

3.2.4. Analysis of Project Alternatives (Options Analysis)

Following on from the options analysis conducted at the PCN stage, options analysis at the PFS stage should include a quantitative assessment of the project's alternatives, which outlines the preliminary costs and benefits of the project. A CBA shall be conducted for all of the project alternatives that are being considered. The analysis is used to assess and compare the identified project alternatives to ensure that the best strategy is adopted pursuant to the project's objectives and that the resources expended are used efficiently and effectively. The preferred project alternative shall be selected based on, among other criteria discussed, the CBA indicators in comparison with those of the other alternatives.

A summary should also be given, which states the preferred option and explains how the preferred option meets the objectives more effectively than other options and provides the best value for money. Illustrative examples of the quantitative financial and economic options analysis of the Chitungwiza Water Supply Project are presented in sections 3.3.1.5 and 3.3.2.4, respectively.

3.2.5. Project Model and its Role in Undertaking a Project Appraisal

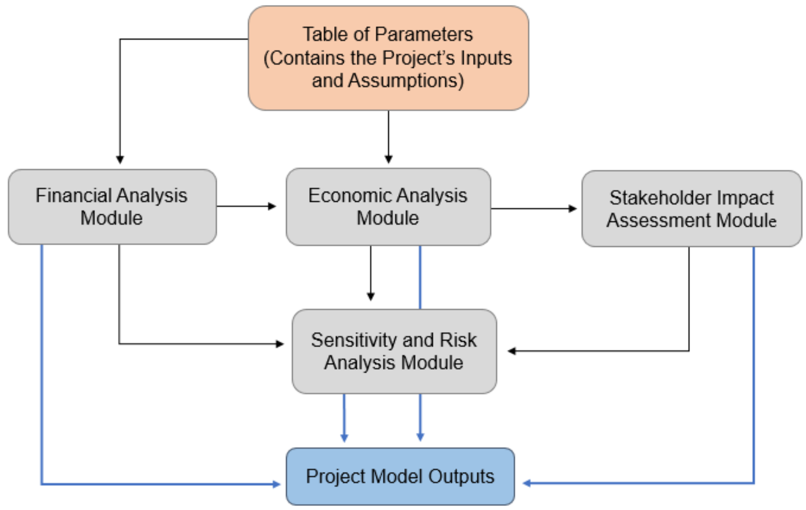
Conducting an appraisal of a water supply project requires that the expected costs and benefits of the proposed project be forecasted into the future. Forecasting costs and benefits into future periods requires modeling the value of the project's costs (capital, operating, and maintenance expenditures) and benefits (increased water supply, reduction in coping costs, and better well-being) in each successive period. Therefore, a project model is constructed to evaluate a proposed project based on the projections of how the project is expected to perform in the future, given various assumptions about how the costs and benefits are likely to turn out over the project's operational life. The project model is used to compute the key decision metrics that will be used to assess the project's financial and economic viability, as well as in assessing the social impacts and identifying the project's risks.

Model Structure

The project model should be created using Microsoft Excel. The model should follow a clear and logical structure. The components and structure of the model are presented in Figure 8. The model should be titled with a name that identifies the project under appraisal and should include the date when the model was constructed or last updated; this should include the year, month and day; for example, "Chitungwiza Water and Supply Project 2013-01-12.xlsx".

The model should be constructed in such a way that it integrates the financial analysis, economic analysis, stakeholder impact assessment and the sensitivity and risk analysis modules. The inputs used to calculate the outputs in the financial, economic, and stakeholder impact modules should be linked to those inputted in the table of parameters. This integration allows for a dynamic model that can be subjected to a sensitivity and risk analysis as any changes in inputs will be reflected in the project's financial analysis, economic analysis, and stakeholder impact assessment outputs in the sensitivity and risk analysis modules. The model should be constructed using a single time frame, such as annual, semi-annual, quarterly, or monthly.

Figure 8. Structure of the Project Model



Model Inputs and Assumptions

Various inputs and assumptions about the project's key parameters (costs and benefits) are required to construct a robust model that captures as accurately as possible the feasibility of undertaking the proposed project. Suppose primary data is not available at the PFS stage. In that case, it can be substituted with secondary data from a project that has already been implemented, that is of a similar scale and/or scope. The required inputs and assumptions are listed below:

- Period of project commencement
- Period of project cessation
- Project evaluation period
- Assets to be constructed (e.g., a dam or reservoir) and their respective costs and useful lifespans
- Assets to be acquired (e.g., water pumps, pipes, taps; etc.) and their respective costs and useful lifespans
- Expenditure on human capital if applicable (engineers and technicians)

- Expected operating costs of the water supply infrastructure (this should be categorized by the item, i.e., fuel/pumping costs, labour costs, cost of chemicals, etc.); for the "without" and "with" project scenarios
- Maintenance costs of the water supply infrastructure (the frequency of these costs should reflect when maintenance is required; this can be on an annual basis or every five or ten years) for the "without" and "with" project scenarios
- The capacity of the water supply infrastructure for the "without" and "with" project scenarios
- The number of beneficiaries expected to use the water supply facility; these water users can be categorized as follow:
    - i. Household Users, and;
    - ii. Commercial Users.
- Existing quantity of water consumed by each category of consumers
- Forecasted demand for water by each category of beneficiaries/consumers
- The existing tariff structure for each category of beneficiaries/consumers
- New tariff structure, if a change of the tariff is expected once the project is implemented
- Current practices of obtaining water and their associated costs (time spent collecting water and cost of purchasing water if applicable)
- Hydrological information such as available water sources and recovery rate
- Financial discount rate
- Economic discount rate
- Macroeconomic parameters (inflation rate, exchange rate, real change in prices and salaries)
- Taxes and other fiscal payments (if applicable)
- Sources of funds
- The gear ratio in the case of multiple sources of funds (debt financing, private sector financing etc.)
- Terms of debt financing if applicable (interest rate, loan repayment period, grace period etc.)
- The depreciation rate for project assets

- Any other key inputs as deemed fit given the nature of the project

3.3. Conducting a Cost-Benefit Analysis of a Water Supply Project

3.3.1. Financial Analysis

There are a number of reasons for conducting a financial appraisal of a water supply project. With any project, it is important to ensure that it is a financially viable and sustainable undertaking. For the project to meet the consumers' demand for water and maintain the quality of service without any interruptions, it is important to ensure that financial resources are available to finance the project's activities throughout its investment and operating phases.

While a positive economic return is a prerequisite to undertaking a project, it is by no means a sufficient reason for a successful outcome. A project with a high expected economic return may fail if there are insufficient resources to finance the project's operations. Many examples of development projects with expected high economic returns have failed as a result of financial difficulties. Water supply projects are a typical example of projects that generate substantial economic benefits due to the high economic value attached to water but may struggle financially, especially when the tariffs levied are not cost-reflective.

Evaluating the financial performance of a project is also key when private sector participation in the project is being considered as a way to finance the project. Assessing the project's financial benefits will allow the public sector to determine if the project generates a sufficient return to attract private sector investment.

Given the preceding discussion, the financial analysis should take into consideration the following key issues:

i. An assessment of the demand for the project's output,
ii. The tariff structure, and;
iii. Private sector participation

3.3.1.1. Project Demand Assessment

Water supply projects must be demand responsive. Project impact evaluations have shown that projects that do not meet demand have difficulties such as underutilization, poor maintenance, and inadequate funds to undertake operating and maintenance activities.

Demand reveals consumers' interest in receiving a particular service (in this case, water supply). Demand is mainly assessed through the willingness of the targeted beneficiaries to commit financial resources in order to receive the project's output. Demand projections are crucial in determining the scale and timing of an investment and its financial viability and sustainability.

In assessing the demand for the project's output (water), the following considerations should be made:

i. The needs and preferences of different types of users of the service,
ii. Their priorities with regards to the use of potable and or non-potable water, and;
iii. Their income, willingness and ability to pay at different price points (this is key in ensuring that vulnerable groups within society such as the poor who may not afford the services are not marginalized).

Different types of water users have different preferences, and hence, the demand for the project's output is not identical. For instance, urban and rural households have different consumption patterns when it comes to potable and non-potable water, which is determined by various factors. Thus the approach to assessing the demand among a host of water users often differs.

Demand is closely linked to the level of service required and provided; that is, the quantity and quality of water must meet the needs and purposes of consumers. The level of service influences the price of the service, which in turn will determine the consumption of the project's output. To the extent possible, the relationship between quantity demanded and the price (price elasticity) should be determined, as the impact and sustainability of a water project can be compromised if actual consumption is significantly more or less than the anticipated demand, this can have a pronounced effect on the financial and economic viability and sustainability of a project.

Besides the level of service provided by the project, the amount of a project's output (water) that is consumed is also a function of the tariff borne by the consumers. Projections for the current and future demand for any water supply project's output should be assessed at different tariff levels. From a financial perspective, the water tariff imposed by the project is a crucial determinant not only of water consumption but also the project's ability to generate revenues which are key to ensuring that the project's operation and maintenance activities are carried out and that any capital expenditures required in the future are met. From an economic perspective, the project's aggregate benefits are determined by the demand, which is directly determined by the tariff, the quality and reliability of the service, time saved from collecting water; as well as the impact of clean and safe water in reducing the burden and cost associated with waterborne diseases. Project benefits are only sustainable as long as the project can deliver its services, which hinges on its financial viability.

3.3.1.2. Tariff Structure

In the case of a water supply project that will charge a tariff for services rendered, the setting of water tariffs is one of the most crucial issues regarding the project's financial performance. For a project to be financially viable and sustainable and generate the anticipated benefits over the long haul, tariffs must be set so that the project can cover the cost of providing the service.

The tariff structure of a water supply project is one of the key elements determining the project's financial success. The water tariff should provide the right set of incentives to water consumers; furthermore, it should match the level of service rendered and maximize the recovery of costs by ensuring that a substantial amount of the community's willingness to pay is captured. In the case of private sector participation, the tariff should be set and regulated by a regulatory body to ensure that consumers are not overcharged and that the private sector does not generate any returns above the normal/required rate of return. However, it is also imperative that the regulatory body allows for the frequent indexing of tariffs to inflation to ensure that the project remains a viable and sustainable undertaking over the long haul so that water services are rendered in line with the agreed service standards.

Most tariffs are usually set below the marginal cost (MC) of providing the service, mostly with the aim of being affordable to the public, most especially low-income households. However, such policies can jeopardize the sustainability of service delivery. The optimal water tariff structure is one where the tariff is equal to the MC of supplying water. However, given that water is a basic need and everyone has a right to it, consumers who cannot afford the water supply when the tariff is set to the MC should be cross-subsidized by higher-income households. Hence, higher-income households will pay a tariff slightly higher than the MC in order to offset the lower tariffs that will be applied to low-income households, thereby giving equitable access to water to all households irrespective of their income level.

The setting of a water tariff should be based on the following considerations:

i. The lifecycle costs of delivering the service and sustaining it (that is, capital costs, O&M costs and replacement costs), and;
ii. Provide good quality water services to all at an affordable price and in line with different income levels.

The use of subsidies or grants should be carefully considered so that they are only used to address the intended purpose of providing water services to the vulnerable and poor at an affordable cost. Poorly designed subsidy policies may result in the misuse of water resources.

3.3.1.3. Private Sector Participation

In cases where the private sector is involved in financing a proposed project, financial analysis can be undertaken to determine if the project generates sufficient returns to attract private investors. If, however, the proposed project cannot generate the rate of return required by private investors, an important function of financial analysis then becomes that of determining the amount of public assistance required to induce private sector participation in the project. Public assistance of a project is warranted if the project is economically viable.

3.3.1.4. Constructing a Financial Cash Flow Statement

The preceding sections discussed the key issues to consider when undertaking financial analysis. In this and subsequent sections, we look at how to conduct and interpret the results of the financial appraisal of a water supply project.

Financial analysis is conducted using the discounted cash flow (DCF) methodology. This method requires constructing a cash flow statement to carry out a financial analysis of a project. A typical cash flow statement is organised into two distinct sections. The first section is dedicated to summarizing all of the receipts generated by the project, whereas the second section is concerned with project expenditures. The main components of the two sections of the cash flow, receipts/revenues (inflows) and expenditures (outflows), are outlined below.

The cash inflows of the project typically consist of the following items:

i. Operational revenues
ii. Changes in accounts receivable
iii. Residual values if the economic life of the project's assets exceed the analysis period

The cash outflows of the project typically consist of the following items:

iv. Capital expenditures
v. Operational expenditures (including income tax liabilities)
vi. Maintenance expenditures
vii. Changes in working capital (accounts payable and cash balances)

Following the cash flow structure outlined above, the financial analysis of a proposed water supply project requires that two cash flows be constructed; one for the "without project" and the other for the "with project" scenario. Once these two respective cash flow statements are constructed, the incremental cash flow statement can be derived. It simply entails subtracting the cash inflow and outflow items of the "with the project" scenario from the corresponding "without project" scenario.

3.3.1.5. Criteria used to evaluate the Financial Attractiveness of a Project

The incremental cash flow statement is what is used to conduct the financial analysis by calculating the net cash flow, which is simply the difference between the total inflows and outflows. When debt financing is part of the capital structure, the incremental cash flow should be constructed from two points of view;

a. **Total Investment Point of View / Lenders Point of View:** This cash flow statement does not include debt and equity financing and debt repayment. This particular cash flow statement is used to evaluate the project's ability to meet its debt service obligations. Debt coverage metrics, namely, Annual Debt Service Coverage Ratios (ADSCRs) and Loan Life Coverage Ratios (LLCRs), are used to measure the project's ability to service its debt. Both these debt service ratios (ADSCRs and LLCRs) should be greater than one or greater than or equal to a benchmark set by a financial/lending institution. Ratios that meet these conditions indicate a project with a healthy cash flow that can meet its debt obligations after paying off all of its operating and maintenance expenditures.

b. **Equity Point of View:** This cash flow statement is constructed to evaluate the project's profitability from the shareholders' perspective as measured using the Financial Net Present Value (FNPV) and the Financial Internal Rate of Return (FIRR) metrics. In contrast to the total investment point of view cash flow statement, the equity point of view cash flow includes debt financing and debt repayment as these are expenditure obligations that the project must settle before its profitability can be measured.

   The primary investment criterion that is used to measure a project's financial performance is the FNPV. A financially viable project will result in a positive FNPV when the real net cash flow is discounted using the appropriate required rate of return. From the government's perspective, the financial returns accruing to the private investors in the case of a Public-Private Partnership (PPP) should never exceed the minimum rate of return required to attract such an investment. It implies that if water tariffs are imposed on a given project, they should always be capped at a minimum rate that allows the private investors to break even. Moreover, the financial gains to the private sector should not result in user and fiscal costs of water supply that are above what they would be if the same project were implemented through traditional procurement methods.

An alternative investment criterion that can be used to gauge a project's financial performance is the FIRR. Based on this criterion, a proposed project should only be accepted if the FIRR is greater than the required rate of return.

An illustrative example of the financial analysis of the Chitungwiza Water Supply Project is given in Box 6.

Box 6. An Example of the Financial Analysis of a Project

Item	PV (million USD)
CAPEX	$ 29.70
Life Cycle O&M Costs	$ 37.35
Total PV of Project Costs	$ 67.05
Present Value of Project Revenues	
Expected Life Cycle Revenue	$ 24.29
Total PV of Project Revenues	$ 24.29
Financial Net Present Value - FNPV	$ (42.76)

Note: The project's revenues and expenditure were discounted using a 12% required rate of return

The conclusion that can be drawn from the financial analysis is that the project is not financially viable, as the project's FNPV is negative. It is clear that the water tariff is not optimally priced to cover the marginal cost of production. The project is likely to be unsustainable unless the tariff is restructured or funding is acquired to subsidize the cost of producing water.

3.3.2. Economic Analysis

The economic analysis of water supply projects is an essential component to determine the economic viability and sustainability of the proposed project. Unlike financial analysis, which only assesses the benefits accruing to one entity, for example, the private sector in the case of a PPP, the economic analysis assesses the benefits accruing to society as a whole. An economic analysis is useful for evaluating if the economy's resources are being put to their best use if they are allocated to be invested in this particular project, given that resources are scarce and there are competing needs (alternative uses) for the resources that are allocated to any project. Hence, the main objective of economic analysis is to ensure that the country's resources are being used efficiently.

The net economic contribution of a project is measured by the present value of the project's incremental net economic benefits. The economic analysis aids decision-makers in allocating the available resources to those projects that maximize the present value of the net economic benefits created for the country, community or group of beneficiaries given the amount of resources invested.

3.3.2.1. Identification of the Economic Benefits Generated by Water Supply Projects

Water supply project benefits can be distinguished between those that provide health benefits and/or non-health benefits. These types of benefits are mainly attributed to the provision of either potable water or non-potable water. This means that when looking at the benefits of a project, one must be careful in correctly identifying the type of benefits generated by the project in question. Given the nature and scope of the project in question, the resulting benefits from the proposed project can be identified using the project benefit identification matrix presented in Table 6.

Table 6. Project Benefit Identification Matrix

	Potable Water	Non-Potable Water
Incremental Output	Health and/or non-health benefits	Non-health benefits
Non-incremental Output	Health and/or non-health benefits	Non-health benefits

i. **Non-Health Benefits:** are generated as a result of the project improving water services (quantity, quality and or reliability) to consumers who are already connected to the water supply system. While for consumers who were not connected to the water supply system, the project generates benefits by providing access to more suitable water services that meet the end-users expectations of the level of service (quantity, quality and or reliability). Some of the more typical non-health benefits of a water supply project are listed below:

   a. **Increased Water Consumption:** as a result of the project, consumers have increased availability/access to water for various uses. The value of increased water consumption can be estimated using consumers' willingness to pay for additional water.
   b. **Cost Savings:** some projects significantly reduce the cost of water for either consumption or production purposes through the reduction of water tariffs or the lowering or elimination of coping costs in cases where in the "without project" scenario, consumers incurred additional costs in obtaining water of a specific quantity or quality relative to their needs/use cases. For example, if in the "without" project scenario, consumers did not have access to clean and safe potable water. They would have had to incur the additional fuel costs of boiling unclean water or the additional costs of chemicals to treat the water and enhance its quality to make it suitable for human consumption. A project that provides clean and safe potable water would lower the cost of accessing

clean and safe water, thereby generating savings for water consumers, which can be used for other purposes or needs. Consumer surplus can be valued using the willingness to pay for water by consumers.

c. **Time savings:** this type of benefit is usually realized when consumers were spending a lot of time fetching water in the "without project" scenario due to, for instance, the unavailability of water sources within close proximity to their areas of use. For example, some rural households' only water sources are rivers and streams far from their settlements. Water supply projects that allow direct access to water by these households, for instance, through household connections; or bring water within close proximity through the use of boreholes located in a central place within the settlement will result in significant time savings. As time has an opportunity cost, time saved could be used for other activities such as engaging in economic or leisure activities during the time that would have otherwise have been spent transporting water from rivers or streams to the home. Time savings can be valued using a proportion of the wage rate of an unskilled worker in the project area.

d. **Water resource savings:** some projects generate benefits by reducing technical losses, where a project fixes pipes and connections to avoid water leakages. The two main benefits that such a project provides are:

   i. Water pressure will increase as a result of lower leakages, improving water supply most especially in high altitude areas, and;
   ii. Water is transferred from low value to high-value consumption.

Other projects can lead to the efficient use of water resources through metering systems, giving consumers an incentive not to waste water.

ii. **Health Benefits**: water supply projects also generate a number of benefits as a result of clean water supplied by the project replacing unclean and unsafe water. The health-related benefits of a project, for instance, might include a reduction in the incidence of water-borne diseases such as diarrhoea, cholera, bilharzia or typhoid, among many others. Health benefits can be valued by estimating the avoided public and private medical costs and the cost per reduction in disability and morbidity. Other health benefits of clean and safe water are increased labour productivity and improved learning outcomes among children due to the number of healthy days gained as a result of avoided sickness. These benefits can be valued by estimating the avoided loss in wages for labour and the time and cost of catching up with studies for children. In some instances, it is not feasible to attach monetary values to the health benefits as it is either difficult or appropriate data may not be available. Hence, some health benefits may be assessed using Cost Effectiveness Analysis (CEA).

3.3.2.2. Economic Valuation of the Benefits and Costs of Water Supply Projects

The provision of water supply services entails a significant outlay of resources, and in turn, these services produce a substantial amount of benefits. As described earlier, these benefits can be split into two broad categories: health and non-health benefits.

The costs and benefits of water supply projects are idiosyncratic; they can hardly be generalized and will depend on the prevailing situation of the particular project.

Valuation of Economic Benefits

The economic benefits generated by the project can be valued based on the willingness to pay (WTP) method. There are various approaches to valuing the different types of benefits generated by the project using the WTP method.

In most cases, project benefits can be valued using the market price of the project's output, where the output has an existing market. In cases where market prices do not accurately reflect the economic value of the project's output, they are adjusted in order to remove the factors that cause a disparity between the output's market and economic value; the process of adjusting market/financial values of either project outputs or inputs is further discussed in section 3.3.2.3.

In cases where the project's output is not traded in any market, market values cannot be used to value the output. The valuation of non-market project outputs can be estimated using the revealed or stated preference approaches of the WTP method.[8] However, certain benefits cannot be valued in monetary terms; for example, the health benefits generated by a project such as reduced

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[8] **Revealed Preference:** This method measures consumers' preference for a good or service through the observation of purchasing behaviour. The underlying assumption of revealed preference is that consumers have a set of alternative options of a good or service that all meet the same need or want; and given these choices, a consumer choose their preferred option. Using the revealed preference approach a schedule of given population can be derived, which given their preferred choice given price and budget constraints.

Stated Preference: An alternative method to revealed preference is the stated preference. This method is based on carefully controlled surveys that estimate WTP given a set of hypothetical project scenarios. These surveys ask questions regarding the current consumption of a good or service by consumers. The consumers are then presented with hypothetical projects scenarios aimed at providing a new good or service or improving an existing one. Such scenarios are presented at different price points, with consumers being asked how much they would be willing to pay given the type and level of good or service provided in each scenario. Such a survey also known as the Contingent Valuation Method (CVM), allows trained and experienced CVM practitioners to determine the type and level of good or service demand by consumers that they would be willing to pay for.

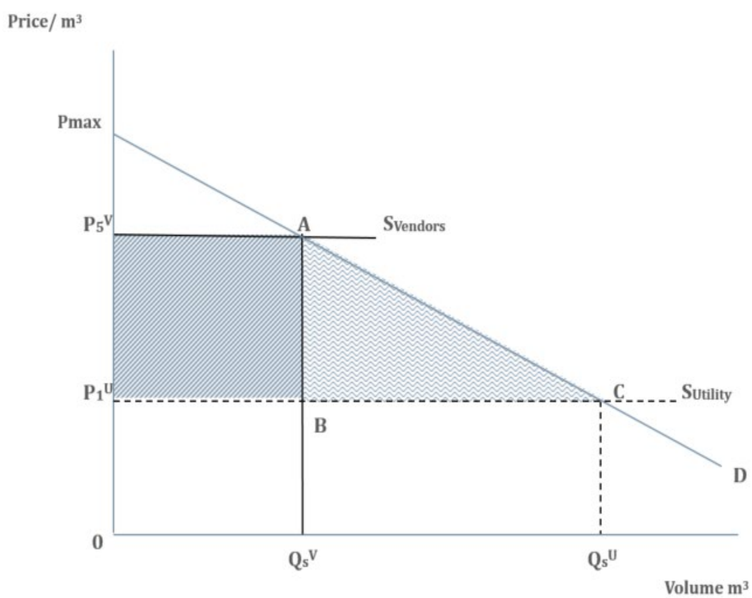
mortality and morbidity due to improved water quality may be impossible to measure in monetary terms. In such instances, the benefits should be valued using other methods such as cost-effectiveness analysis.

The economic benefits of a water supply project can be measured based on the type of output the project delivers (incremental or non-incremental). The examples given below illustrate some of the economic benefits generated by the Chitungwiza Water Supply Project and how to value them.

Case 1: Valuation of the benefits generated by substituting water supplies from vendors

In the Chitungwiza Water Supply Project case, residents were supplementing their water requirements with water from vendors as there was not enough supply from the water utility. With the advent of the new water supply project, the water supplied by the vendors will be replaced with water from the utility. The benefits of this substitution are shown in Figure 9.

Figure 9. Economic Benefits of Water Supply Substitution



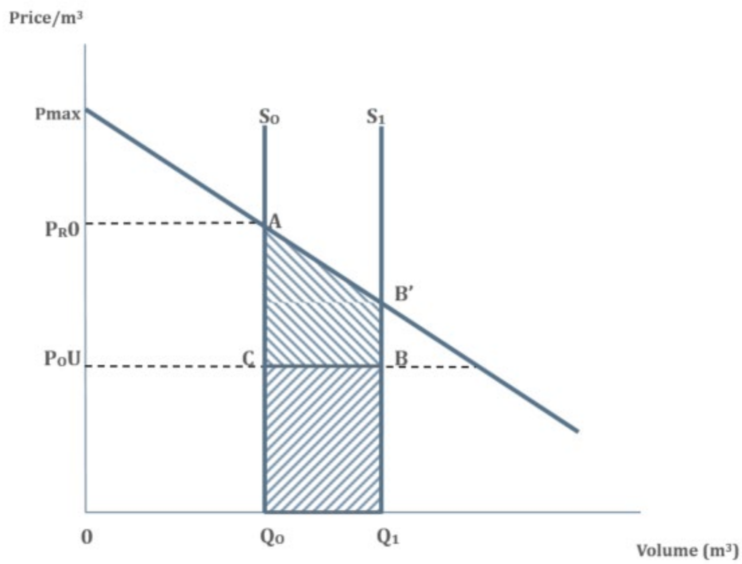
As shown in Figure 9, "without" the project, vendors charge consumers P_5^V for a cubic meter of water. At this price, consumers demand a quantity equal to Q_s^V.

On the other hand, "with" the project, the utility levies a tariff of P_1^U, which is significantly lower than the price charged by the vendors. As a result, consumers substitute the water supplied by the vendors with that of the utility. As the price charged by the utility is lower than that of the vendors, the quantity demanded is higher and stands at Q_s^U. Three distinct benefits arise as a result of the project. The first one is the reduction in payments made for water consumption by consumers due to the reduction in the cost of water. This benefit is represented by the area ($P_1^U P_5^V$AB). It is non-incremental as the quantity (O- Q_s^V) represents the quantity of water from the vendors substituted by water supplied by the project. The second benefit is the additional consumer surplus due to a reduction in price and the incremental water supply (Q_s^U - Q_s^V) of water supplied by the project. This consumer surplus is represented by the area (ABC). The third benefit is increased access to water, as shown in the diagram by the increased volume of water available to consumers (Q_s^U - Q_s^V).

Case 2: Valuation of the benefits generated by reducing coping costs

Apart from purchasing water from vendors, the residents of Chitungwiza also spent considerable time fetching part of their water requirements from nearby wells. Additionally, they also faced the cost of storing water. As the project will provide direct access to water at the household level, the residents will no longer have to spend time fetching water or the costs associated with storing water as they have unrestricted access to water all day long.

Figure 10. Economic Benefits of Reduced Coping Costs



As shown in Figure 10, P_R0 is the cost of accessing water that the residents face in the "without" project scenario. This cost is equal to P_0U (water tariff) plus P_0U-P_R0 (which is the coping cost and includes the time spent fetching water and the cost of storing it).

"With" the project, consumers' cost of obtaining water decreases from P_R0 to P_0U. Hence the savings in coping costs that result from the non-incremental water from the well substituted by water from the project is equal to area P_0UP_R0AC. The project also supplies an additional quantity of water equal to $Q_1 – Q_0$, and in turn, reduces the cost of water consumption, resulting in a consumer surplus represented by the area (CAB'B).

Valuation of Economic Costs

Largely the costs incurred in any water supply project can be categorized into two main components: investment costs and operation and maintenance costs. For economic analysis purposes, these costs should be valued at their economic prices as described in section 3.3.2.3.

In addition to these two project cost components, one of the most important cost items in a water supply project is the water itself. Water constitutes the main input in a water supply project. Water has an opportunity cost. The valuation of water from a financial perspective would only take into account the market price of obtaining or extracting water from water sources for the purposes of supplying it to consumers; the economic valuation should take into consideration the opportunity cost of using water in this particular project versus other alternative uses. The value of the opportunity cost of water will depend on the amount of water resources available relative to demand. For instance, if water resources are limited and a water supply project is only able to make water available to urban users by diverting some of the water used for agricultural purposes; the opportunity cost of water would be equal to the agricultural production lost as a result of diverting water from its primary use in agriculture to urban areas.

3.3.2.3. Constructing an Economic Resource Flow Statement

The preceding sections discussed the identification and valuation of project benefits and costs. In this section and the ones that follow, we look at how to conduct and interpret the results of the economic appraisal of a water supply project.

Constructing the economic resource flow statement used in the economic analysis; entails converting the financial cash flow statement into an economic resource flow statement. The receipts and expenditures recorded in the financial cash flow statement are converted to their economic equivalents, benefits (revenues), and costs (expenditures). The economic value of a project's benefits and costs do not always have corresponding values in financial terms, as financial values of certain items are distorted due to the presence of various tariffs, taxes, subsidies and the foreign exchange premium (FEP).[9] Hence, conducting an economic analysis is to convert all the financial cash flow values into their economic equivalents. This is done through the use of conversion factors. An economic Conversion Factor (CF) is the ratio of the economic price of an expenditure or receipt item to its financial price. An analyst is required to estimate the CFs for all the project's cash flow items. Once the CFs have been estimated, the economic resource flow statements for the "without" and "with" project scenarios are derived by converting the expenditures and receipts of the financial cash flows into their equivalent economic costs and benefits by multiplying the financial expenditures and receipts by their corresponding CFs.

The incremental resource flow statement is then derived by subtracting the "with" project resource flow statement from the "without" project resource flow statement.

[9] When funds are sourced in the capital market and used to purchase either tradable goods, investment and consumption by others in the market is displaced. This displacement results in the government losing tariff revenues, VAT, and other indirect taxes. Such loses must be accounted for during the economic valuation of tradable inputs or outputs of a project. By calculating the foreign exchange premium (FEP), it is possible to adjust the financial price of tradable items, along with other distortions like tariffs and VAT to find their economic value.

3.3.2.4. Criteria used to evaluate the Economic Attractiveness of a Project

The incremental resource flow statement represents the overall costs and benefits generated by the project from society's perspective as a whole. It is used to compute the indicators used to measure the economic viability and sustainability of the project.

The primary investment criterion used to measure a project's economic attractiveness is the Economic Net Present Value (ENPV). An economically viable project will result in a positive ENPV when the real net economic resource flow is discounted using the appropriate economic opportunity cost of capital (EOCK). Suppose the ENPV of the proposed project is greater than zero. In that case, the project is a potentially worthwhile undertaking. A positive ENPV implies that the project would generate a greater net economic benefit than if the resources had been used elsewhere in the economy. On the other hand, if the ENPV is negative, the project should not be pursued on the grounds that the country's resources can be put to better use elsewhere.

An alternative investment criterion that can gauge a project's economic performance is the Economic Rate of Return (ERR). Based on this criterion, a proposed project should only be accepted if the ERR is greater than the EOCK. A project with an ERR that is greater than the EOCK represents a project that generates a greater amount of net economic benefits compared to the resources invested and any other alternative investments for which the resources could have been used. A project whose ERR is less than the EOCK indicates that the country's resources are better off used elsewhere in the economy. An illustrative example of the economic analysis of the Chitungwiza Water Supply Project is shown in Box 7.

The investment criteria presented above can only be computed given that both the project's benefits and costs can be monetized. Hence CBA tends to exclude health benefits that may not easily be quantifiable in monetary terms. Suppose the health benefits generated by a project cannot be quantified in monetary terms, and they are anticipated to be significant. In that case, CBA should be supplemented with a qualitative and/or quantitative assessment of such benefits. As discussed in section 3.3.2.1, CEA can be used to assess health benefits quantitatively. Using CEA, the effectiveness of the project to generate a given unit of health benefits for a given cost can be measured through the use of CEA ratios. CEA ratios are computed as follows:

$$CE = \frac{C}{E}$$

Where:
C = costs, ideally these costs should be the net cost (in other words, any cost savings, such as reduced costs of health care borne by the beneficiaries of the project in the without project situation, should be deducted from the overall project cost)

E = Units of Effectiveness

The CEA ratio is interpreted as the average cost of generating a unit of health benefits such as reduced disease burden from water-related illness.[10] According to the CEA criterion, projects with the lowest ratios are preferred.[11]

In cases where the project's ENPV is positive, and the EIRR is greater than the EOCK, then the project is justified based on the merits of its benefits outweighing its costs. However, in projects where the ENPV may be negative, or the EIRR is lower than the EOCK, then projects may be justified based on their CEA ratio (considering that the ratio is lower than the threshold benchmark).

In assessing the economic attractiveness, the following procedure is recommended when some of the project's benefits cannot be quantified in monetary terms, or it isn't easy to monetize such benefits.

Step 1: Compute the ENPV based on the costs and benefits that can be monetized.

i. If the ENPV is positive, then the project is justifiable. The assessment would stop at this point, as there is no need to further justify the project's worthwhileness. Any project benefits that cannot be monetized or are difficult to monetize would only increase the project's ENPV if they were expressed in monetary terms. However, if needed, a qualitative assessment of these benefits can be included in the assessment as additional evidence of the positive impact that the project would have on its beneficiaries.
ii. If the project results in a negative ENPV, step two would need to be carried out.

Step 2: For negative ENPV projects, the following should be done to assess the viability of the project further:

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[10] Reduced disease burden can be measured by looking at measures such as Disability Adjusted Life Years (DALYs) or Quality Adjusted Life Years (QALYs) which take into account the project's impact on life expectancy and quality of that life.

[11] The CEA ratio(s) the project should be compared against a benchmark of other projects within the country that are of similar nature and scope or against other projects within the region if country specific benchmarks are unavailable. With the inclusion of benchmarking the effectiveness of the project in generating health benefits is assessed by looking at whether or not the project's CEA ratio(s) exceed the threshold.

i. Monetize any of the benefits of the project that are particularly difficult to translate into monetary terms. Some project benefits are not easy to monetize due to a lack of sufficient data, the expertise required and/or the resources that would be required to do so (time and money). For example, the assessment of health benefits would require ex-ante health assessment and impact studies that do not come cheap. It only becomes necessary to undertake such studies only when the initial project evaluation generates a negative ENPV. Once these benefits have been monetized, they should be added to all of the project's other benefits and measured against the cost. If the ENPV generated is positive, then there is no need to assess the project further.

ii. However, if the project produces a negative ENPV and does not have any benefits that cannot be monetized, this project is not a worthwhile undertaking.

iii. If the project produces a negative ENPV and some of its benefits cannot be monetized, then the project's assessment should be conducted based on the recommendations outlined in step 3.

Step 3: Projects with negative ENPV and have some benefits that cannot be monetized can be assessed using CEA. This entails calculating CEA ratios given the cost of generating such benefits (e.g., health benefits). Hence, the justification of such projects ceases to be based on CBA metrics such as ENPV and EIRR but would be justified based on its CEA ratios compared against existing benchmarks as described above.

Box 7. An Example of undertaking an Economic Analysis of a Project

Project Benefits	**PV (million USD)**
1. Time savings	$ 26.82
2. Cost savings (water purchases from vendors and water storage)	$ 91.34
3. Water resource savings (leaking pipes)	$ 12.46
Total Life Cycle Benefits	**$ 130.62**
Project Costs	
1. CAPEX (valued at shadow prices)	$ 23.76
2. O&M Costs (valued at shadow prices)	$ 26.14
Total Life Cycle Costs	**$ 49.90**
Economic Net Present Value - ENPV	**$ 80.71**

Note: The project's revenues and expenditure were discounted using a 12% required rate of return

The conclusion that can be drawn from the economic analysis is that the project is economically viable, as the project's ENPV is positive.

3.3.3. Distributive Analysis

The implementation of a project may result in both positive and negative impacts on various groups of society. These impacts can be both direct and indirect. The distributive impact assessment is used to identify and quantify the proposed project's impacts on the project's stakeholders. In other words, distributive analysis is used to identify who stands to gain or lose as a result of the project and by how much. In the case where the project poses adverse impacts on society, mitigation measures should be found to ameliorate these negative impacts.

The distributive impacts of the project within each category of stakeholders should be disaggregated by gender wherever possible. As far as the benefits of water supply projects are concerned, given the fact that women and girls play a more active role in the management of water resources, it is likely that the majority of benefits such as health, cost and time savings will largely accrue to women as opposed to men. For instance;

i. Access to clean and safe water will mean that women will spend less time taking care of sick family members, pregnant women will not be exposed to water-borne diseases during pregnancy and delivery, which can lower mortality and morbidity for both mother and child
ii. Improved access to a convenient water supply would reduce the time spent by women and girls collecting and carrying water. The implications are that women have more free time to engage in other activities and girls are free to attend school.

The project's gender impacts can be broken down by applying sex-disaggregated statistics to the benefits' distributive analysis. The distributive impacts of the project may also be disaggregated based on other relevant groupings such as income groups within the population of beneficiaries to show how the project impacts poorer households, for example.

The distributive analysis is based on the project's financial and economic analysis. It is conducted by estimating the externalities generated by the project. Project externalities are derived by finding the difference between the financial and economic values of the project's inflows and outflows. The externalities generated across various social groups, either directly or indirectly by the project, represent the costs or benefits accruing to each group of stakeholders. Distributive analysis excludes the equity holders and lenders as their interests are financial and are assessed in the financial analysis module.
The distributive analysis is composed of the following steps:

1. Identification of project stakeholders and externalities.
2. Estimation of the magnitude of the project's externalities, measured by taking the difference between the economic value of a project's inflows or outflows and the financial value of the same inflow and outflow items.
3. Computing the present values (PVs) of the project's externalities over the project's life using the EOCK.
4. Reconciliation of the financial, economic, and stakeholder analysis modules.[12]
5. Allocation of the PV of externalities among the project's stakeholders.

An illustrative example of the distributive analysis of the Chitungwiza Water Supply Project is shown in Box 8.

Box 8. An Example of undertaking the Distributive Analysis of a Project

Project Benefits	PV (million USD)	Stakeholder
1Time Savings	$ 18.77	Consumers - Women
	$ 8.05	Consumers - Men
2. Coping Cost savings (water purchases from vendors and water storage)	$ 63.94	Consumers - Women
	$ 27.40	Consumers - Men
3. Water resource savings (leaking pipes)	$ 12.46	Water Utility

3.3.4. Risk Analysis

A CBA would not be complete without taking into account project risk(s). As the benefits and costs of a water supply project are projected into future periods, uncertainty exists regarding their realization and the attainment of the required financial and economic returns as well as the intended outcomes set out for the project. The financial and economic variables that pose a risk to the project's overall financial and economic performance should be identified and their impacts assessed at the PFS stage using sensitivity analysis. For example, since water demand forecasts

[12] When conducting reconciliation, the analyst should ensure that the he following relationship holds:

$$NPV_e^{EOCK} = NPV_f^{EOCK} + PV^{EOCK} \sum Ext_i$$

Where: NPV_e^{EOCK} is the net present value of net economic benefits

NPV_f^{EOCK} is the net present value of the net financial cash flow

$PV^{EOCK} \sum Ext_i$ is the sum of the present value of all externalities generated by the project and tariffs form the backbone of the financial and economic analysis, deviations in any of these two parameters should be tested to measure their impact on the project's outputs, such as FNPV and ENPV. The identification of project risk variables and their financial and economic impacts can be used as the basis for formulating measures to reallocate or mitigate such risks to make the project viable and/or sustainable.

Sensitivity analysis is used to assess the impact of changes in key factors on the results of financial and economic forecasts (NPVs, IRRs). However, other methods such as break-even analysis, scenario analysis and Monte Carlo simulations can also be utilized to assess the various risks of the proposed project. Key sensitivity factors include the assumptions (initial data/inputs) of the financial and economic model, the actual values of which during project implementation may deviate significantly from the values embedded in the model; due to an inability to accurately forecast them during project appraisal or as a result of their inherent volatility. Typical sensitivity factors include investment costs of a water supply project, operating and maintenance expenditures of the project, water tariffs, and demand elasticity. The sensitivity analysis results should be reported using "Sensitivity Analysis Tables," an example of which is illustrated in Box 9. using the case of the Chitungwiza Water Supply Project.

Box 9. An Example of undertaking a Sensitivity Analysis of a Project

	FNPV	ENPV
	million USD	
20%	**(48.70)**	**75.96**
10%	**(45.73)**	**78.34**
0%	**(42.76)**	**80.71**
-10%	**(39.79)**	**83.09**
-20%	**(36.82)**	**85.47**

- The sensitivity table shows how the project's FNPV and ENPV indicators respond to a change in investment costs between +20% and -20%

3.4. Preliminary Environmental and Social Impact Assessment

As stipulated in the PIM Guidelines, the appraisal of a water supply project at the PFS stage should include an Environmental and Social Impact Assessment (ESIA), which is used to determine the impact the proposed project will have on the environment and society either directly or indirectly.

ESIAs are regulated under the Environmental Management Act[13], which stipulates the requirements and procedures of preparing an ESIA report. According to EMA, An ESIA is required for water supply projects. Therefore, the CA should seek guidance from the Environmental Management Agency (EMA), the regulatory authority charged with protecting the environment.

3.4.1. Environmental Impact Assessment

An Environmental Impact Assessment (EIA) is useful in identifying and, where possible, quantifying the potential environmental impacts of a proposed water supply project. Water supply projects can have various negative effects on the environment within the area/region where they are located. Water supply projects threaten land use patterns, the natural flow of rivers and lakes and the depletion and pollution of surface and groundwater sources. Therefore, apart from identifying the environmental impacts resulting from a water supply project, the EIA should also outline the appropriate measures that can be taken to monitor, mitigate or manage such impacts.

In preparing an EIA for the project, the CA must follow the necessary steps and procedures required by the Environmental Management Agency (EMA) before preparing the EIA report. The EIA report must be attached along with other PFS submission requirements. The contents of the EIA report generally include items such as a description of the likely direct or indirect impacts (short and long-term) that the project may have on the environment. It should also include proposed measures of reducing or mitigating any adverse environmental effects.

3.4.2. Social Impact Assessment

A Social Impact Assessment (SIA) is necessary for identifying the direct and indirect, short or long-term impacts that a project will have on the society in the project's area of influence. Water supply projects can have numerous impacts on society; for example, the construction of a dam upstream that will be used to supply water to households and/or commercial enterprises may negatively impact fishers' livelihoods. Similarly, a project may result in the displacement and relocation of people. The SIA should identify the social impacts of the project and outline the appropriate measures that can be taken to mitigate or manage them to ensure the successful implementation of a project.

[13] Environmental Management Act 13 of 2002

Depending on the project and if deemed necessary, the CA should conduct a preliminary SIA. At the PFS stage, the SIA should identify the impact that may occur in the project's sphere of influence. The impacts should be evaluated based on whether they are:

a) Direct or indirect;
b) Immediate or delayed;
c) Negative or positive.

Secondary sources of information may be consulted at this stage. The preliminary SIA report should include proposed ways to alleviate or abate the negative impacts. Furthermore, the social impacts should disaggregate the social impact by gender, income groups and other relevant demographics such as age and sex of head of the household.

3.5. Climate Risk Assessment

The climate risk assessment is a continuation of the climate risk screening conducted at PCN. However, climate risk assessment is an in-depth analysis of how climate change impacts the project and its performance. The impacts are quantified and expressed as economic costs. Furthermore, climate risk assessment leads to the development of adaptation measures that can be utilized to climate-proof the project if it is adversely affected by climate change. The benefits of each climate-proofing option are then assessed to determine the best alternative to mitigate the impacts of climate change on the project.

Climate risk assessment at the PFS stage consists of four steps, that is;

i. The assessment of the economic viability of a regular infrastructure investment project,
ii. Estimating the benefits of climate proofing the project and assessing options to climate-proof the project.
iii. The assessment of the economic viability of climate-proofing, and,
iv. Decision making.

3.5.1. Assessment of the Economic Viability of a Regular Infrastructure Investment Project

A regular infrastructure investment project should be quantitatively assessed with respect to its technical, financial, and socio-economic feasibility and viability. It should be assessed based on the following considerations:

a. Financial viability based on financial metrics such as the financial net present value (FNPV) or the internal rate of return (IRR).
b. Socio-economic viability based on economic project performance metrics such as the economic net present value (ENPV) or the economic rate of return (ERR).

Box 10 provides a summary of the socio-economic analysis of the Chitungwiza water supply project.

Box 10. Illustrative Example of the Economic Viability of a Regular Infrastructure Investment Project

Assessment Criteria	Million USD
Economic Net Present Value - ENPV	$ 80.71

The conclusion that can be drawn from the economic analysis is that the project is economically viable, as the project's ENPV is positive, i.e., the ENPV>0. However, the project must be assessed for climate risk before it is implemented to determine if any climate-proof interventions are necessary.

3.5.2. Estimating the Benefits of Climate Proofing the Project

The determination of whether a project should be climate proofed, as well as the assessment of the benefits of climate-proofing it, should only be done if the 'Regular Infrastructure Investment Project' is deemed to be economically viable; in other words, the project should exhibit an ENPV > 0, as outlined in section 3.5.1.

To determine if a project should be climate-proofed, a detailed quantitative climate risk assessment should be conducted. The climate risk assessment, which is a continuation of the climate risk screening conducted at PCN, is conducted to determine the benefits of climate-proofing the project. The benefits of climate-proofing are the avoided impacts that climate change would cause if the project were not climate-proofed (i.e., the cost of repairing damaged infrastructure and the associated economic losses) if a climactic event such as a drought occurs. Box 11 provides an illustrative example. The benefits of climate-proofing a project should be estimated based on the most likely climate change scenario, i.e., extreme scenarios such as highly pessimistic or optimistic should be disregarded. A common base case scenario should be developed based on the most likely evolution of climate change over a given period. This base case, climate change scenario, should be utilized consistently amongst projects from all sectors.

BOX 11: Illustrative Example of Estimating the Benefits of Climate Proofing a Project

Climatic Change Risk:

- Chitungwiza is located in an area that is susceptible to droughts.
- Historical data shows that the chances of the occurrence of a drought are once every 10 years, i.e., 10%. Furthermore, each drought event leads to a decline in water supply capacity. It is estimated that on average the utility loses about 20% of its supply capacity during a drought.
- According to climate change models developed by climate specialists, the frequency of droughts in the area is likely to increase. It is anticipated that the probability of having a drought will increase to 15%, i.e., the risk of a drought will increase from once every 10 years to 1.5 times every 10 years. In addition, the severity of a drought is expected to increase, with the utility losing about 25% of its capacity on average in the event of a drought. Hence, the annual water production capacity of the utility is likely to decreased by 3.75% per annum.

NPV of a Regular Project ($ million) (W)	NPV of a Regular Project Adjusted for the Impacts of Climate Change Risk ($ million) (Y)	PV of the Benefits of Averting Climate Change Impacts on the Project ($ million) (Z) = (W) – (Y)
ENPV = 80.71	**ENPV = 76.53**	**ENPV = 4.18**

Note:

a. All values in the table are expressed in real terms and discounted using an economic opportunity cost of capital (EOCK) of 12%.

Should Climate Proofing Options be explored?

Yes, climate proofing the project should be explored as the anticipated drought has negative impacts on the project. The benefits of climate-proofing the project are the averted impacts of climate change on the project. The project should be climate proofed if feasible and viable options are available.

3.5.3. Assessment of Options to Climate Proof a Project

The term 'Climate-Proofing' refers to the component or intervention added to the project to enable it to withstand a climate change related event. When it has been determined that climatic change has adverse impacts on the project, CAs should consider what can be done to reduce or minimize those impacts. A key consideration is the cost-effectiveness of various options to climate-proof the project. It should be noted that the benefits that will be derived from climate-proofing the project are unlikely to be technically and economically efficient to mitigate all the climatic risk (i.e., 100% of the risk) that the project is exposed to. Hence, in deciding which climate-proofing option effectively addresses the impacts of climate change on the project, CAs should ensure that the cost of any climate-proofing option does not exceed the benefits that will be derived by adopting measures that alleviate the impacts associated with climate change.

Numerous interventions can be employed to climate-proof a water supply project; however, they can be group into two broad categories, that is;

a. Infrastructure interventions, and,
b. Non-Infrastructure interventions.

Some examples of the various types of infrastructure and non-infrastructure interventions are outlined in Table 7.

Box 12: Climate Proofing Water Supply Projects

- Changes in climate especially changes in rainfall patterns may impact water supply infrastructure and disrupt water delivery services. Water supply infrastructure comprises of an ecosystem of multiple components, such as water adduction, pumping stations, water treatment facilities, storage (e.g., reservoirs and dams), and water conveyance and distribution systems. Climate change may have an impact on one component, multiple components, or the entire system. Hence, one of the key elements of assessing the options of climate proofing a water supply project is to determine which components of the water supply system are vulnerable to the expected changes in climate over the projects life.
- It is crucial to take into consideration population and water demand growth into the assessment of climate proofing options. As the population in the project area grows, demand for water will increase. Hence, climate proofing options will only be effective if they account for both the variability in weather patterns as well as water demand.
- Climate proofing measure should be developed in consultation with project beneficiaries to ensure that they are relevant and suitable enough for them to adapt to changes in climate.

Table 7. Water Supply Climate Proofing Interventions[14]

Climate Change Risk	Vulnerability to Climate Change	Climate Change Impact	Infrastructure Climate Proofing Options	Non-Infrastructure Climate Proofing Options
Increased Flooding	Damage to infrastructure	Potential catastrophic failure of the water supply system and potential damage of other infrastructure from large release from failed water storage infrastructure, e.g., dam.	• Adopt a higher design standard for infrastructure to take more frequent extreme weather events into consideration. • Design or adapt reservoir overflows and spillways to cope with larger flows and prevent failure.	• Update and disseminate evacuation procedures. • Increase the frequency with which emergency procedures are practised.
	Flooding of water treatment system	Floods may lead to structural damage to the treatment works or the failure of pumping stations. Water supplies fail.	• Site water treatment works and other major infrastructure away from flood zones or build appropriate flood defences. • Build smaller, more localize treatment and water supply systems to spread the risk of widespread water shortages.	• Intensify water quality monitoring after a flooding event and before bringing the water supply system back online after a flood. • Develop communication procedures for notifying the public when the water is safe. Possible mechanisms include posting leaflets, door-to-door visits, and radio and television announcements. • Raise awareness among water engineers of the risks of water quality changes during flooding and how water treatment can be adapted to manage the risks.
	Entry of contaminated flood water into water supply pipes	Public health risk from localized or widespread contamination of the water distribution system.	• Plan for emergency supplies of drinking water to be available in the event of system failure. • Where possible, aim to site pipes in areas of low risk of flooding. • In areas where flooding is likely, aim to keep water and sewage pipes separate in case of cross-contamination through fractures.	• Design and implement a monitoring programme for flooding of the pipe network. This might include monitoring water pressure in pipes, water quality monitoring, or a reporting mechanism for when certain areas have flooded pipes. • Raise awareness amongst the public of contamination issues during floods and reduction in drinking-water availability. This may be done by

[14] For a comprehensive review of water supply and sanitation climate-proofing options refer to, K., Charles, K, Pond, and S., Pedley, "Vision 2030: "The resilience of water supply and sanitation in the face of climate change".

Climate Change Risk	Vulnerability to Climate Change	Climate Change Impact	Infrastructure Climate Proofing Options	Non-Infrastructure Climate Proofing Options
			• Relocate water pipes away from open sewers and drainage channels.	posting leaflets, door-to-door visits, radio and TV announcements to inform people.
Drought	Insufficient water to meet demand	Water shortages and potential for water rationing. Low pressure in the water supply system may allow ingress of contamination into the water distribution network. Intermittent water supplies and pressure changes in the distribution network lead to damage to the infrastructure.	• Increase water storage capacity to provide supply over extended dry periods. • Invest in alternative water sources where possible, e.g., desalination, water harvesting and reuse infrastructure. • Decentralization of water systems may allow for quicker adaptation to local conditions. • Improve the efficiency of the water supply system by plugging leaks.	• Demand-side water management interventions to decrease water demand. These could include educating water users on using water more efficiently or raising awareness of wastewater reuse for agricultural and industrial purposes. In addition, a water pricing policy can be used to manage demand.
	Fluctuating surface and groundwater levels may cause problems for infrastructure	Water intakes may be left exposed as water levels fall.	• Design water intake to accommodate varying water levels (for example, floating booms). River intakes strengthened to withstand more turbulent flows.	• Water resource monitoring and management of water abstraction to maintain water resources.
	Decreased water flow may lower levels in reservoirs and damage infrastructure, or restrict use	Potential deterioration in the quality of stored water. Prolonged low storage levels may weaken dams.	• Adapt reservoirs to handle low water levels.	• Water resource monitoring and management of water abstraction to maintain water resources.

Source: "Vision 2030: "The resilience of water supply and sanitation in the face of climate change".

The technical design and cost of climate-proofing options should be obtained from engineers. They should be based on the likelihood and magnitude of climate change forecasted by climate experts during the project's economic life.

Climate-proofing the project will not eliminate all the impacts of climate change. In other words, the benefits of climate proofing the project should be adjusted to consider any unmitigated risk of climate change. After the project has been climate-proofed, the remaining impacts of a climatic change event are referred to as the "residual risk" of climate change. The residual risk is estimated based on the anticipated effectiveness of the climate-proofing options, as shown in the illustrative example below. The effectiveness of climate-proofing is determined by an engineer, given the most likely climate change scenario expected to occur over the project's economic life.

BOX 13: Illustrative Example of Assessing Options to Climate Proof a Project

Climatic Change Risk:

- A drought especially a severe one will lead to insufficient water to meet demand, which will lead to water shortages and possible water rationing.
- To climate-proof the Chitungwiza water supply project an infrastructure intervention will be utilized. To ensure that there is enough water to meet demand, water storage capacity will be increased by building a dam that will provide additional water supply capacity.
- The table below shows the estimated costs and benefits of climate-proofing the project using the dam.

Climate Proofing Option	**PV Costs of Climate Proofing the Project ($ million)**	**PV Benefits of Climate Proofing the Project - *with no adjustments for residual risk* ($ million) (A)**	**Anticipated Effectiveness of each Climate Proofing Option in Mitigating Climate Change Risk (%) (B)**	**PV Benefits of Climate Proofing the Project - *adjusted for residual risk* ($ million) (C) = (A) * (B)**
Dam with a capacity to store 5.5. million m3	4.50	4.18	100%	4.18
Dam with a capacity to store 4.6 million m3	3.03	4.18	90%	3.77
Dam with a capacity to store 3.7 million m3	1.53	4.18	80%	3.35

Note: All values in the table are expressed in real terms and discounted using an economic opportunity cost of capital (EOCK) of 12%.

Additional Climate Proofing Measures?

In addition to the dam, the utility can also utilize the following non-infrastructure climate-proofing options to manage demand, when supply is greatly impacted by a climate change event such as severe drought:

a. Water resource monitoring and management of water abstraction to maintain water resources.
b. Education on efficient water use and reuse of wastewater for agricultural and industrial purposes.

3.5.4. Assessment of the Economic Viability of Climate Proofing a Project

The climate-proofed project's costs should be weighed against the residual risk-adjusted benefits to determine the economic feasibility and viability of climate-proofing a project. ENPV is used to measure the economic efficiency of Project B in addressing the impacts of climate change.

In determining the preferred climate-proofing option to implement, CAs should also take into consideration:

a. Technical feasibility,
b. Financial affordability,
c. Capacity and experience of the CA to implement the option,
d. Environmental impacts,
e. Legal implications.

BOX 14: Illustrative Example of Assessing the Economic Viability of Climate Proofing a Project

Climate Proofing Option	PV Costs of Climate Proofing the Project ($ million) (A)	PV Benefits of Climate Proofing the Project - *adjusted for residual risk* ($ million) (B)	NPV of Climate Proofing Option ($ million) (C) = (B) – (A)
Dam with a capacity to store 5.5. million m3	4.50	4.18	(0.32)
Dam with a capacity to store 4.6 million m3	3.03	3.77	0.74
Dam with a capacity to store 3.7 million m3	1.53	3.35	1.82

Note: All values in the table are expressed in real terms discounted using an economic opportunity cost of capital (EOCK) of 12%.

3.5.5. Decision Making

As highlighted in the preceding sections, it is important to determine if both Project A (a regular infrastructure project "without" climate-proofing) and Project B (the climate-proofing option) are economically viable. When making decisions about projects based on the CBA methodology, the rule of thumb is that only projects that have a positive ENPV should be chosen as they are the ones that will add to the socio-economic welfare of a country. Even though tackling climate change is crucial to socio-economic welfare, climate-proofed projects should not be approved based on development objectives and political imperatives alone. They should be given the green light based on their economic efficiency in achieving targeted outcomes such as fostering socio-economic adaptation and resilience and mitigating climate change.

When there are multiple options to climate-proof the project, the preferred option should be the most effective and efficient in climate-proofing the project against climate change over its economic life. In other words, it should be the option that maximizes the ENPV of climate proofing. The decision criteria in the context of projects exposed to and vulnerable to climate change are outlined in Box 15, and an illustrative example is provided in Box 16.

BOX 15: Criteria for Decision Making in the Context of Climate Change

1. If **ENPV Project A < 0, do not proceed with the project.** In such a case, climate-proofing will not be explored as the project will not be implemented given that it is not economically viable.

2. If **ENPV Project A > 0**, and **ENPV Project B < 0, proceed with project A and not project B.** In such a case, climate-proofing is not a viable option as there are no technically and economically efficient climate-proofing options available. Therefore, the best course of action is to implement a regular infrastructure project that is not climate-proofed and deal with the impacts of climate change if and when they occur.

3. If **ENPV Project A > 0**, and **ENPV Project B > 0, proceed with project A and B**. In such a case, climate-proofing the project is a viable undertaking. Hence, the regular infrastructure project should be implemented with a climate-proofing component.

Note:

a. Project A refers to a regular infrastructure project that does not include a climate-proofing component.

b. Project B refers to the climate-proofing option that will enable the project to withstand climate change impacts to a certain degree.

BOX 16: Illustrative Example of Project Decision Making

NPV of a Regular Project – "without" climate proofing ($ million)	NPV of the Preferred Climate Proofing Option ($ million)	NPV of a Regular Project that is Climate Proofed ($ million)
76.53	**1.82**	**78.35**

Note: All values in the table are expressed in real terms discounted using an economic opportunity cost of capital (EOCK) of 12%.

<u>Decision on the Project</u>

- As **ENPV Project A > 0** and **ENPV Project B > 0,** the CA should proceed with Project A and B, as climate proofing the project is an economically viable undertaking.

Note:
a. Project A refers to a regular infrastructure project that does not include a climate-proofing component.
b. Project B refers to the climate-proofing option that will enable the project to withstand climate change impacts to a certain degree.

3.6. PFS Form for presenting the Preliminary Feasibility of a Project

Once the Pre-Feasibility Study has been conducted, it should be presented in a structured format using the PFS form. The structure, format, and data requirements of the PFS form are outlined in Annex C.

3.7. Assessment of PFS

The assessment of the PFS involves checking the robustness and effectiveness of the proposed project according to its ability to meet financial and socio-economic outcomes while adhering to national and sectoral objectives and goals in addressing the identified problem.

The assessment of the PFS consists of two phases. The first phase entails an internal assessment of the PFS by the Line Ministry. The internal assessment shall attempt to answer three questions:

1. Is the project consistent with National and Sectoral development strategies?
2. Out of a number of project alternatives, what is the preferred project alternative, and why is this the best strategy for addressing the identified problems?
3. Do the expected socio-economic benefits of the project exceed its economic costs?

Once the PFS has passed the internal screening, it should be submitted to the IMC through the MoFED for the second phase of the screening process. It should be noted that PFS submissions are made between March and April, according to the Public Investment Management and Budgeting Calendar defined in the PIM Guidelines.

The external assessment of the PFS by the IMC is a three-step process aimed at assessing the project's alignment with the Government's objectives and priorities. It also entails evaluating resource availability to fund the project with consideration of resource allocation to projects from other sectors vying for the same pool of resources. The three steps carried out in assessing the PFS are as follows:

i. The first stage is to assess the compliance of the CA with the submission process and other procedural requirements stipulated in the PIM Guidelines and this Manual. CAs are required to submit PFSs in compliance with the PFS form outlined in the PIM Guidelines. In case of missing information, the IMC may postpone the PFS pending the submission of complete information.
ii. At the second stage of the assessment, the IMC will assess the project's alignment with the National and Sectoral Strategic Objectives. Projects that are not in line with the National development strategies and sectoral development plans will get postponed. In exceptional cases, CAs may justify projects that are not directly aligned with the strategic development

plans. Such cases, for instance, may include projects that are designed to mitigate force majeure situations, such as droughts, floods, earthquakes, Et cetera.

iii. The last stage involves the IMC assessing the project's affordability and the likelihood of the expected economic benefits of the project exceeding the cost of resources.

The IMC's decisions on PFSs shall be issued in May-June. Only projects whose PFSs pass both the internal assessment by the CA and the external assessment by the IMC should be allowed to progress to the FS stage. PFSs approved by the IMC are valid for a period of three (3) years. Once a project's PFS expires, the project should be reappraised and resubmitted to the IMC for consideration, following the internal and external screening processes described above.

4. FEASIBILITY STUDY (FS)

The Feasibility Study (FS) builds on a project's information developed at the PCN and PFS stages by providing information on different aspects of the project in greater detail. To provide clearer insight into the project's feasibility, the FS should make use of primary data, and where such data is not available, studies should be undertaken to obtain accurate information about the project's costs and benefits. This data should replace the secondary and/or proxy used to conduct the PFS. The FS should form a more accurate picture of the project's technical, financial and socio-economic prospects to aid decision makers in allocating resources efficiently. The FS shall be undertaken by the project sponsor or outsourced to a third party in the case where, for example, the project sponsor lacks the technical capacity to do so.

4.1. Financial Modality of Public Investment

The PIM Guidelines stipulate three modalities of investment projects, Public Investment, Joint Venture, and Private-Sector Financing. The assessment of the financial modality of an investment project shall be done as stipulated in the PIM Guidelines. Projects proposed as JVs shall follow the provisions of the JV Act and corresponding regulations.

4.2. Environmental and Social Impact Assessment

The FS of a water supply project should include an Environmental and Social Impact Assessment (ESIA) study, which should identify and quantify a proposed project's potential environmental and social impacts. This should be done by updating the preliminary ESIA conducted at the PFS stage with the changes made to the FS based on new and more accurate project data.

4.2.1. Environmental Impact Assessment

Environment Management Act (EMA), 13 of 2002, exists to provide for the sustainable management of natural resources and protection of the environment. It also provides a guide regarding the Environmental Impact Assessment (EIA) and how it should be conducted. The EMA defines EIA as an evaluation of a project to determine its impact on the environment and human health and to set out the required environmental monitoring and management procedures and plans.

According to the EMA, a project's EIA report should:

1. Give a detailed description of the project and the activities to be undertaken in implementing it,
2. State the reasons for selecting the proposed site of the project,

3. Give a detailed description of the likely impact the project may have on the environment or any segment thereof, covering the direct, indirect, cumulative, short-term and long-term effects of the project,
4. Specify the measures proposed for eliminating, reducing or mitigating any anticipated adverse effects the project may have on the environment, identifying ways of monitoring and managing the environmental effects of the project,
5. Indicate whether the environment of any other country is likely to be affected by the project and any measures to be taken to minimize any damage to that environment,
6. Have an analysis of the biodiversity impacts of the project, land tenure system, soil as well as a hydrological analysis, and;
7. Attachments of soils, hydrological and topographical maps, and make an analysis of the impacts of the project to the current environmental baseline.

When conducting an EIA, public consultations should be done with LMs, certain departments at the Local, District, Provincial and National levels. These consultations should also include other institutions related to the project as well as neighbouring land users.

An Environmental Management Plan, which outlines how the project will manage and mitigate any adverse impacts the project may have on the environment, should be submitted to the Treasury during the FS stage. Table 8 below displays how the plan should be presented.

Table 8. Biophysical Environment Management Plan (Sample)

Impact Statement	Process/Activity responsible for impact	Proposed Mitigation on impact	Monitoring and Management Agency	Management and Monitoring activities	Time frame	Budget

An EIA certificate for the project should be obtained from the Director-General at the FS stage. The certificate should be attached as an Annex to the submission of the FS. It is important to note that this certificate is valid for only two years with the possibility of an extension if deemed necessary; otherwise, the whole EIA process will have to be repeated.

4.2.2. Social Impact Assessment

The social impact assessment (SIA) is carried out to understand the proposed project's possible social and cultural impacts. SIA is the process of managing the social issues associated with a project. Unlike the EIA, the SIA focuses on social considerations rather than biophysical issues. Social impacts start even before the construction of a project. The following steps are taken during an SIA:

1. Understanding the issues

    a. Forecasting the social changes that may result from the project,
    b. Stakeholder consultations, and;
    c. Community assets and aspirations scoping.

2. Predicting and assessing likely impacts

   a. Collaborative selection of sustainability and impact indicators,
   b. Baseline indicator data collection,
   c. Impact significance determination,
   d. Social and economic development opportunities assessment,
   e. Establishing the significance of the predicted changes and determining how the various affected groups and communities will likely respond, and;
   f. Identifying ways to mitigate negative impacts and capitalize on the positive impacts.

3. Developing monitoring and mitigation strategies

   a. For the negative impacts, develop mitigation strategies, and;
   b. Monitor in case new unpredictable impacts arise.

4.3. Climate Risk Assessment

The assessment of projects at the FS stage of the project cycle consists of three steps.

i. The reassessment of a regular Infrastructure investment project's economic viability using primary data and detailed cost estimates.
ii. The reassessment of the economic viability of the preferred climate-proofing option.
iii. Decision making.

4.3.1. Reassessment of the Economic Viability of a Regular Infrastructure Investment Project

BOX 17: Illustrative Example – Reassessment of the Economic Viability of a Regular Infrastructure Investment Project

- Based on technical studies and a final design conducted at FS, the water supply project is expected to have a capital cost of $ 29.70 million and annual O&M costs of $ 5 million. The project is anticipated to produce benefits of $ 17 million per annum, which consist of an improved water supply, reduced coping costs and water leakages.
- .

NPV of a Regular Project "without" climate proofing ($ million) (Y)
ENPV = 76.53

Note: All values in the table are expressed in real terms discounted using an economic opportunity cost of capital (EOCK) of 12%.

- **Only projects that exhibit a positive ENPV after reassessment based on updated cost and benefits should be considered for climate proofing.**

4.3.2. The Reassessment of the Economic Viability of the Preferred Climate-Proofing Option

BOX 18: Illustrative Example – Reassessment of the Economic Viability of the Preferred Climate Proofing Option

- The preferred climate proofing option identified at the PFS stage is reassessed at FS based on updated climate change models and cost and benefit estimates of climate proofing the project.

Preferred Climate Proofing Option	PV Costs of Climate Proofing the Project ($ million) (A)	PV Benefits of Climate Proofing the Project – with no *adjustment for residual risk* ($ million) (B)	Anticipated Effectiveness of the Preferred Climate Proofing Option in Mitigating Climate Change Risk (C)	PV Benefits of Climate Proofing the Project – *adjusted for residual risk* ($ million) (D) = (B) * (C)	NPV of the Preferred Climate Proofing Option ($ million) (E) = (D) – (A)
Dam with a capacity to store 3.7 million m3	**1.67**	**4.18**	**80%**	**3.35**	**1.68**

Note: All values in the table are expressed in real terms discounted using an economic opportunity cost of capital (EOCK) of 12%.

The cost estimates for the preferred climate-proofing option were update based on final engineering designs. The cost of the climate-proofing option is 10% higher than what was quoted in the PFS.

4.3.3. Decision Making

Once Project A and B have been reassessed at the FS stage using updated cost and benefit data, a decision should be made on whether to implement the project based on the criteria outlined in Box 19.

BOX 19: Illustrative Example of Project Decision Making

NPV of a Regular Project "without" climate proofing ($ million)	NPV of the Preferred Climate Proofing Option ($ million)	NPV of a Regular Project that is Climate Proofed ($ million)
76.53	**1.68**	**78.21**

Note: All values in the table are expressed in real terms discounted using an economic opportunity cost of capital (EOCK) of 12%.

Decision on the Project

- As **ENPV Project A > 0** and **ENPV Project B > 0,** the CA should proceed with Project A and B, as climate proofing the project is an economically viable undertaking.
- **Note:**
- a. Project A refers to a regular infrastructure project that does not include a climate-proofing component.
- b. Project B refers to the climate-proofing option that will enable the project to withstand climate change impacts to a certain degree.

4.4. Monitoring, Review, Reporting, and Action Plan

4.4.1. Monitoring, Review, and Reporting

As stipulated by the National Monitoring and Evaluation (M&E) Policy[15], it is the role of the Line Ministries, local authorities and public entities to develop and implement Monitoring Plans and to disseminate periodic reports. The Line Ministry must specify the frequency of the monitoring and reporting cycle. The PIM Guidelines outline the need for well-designed and realistic key performance indicators (KPIs), as agreed by all key stakeholders. These indicators should clarify the project's intentions and should aid in the assessment of achievements.

The LM should use Monitoring Plans to keep track of how the project is aligned to and achieves its objectives; a monitoring plan is a key instrument during the project's implementation stage. Its purpose is to determine if the outputs, deliveries, and schedules planned have been reached so that action can be taken to correct the deficiencies as quickly as possible.

It is important to develop an M&E plan before beginning any monitoring activities so that there is a clear plan for what questions about the project are to be answered. It will help the program staff decide how they will collect data to track KPIs, how monitoring data will be analysed, and how the results of data collection will be disseminated to various stakeholders. The M&E

[15] Government of Zimbabwe. (2015). *National Monitoring and Evaluation Policy.* Harare

plan will help make sure that data is being used efficiently to make programs as effective as possible and to be able to report on results at the end of the program.

Steps to develop an M&E Plan include:

1. Identify project goals and objectives

2. Determine what KPIs to track; some of the most important and useful KPIs are:

    a. Process indicators: are used to track the progress of the project. They help to answer the question, "Are the project's activities being implemented as planned?"
    b. Outcome indicators: are used to track how successful the project activities have been at achieving the set objectives. They help to answer the question, "Have project activities made a difference?"

3. Define data collection methods and timelines: After creating monitoring indicators, it is time to decide on the methods for gathering data and how often various data will be recorded to track the project's KPIs. Project KPIs should be determined based on discussions between program staff and various stakeholders. These discussions will have significant implications for what data collection methods will be used and how the results will be reported.

4. Identify M&E roles and responsibilities: Line Ministries should identify stakeholders responsible for monitoring the delivery of project outputs. It is important to decide from the early planning stages the parties responsible for collecting the data for each indicator. Data management roles should be decided with input from the key stakeholders so that all parties are on the same page and know which indicators they are assigned.

5. Plan for Report Dissemination: The last element of the M&E plan describes how often and to whom data will be disseminated. Line Ministries must spell this out guided by the National M&E Policy

4.4.2. Action

The Monitoring, Review, Reporting, and Action Plan should also include a section that lists the steps needed to achieve the project's goals and objectives. It should clarify and break down the resources and timeline for each activity required to reach the project's goals and objectives. An action plan makes it possible to monitor the project's progress and take each activity step-by-step, allowing for efficient project handling. The advantage of doing this is to allow the LM to execute a structured plan for the end goal that they intend to achieve. Moreover, it provides the team with appropriate foundations, therefore prioritising the amount of time spent on each activity. An action plan will also help redirect the project when it deviates from its intended targets during the implementation stage.

The action plan section should also include a list of actions or changes to be brought about in the community. Each action or change to be sought should include the following information:

- **What** actions or changes will occur?
- **Who** will carry out these changes?
- **By when** they will take place, and for how long?
- **What** resources (i.e., funds, personnel) are needed to carry out these changes?
- **Communication**, who should know what?

4.5. Project Governance Structure Plan

The project governance structure is the framework through which the project is managed. Good project governance sets the direction the project will take and ensure that the correct decisions are taken pursuant to the project's goals and objectives.

To ensure the success of the project, a comprehensive assessment of the project's organizational structure should be made that includes the following key components;

a. Project management: who will have overall accountability and responsibility for managing the project? The project's officers and team, as well as their allocated roles within the project, should be outlined,
b. Human resource requirements: the capacity and skills of the project team as well as technical advisors is a key consideration in ensuring the project is successfully delivered, and;
c. Project management strategies during the investment and post-investment phases of the project.

Furthermore, issues of gender should be addressed regarding the overall gender balance of the project team and key decision-making processes.

A description of the project's main participants should also be assessed, taking into consideration the following issues:

a. The scope of interaction amongst project participants,
b. The role, function and responsibility of each of the project participants (as illustrated in Table 9), and;
c. The distribution of benefits and costs between project beneficiaries and other stakeholders.

Table 9. Project's Institutional Scheme

#	Project Participant	Information about the project participant	Functions of the project participant	Responsibility of the project participant

1.	Line Ministry			
2.	Contracting Authority			
3.	Project Assets' Holder			
4.	Project Operator			
5.	Project Participant			

4.6. Project Implementation Plan

As part of the FS, a proposal that outlines how the project will be implemented should be included. The implementation plan should clearly delineate the scheduled timing of the activities within each phase of the project's implementation plan and should be accompanied by the relevant cost schedules. The successful implementation of the project is subject to the availability of resources required to undertake the project. Therefore the implementation plan should ensure that the financial, human and input resources required to execute the project are adequately available. Consideration should be given to contractual structures such as supply contracts and forward and futures contracts to secure key inputs. Additionally, secondary sources of all resources must be identified so as to guard against the inability of primary sources to meet the project's needs. The implementation plan should also outline how the implementation process will be managed by assigning responsibilities to the parties most suitable to carry out the given role. Lastly, a proposal must be provided on how the project's progress will be monitored and evaluated. This should include the KPIs that will be used to measure performance and overall progress against a set of objectives and targets.

4.7. FS Form for presenting the Feasibility of a Project

Once the Feasibility Study has been conducted, it should be presented in a structured format using the FS form. The structure, format, and data requirements of the PFS form are outlined in Annex D.

4.8. Assessment of FS

The assessment of the FS involves checking the robustness and effectiveness of the proposed project according to its ability to meet financial and socio-economic outcomes while adhering to national and sectoral objectives and goals in addressing the identified problem.

The assessment of the FS consists of two phases. The first phase entails an internal assessment of the FS by the Line Ministry. The internal assessment shall attempt to answer three questions:

1. Is the project consistent with National and Sectoral development strategies?
2. Is the proposed solution technically optimized?
3. Do the expected socio-economic benefits of the project exceed its economic costs?

Once the FS has passed the internal screening, it should be submitted to the IMC through the MoFED for the second phase of the screening process. It should be noted that FS submissions are made in July, according to the Public Investment Management and Budgeting Calendar defined in the PIM Guidelines.

The external assessment of the FS by the IMC is a three-step process aimed at assessing the project's alignment with the Government's objectives and priorities. It also entails evaluating resource availability to fund the project with consideration of resource requirements from projects in other sectors vying for the same pool of resources. The three steps carried out in assessing the FS are as follows:

i. The first stage is to assess the compliance of the CA with the submission process and other procedural requirements stipulated in the PIM Guidelines and this Manual. CAs are required to submit FSs in compliance with the FS form outlined in the PIM Guidelines. In case of missing information, the IMC may postpone the FS pending the submission of complete information.
ii. At the second stage of the assessment, the IMC will assess the project's alignment with the National and Sectoral Strategic Objectives. Projects that are not in line with the National development strategies and sectoral development plans will get postponed. In exceptional cases, CAs may justify projects that are not directly aligned with the strategic development plans. Such cases, for instance, may include projects that are designed to mitigate force majeure situations, such as droughts, floods, earthquakes, Et cetera.
iii. The last stage involves the IMC assessing the technical feasibility of the project, affordability of the project, and the likelihood of the expected economic benefits of the project exceeding the cost of resources.

The IMC's decisions on FSs shall be issued between August and September. Only projects whose FSs pass both the internal assessment by the CA and the external assessment by the IMC should be selected for inclusion in the National Budget. FSs approved by the IMC are valid for a period of three (3) years. Once a project's FS expires, the project should be reappraised and resubmitted to the IMC for consideration following the internal and external screening processes described above.

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ANNEXES

ANNEX A: TYPES OF INVESTMENTS REQUIRED FOR WATER SUPPLY PROJECTS

Water supply projects require investments in a number of physical assets, which are all essential and complement each other in ensuring water is delivered to the end-user. The main components that compose a typical water supply project include:

a. **Water storage and adduction:** the water resources available in a particular location depend on the catchment hydrology. Water may be drawn from surface sources such as rivers and lakes. On the other hand, water may be drawn from ground sources such as aquifers. It is essential in water supply projects to identify and evaluate the quantity and quality of the water resources available for use in the water supply project. Some of the key considerations are:
    a. Reliability of the water source;
    b. Capacity to meet current and future demand;
    c. Safety with respect to human consumption; and,
    d. Rights to the water source and limitations on withdrawals

   Depending on the water source, an investment in water adduction systems will be required. For example, suppose water will be sourced from a river which is intermittent and only available during the rainy season. In that case, there will be a need to construct a dam or a reservoir to capture the water for use during the rainy and dry seasons. Additional investments will also be required to withdraw water from the source, such as a pumping system.

b. **Water treatment:** raw water may not always be suitable for human consumption (cooking and drinking). The provision of potable water will require an investment in water treatment facilities. In addition, once water is utilized within the household, most especially for sanitation purposes, wastewater will be produced, which must be treated to prevent any hazard to human health and the environment.

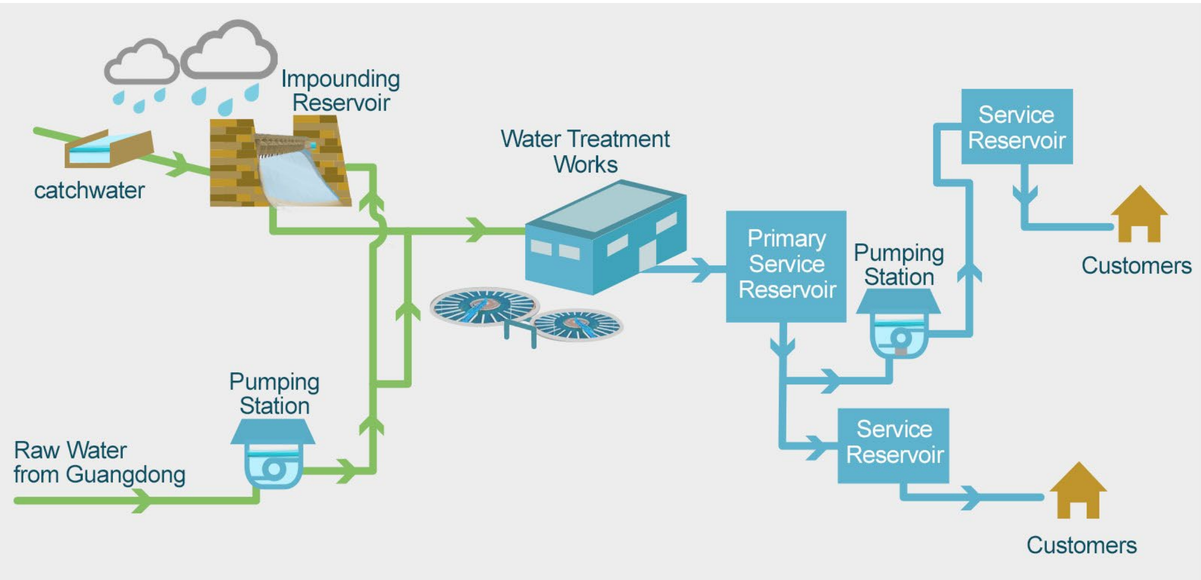
c. **Water conveyance:** an investment into a water distribution network is required, which facilitates water transportation from water sources and treatment plants to the end-users. A water conveyance network consists of a network of pipes and includes tanks, pumping stations and water meters.

d. **Water dispensation:** the final component of a water supply project is an investment in water dispensation systems at the final point of use, such as boreholes, wells, standpipes, household connections, and water meters.

The Figure below illustrates how all of the components of the water supply system described above are connected and function in providing water from its source(s) to the final users.

Water infrastructure projects can span the entirety of the water supply system: water storage, adduction, treatment, conveyance and dispensation, or they can focus on just one or a few components within the entire system. The scope of the project will depend on the problem that is being addressed by the project.

Typical Water Supply System



Source: Water Supplies Department, Hong Kong

ANNEX B: PROJECT CONCEPT NOTE FORM

Item	Project Information Required
Project Identification (ID)	Insert the project identification number. The identification number should be unique and should include up to 5 alphabetic letters to identify the Contracting Authority, followed by a numerical sequence.
Line Ministry	Insert the Line Ministry functionally responsible for the project.
Contracting Authority	Insert Contracting Authority responsible for the project.
Project Title	Provide a short and succinct project title, capturing the essence of the project.
Location	Provide the project location including the Province and District .
Project Objective	Provide clear sentence to describe the direct benefit of implementing the project. Think of the fundamental reason the project is being proposed — examining immediate change or overall result. **Do not** provide project details here that can be described elsewhere on the Form.
Status before Project	**Briefly** describe the current situation (that is, without the project), using concrete and factual data.
Status after Project	**Briefly**, describe how the current situation will be affected if the project is implemented. Use specific and accurate data.
Justification	Justify the reason for undertaking the project in less than 250 words. Justification is done by comparing anticipated results and expected costs.
Alignment with National Development Strategies	Results-based management requires Ministries to agree on policy objectives and key result areas, which are then included in the Budget. How is the project aligned with Government policy objectives? Which Government strategic objectives does the project address, and how does it do so?
Alignment with Sector Strategies	Provide a detailed description of how the project links to and supports key sector policy objectives and key Ministry Strategic policy objectives.
Alignment with Provincial and District Development Plan Objectives supported by the Project	Will the project have an impact at the provincial and district levels? If so, what consultations have taken place with provincial and district stakeholders?
Alignment with Climate Change Objectives	Highlight how the project is expected to contribute to climate change adaptation, resilience or mitigation objectives outlined in the national development plans and strategies as well as the NDCs.
Other Strategic Considerations	Does the project fit with national security considerations? Could it prevent or mitigate a national disaster (for example an epidemic)?
Total Capital Cost	Include the preliminary estimates of the project's total capital costs.
Operations and Maintenance Cost	Include anticipated annual operations/maintenance expenditures.
Sources of Project Funds	Indicate the internal project promoter funds, Government budget funds, private sector funds and borrowing.
Funds required to conduct Pre-Feasibility Analysis	Indicate the funding required to complete the Pre-Feasibility analysis of the project.
Outcomes (expected)	List all **expected outcomes** resulting from the project. Outcomes should be a direct result of the project outputs.

Item	Project Information Required
Outputs (expected)	List all **expected outputs** to be directly delivered by the project (that is, the direct result of project activities. See below). Outputs should be within or just within the Government agency's control. List all **anticipated results** (that is, those that will remain once the project has ended).
Main Activities	List the main project activities associated with the delivery of outputs. Activities should be listed **in a logical order** and **numerically linked** to outputs to facilitate an assessment of whether the proposed activities can realistically produce the expected outputs.
Implementation Plan:	Provide a technically optimum implementation plan. The construction schedule should also specify funds required for each phase and propose sources of funding.
Financial Effectiveness	Indicate if the project is expected to result in financial revenues.
Socio-economic Effectiveness	Provide an initial demand forecast. A clear linkage should be made to the project justification as well as to the output and outcomes sections.
Preliminary Environmental and Social Impact Assessment	Not Applicable
Risk Analysis	Outline the project's key risks and their direct or indirect impact(s) on the project and its beneficiaries and were possible outline measures to mitigate or manage those risks.
Climate Risk Screening	Does climate change impose a high degree of risk to the project? Is the project located in an area prone to climate change related events? Do climate change scenarios suggest that these events' frequency and/or severity is likely to increase? What will be the implications, including the cost of infrastructure rehabilitation, cost of service disruptions both to the project and the service users?
Other Studies	Not Applicable
Sources of Information	List primary sources of information used to derive alignment with strategic policies, preliminary project costs, demand projections and other information used in the preparation of Project Concept Note Form. Provide references to support key assumptions.

ANNEX C: PRE-FEASIBILITY STUDY NOTE FORM

Item	Project Information Required
Project ID	Insert project identification number. The identification number should be unique and should include up to 5 alphabetic letters to identify the Contracting Authority followed by a numerical sequence.
Line Ministry	Insert Line Ministry functionally responsible for the project.
Contracting Authority	Insert Contracting Authority responsible for the project.
Project Title	Provide a short and succinct project title, capturing the essence of the project.
Location	Provide the project location including the Province and District.
Project Concept Decision and Date	Insert the decision number for the project concept. Enter the project concept decision date.
Project Objective	Describe the direct benefit of implementing the project. Think of the fundamental reason the project is being proposed — examining immediate change or overall result. **Do not** provide project details here that can be described elsewhere on the Form.
Status before Project	**Briefly** describe the current situation (that is, without the project), using specific and factual data.
Status after Project	**Briefly**, describe how the current situation will be affected if the project is implemented. Use specific and factual data.
Justification	Justify the reason for undertaking the project in less than 250 words. The project should comply with all regulations and have positive socio-economic returns.
Alignment with National Development Strategies	Results-based management requires Ministries to agree on policy objectives and key result areas, which are then included in the Budget. How is the project aligned with Government policy objectives? Which Government strategic objectives does the project address, and how does it do so?
Alignment with Sector Strategies	Provide a detailed description of how the project links to and supports key sector policy and Ministry strategic policy objectives (see Ministerial preambles in the Estimates of Expenditure Book).
Alignment with Provincial and District Development Plan Objectives Supported by the Project	Will the project have an impact at the provincial anddistrict levels? If so, what consultations has taken place with provincial and district stakeholders?
Alignment with Climate Change Objectives	Highlight how the project is expected to contribute to climate change adaptation, resilience or mitigation objectives outlined in the national development plans and strategies as well as the NDCs.
Other Strategic Considerations	Does the project align with national security considerations? Could it prevent or mitigate a national disaster (for example, a drought or an epidemic)?
Total Capital Costs	Update estimates to the project's total capital costs. The estimates of the project's total capital cost should be **as accurate as possible**. Please provide the source of information and justification for the amount stated.
Operating and Maintenance Cost	Anticipated annual operating and maintenance expenses.
Sources of Project Funds	Indicate funding source such as project promoter funds, Government budget funds, private sector, borrowing.
Funds Required to Conduct Feasibility Study	Indicate the funding needed to complete the feasibility analysis of the project. A compelling case should be made if the funding requirement exceeds 3 percent of the total capital cost.

Item	Project Information Required
Outcomes (expected)	List all **expected outcomes** resulting from the project. Outcomes should be a direct result of the project outputs.
Outputs (expected)	List all **expected outputs** to be directly delivered by the project (that is, the direct result of project activities. (See below). Outputs should be within or just within the Government agency's control. List all **anticipated results** (that is, those that will remain once the project hasended).
Main Activities	List the main project activities associated with the delivery of outputs. Activities should be listed **in a logical order** and **numerically linked** to outputs to facilitate an assessment of whether the proposed activities can realistically produce the outputs expected.
Implementation Plan	Provide a technically optimal project implementation plan. The implementation plan should also specify funds required for each phase and propose sources of funding. Provide output and activity schedule (Gantt chart) indicating the timing, sequencing, and dependencies for all activities.
Financial Effectiveness	Indicate the financial rate of return and the financial net present value.
Socio-economic Effective- ness	Indicate the economic rate of return and the economic net present value.
Fiscal Effectiveness	Indicate the annual nominal net fiscal impact and the present value of net fiscal impact over the project's life.
Risk Analysis	Outline the project's key risks and their direct or indirect impact(s) on the project and its beneficiaries and were possible outline measures to mitigate or manage those risks.
Results of Preliminary Environmental and Social Impact Assessment	Provide a summary (less than 500 words) of the results of the Environmental and Social Impact Assessment.
Climate Risk Assessment	Provide a summary (no more than 500 words) outlining the results of the climate risk assessment. The assessment should provide an indication of whether the project should be climate proofed.
Climate Proofing	Provide a summary of the proposed climate proofing option(s) including: a. The estimated capital cost of each option. b. The benefits of each option with respect to reducing the impacts of climate change. c. A summary of the socio-economic viability of the option(s). d. Indication and justification of the preferred climate proofing option.
Procurement Plan	Draft project procurement methods — open tender, closed tender, direct purchases — for all project goods and services (with due attention to any Government thresholds). Include a schedule (Gantt chart) detailing principal procurement deadlines.
Other Studies Conducted	List and provide a summary of results of other studies carried out with regards to the project.
Sources of Information	List primary sources of information used to derive alignment with strategic policies, preliminary project costs, demand projections and other information used in the preparation of Project Concept Note Form. Provide references to support key assumptions.

ANNEX D: FEASIBILITY STUDY NOTE FORM

Item	Project Information Required
Project ID	Insert the project identification number. The identification number should be unique and should include up to 5 alphabetic letters to identify the Contracting Authority, followed by a numerical sequence.
Line Ministry	Indicate the Line Ministry functionally responsible for the project.
Contracting Authority	Indicate the Contracting Authority responsible for the project.
Project Title	Provide a short, succinct title, capturing the essence of the project.
Location	Provide project location including the Province and District.
Project Pre- feasibility Study Decision and Date	Insert decision number for the project Pre-Feasibility Study. Enter project PFS decision date.
Feasibility Analysis Completion Date	Indicate the completion date, day/month/year (dd/mm/yyyy)
Project Objective	Describe the direct benefit of implementing the project. Think of the fundamental reason the project is being proposed — examining immediate change or overall result. **Do not** provide project details here that can be described elsewhere on the Form.
Status before Project	Describe the current situation (that is, without the project), using specific and factual data.
Status after Project	Describe how the current situation will be affected if the project is implemented. Use specific and factual data.
Justification	Justify the reason for undertaking project. The project should comply with all regulations and have positive socio-economic returns.
Alignment with National Development Strategies	Results-based management requires Ministries to agree on policy objectives and key result areas, which are then included in the Budget. How is the project aligned with Government policy objectives? Which Government strategic objectives does the project address, and how does it do so?
Alignment with Sector Strategies	Provide a detailed description of how the project links to and supports key sector policy and Ministry strategic policy objectives (see Ministerial preambles in the Estimates of Expenditure Book).
Alignment with Provincial and District Development Plan Objectives Supported by the Project	Will the project have an impact at the provincial and district levels? If so, what consultations has taken place with provincial and district stakeholders?
Alignment with Climate Change Objectives	Highlight how the project is expected to contribute to climate change adaptation, resilience or mitigation objectives outlined in the national development plans and strategies as well as the NDCs.
Other Strategic Considerations	Does the project align with national security considerations? Could it prevent or mitigate a national disaster (for example, a drought or an epidemic)?
Total Capital Costs	Provide final estimates of the project's total capital costs. The estimates of the project's capital costs should be **as accurate as possible**. Copies of engineering drawings and costing should also be submitted.
Operating and Maintenance Cost	Indicate the optimal annual operations and maintenance expenditures.
Sources of Project Funds	Indicate sources of project funding such as internal Contracting Authority funds, Government budget funds, the private sector and borrowing among others.
Outcomes (expected)	List all **expected outcomes** resulting from the project. Outcomes should be a direct result of the project outputs.

Item	Project Information Required
Outputs (expected)	List all **expected outputs** to be directly delivered by the project (that is, the direct result of project activities. See below). Outputs should be within or just within the Government agency's control. List all **anticipated results** (that is, those that will remain once the project has ended).
Main Activities	List the main project activities associated with the delivery of outputs. Activities should be listed **in a logical order** and **numerically linked** to outputs to facilitate an assessment of whether the proposed activities can realistically produce the expected outputs.
Implementation Plan	Provide a technically optimal project implementation plan. The implementation plan should also specify funds required for each phase and propose sources of funding. Provide output and activity schedule (Gantt chart) indicating the timing, sequencing, and dependencies for all activities.
Financial Effectiveness	Indicate financial rate of return and financial net present value.
Economic Effectiveness	Indicate economic rate of return and economic net present value.
Fiscal Effectiveness	Annual nominal net fiscal impact. Present value of net fiscal impact over the project's life.
Risk Analysis	A comprehensive risk analysis shall be conducted at this stage. Whenever possible additional data should be collected to better measure the risk. At this stage implementing agencies are encouraged to use entire range of techniques, such as, sensitivity analysis, decision trees, and risk simulation software.
Proposed Financing Modality of Public Investment	Specify the financing mode, for example public investment project or joint venture.
Environmental and Social Impact Assessment	Provide a summary (less than 500 words) of the results of Environmental and Social Impact Assessment including the Environmental and Social Management Plan.
Climate Risk Assessment	Provide a summary (no more than 500 words) outlining the results of the climate risk assessment. The assessment should provide a climate risk mitigation/management plan.
Climate Proofing	Provide a summary of the preferred climate-proofing option, including: a. The final cost estimates. b. The final estimation of the benefits of climate-proofing the project. c. The socio-economic viability of the climate-proofing option.
Procurement Plan	Indicate project procurement methods — open tender, closed tender, direct purchases — for all project goods and services (with due attention to any Government thresholds). Include a schedule (Gantt chart) detailing principal procurement deadlines.
Monitoring, Review, Action and Reporting Plan	The Line Ministry shall identify stakeholders responsible for monitoring outputs delivery and specify the frequency of the monitoring and reporting cycle. Outline the roles and responsibilities of the ministerial project board, project manager and executing agency. Consider developing a monitoring framework, including indicators of project progress/success, as agreed by all parties.
Project Governance Structure Plan	Provide details of the party responsible for project management within the applicant line ministry/department/agency. (If there will be a project steering committee, provide details of the proposed membership.)
Other Studies	List and provide a summary of results of other studies carried out with regard to the project.