GOVERNMENT OF THE REPUBLIC OF MALAWI

Ministry of Irrigation and Water Development

Implementation Manual
For
Piped and Point Water Supply Systems

July 2010

Implementation Guidelines

for

Rural Water Supply and Sanitation

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Foreword

The overarching objective of Malawi's Growth and Development Strategy (MGDS) is to reduce poverty by enhancing rapid economic growth while at the same time improving service delivery. Water and sanitation are among the key sectoral measures and cross cutting issues to be addressed. The MGDS targets for the medium and long term are consistent with the Millennium Development Goals (MDGs). For water supply, the MDG target is to halve, by 2015, the proportion of people without sustainable access to safe drinking water and sanitation and full coverage by 2025.

The primary objective of water supply and sanitation programmes is to implement the National Water Policy (2005) and National Sanitation Policy (2008). The objective of the National Water Policy is to guide the country in the management and development of its water resources using the Integrated Water Resources Management principles, improving the institutional and legal framework, ensuring sustainable delivery of water supply and sanitation services, effective involvement of the private sector and protection of the environment among others. While the objective of the sanitation is to establish mechanisms that bring about effective integrated multisectoral planning coordination implementation and monitoring of sanitation and hygiene promotion.

Water supply and sanitation programmes address constraints in service delivery, by developing district-based, community-managed approach to water supply and sanitation services; constructing/rehabilitating piped and point source water supplies; promoting hygiene and sanitation. This ensures increased access to safe water and improved sanitation to the communities to underpin socio-economic development.

The Ministry responsible for water affairs and other stakeholders consolidated experiences in piped and point water supply systems to develop this implementation manual in order to ensure a smooth implementation of water supply systems. The manual spells out the rules and procedures for identifying, appraising, implementing, monitoring and evaluating piped and point water supply systems.

Hon. Richie Muheya, M.P.
MINISTER OF IRRIGATION AND WATER DEVELOPMENT

LIST OF ACCRONYMS AND ABBREVIATIONS

ADC	Area Development Committee
AEC	Area Executive Committee
AIDS	Acquired Immune Deficiency Syndrome
CBM	Community Based Management
DA	District Assembly
DCT	District Coordination Team
DRA	Demand Responsive Approach
DWO	District Water Office
DWSP	District Water & Sanitation Plan
EW	Extension Worker
EWT	Extension Worker Team
FMP	Facility Management Plan
HA	Health Assistant
HSA	Health Surveillance Assistant
HESP	Hygiene Education and Sanitation Promotion
LSP	Local Service Provider
MGDS	Malawi Growth and Development Strategy
M&E	Monitoring & Evaluation
MDG	Millennium Development Goals
MoIWD	Ministry of Irrigation and Water Development
NSO	National Statistical Office
NGO	Non Governmental Organisation
O&M	Operation and Maintenance
PHAST	Participatory Hygiene and Sanitation Transformation
RWSS	Rural Water Supply and Sanitation
TA	Traditional Authority
VDC	Village Development Committee
VHWC	Village Health and Water Committee
VLOM	Village Level Operation and Maintenance
WMA	Water Monitoring Assistant
WPC	Water Point Committee

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Preface

Water supply and sanitation services are crucial to a country's prosperity. However, service provision in the rural and low income areas, has not been satisfactory. The piped water supply systems that exist in some of the rural and low income areas are old and cannot cope with the growing population. On the other hand most boreholes breakdown frequently due to ineffective village level operation and maintenance.

This Implementation Manual is designed to standardize the approach for carrying out water and sanitation services by various stakeholders to ensure sustainable implementation of piped and point water supply.

It is expected that all stakeholders will use this manual in implementing community water and sanitation programs to ensure not only uniformity of approaches but also sustainability of constructed facilities.

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1. 0 INTRODUCTION

Implementation of piped and point water supply systems in the country is in accordance with the existing water and sanitation policies, legislation, standards and guidelines. This Implementation Manual has been developed to provide guidelines to stakeholders with all the required arrangements and framework for the implementation of piped and point water supply systems.

The manual has been developed based on the past experience and the best practices learnt from the implementation of projects such as the National Water Development Project (NWDP). The implementation manual outlines the institutional and implementation arrangements for piped and point water supply systems.

1.1 Sector Targets and Investment Needs

The overarching objective of Malawi's Growth and Development Strategy (MGDS) is to reduce poverty by enhancing rapid economic growth while at the same time improving service delivery. Water and sanitation are among the key sectoral measures and cross cutting issues to be addressed. The MGDS targets for the medium and long term are consistent with the Millennium Development Goals (MDGs). For water supply, the MDG target is to halve, by 2015, the proportion of people without sustainable access to safe drinking water and attain full coverage of sanitation by 2025.

The goal of the Sector is to achieve 85% coverage for water and 68% for improved sanitation by 2015. In 2008 access to safe water supply was estimated at 75% (NSO, 2008) while improved sanitation was estimated at 46% according to National Sanitation Policy 2008.

There is however, need for major investment in both water supply and sanitation infrastructure and management system in order to achieve the above goals.

This implementation manual is designed to assist all stakeholders to have a standardised approach when implementing water supply and sanitation activities at point source. The manual should be used alongside water and sanitation sector policies, strategy documents, guidelines and other manuals including the following:

- ***Malawi Growth & Development Strategy; National Water Policy***;
- ***National Sanitation Policy;***
- ***Extension Workers' Manual***: a practical guide for extension workers on how to do their tasks in the Project Cycle.
- ***Trainer's Guide for Extension Worker Training***: a guide to be used for the training of Extension Workers.
- ***Trainer's Guide for WPC Training***: a guide to be used in training of Water Point Committees (WPC) and VHWCs.
- ***Community Handbook on Water And Sanitation***: a guide for WPCs on how to manage each of their tasks.
- ***Piped Water Schemes Design Manual***: manual on the design and construction of gravity fed piped water schemes.
- ***Groundwater Development Technical Manual***: manual on siting & construction of boreholes and hand dug wells.
- ***District Implementation Guidelines for Rural Water Supply And Sanitation***: guidelines for implementation of rural water supply and sanitation.
- ***Participatory Hygiene, Water and Sanitation Promotion Manual****:* manual on how to conduct participatory sanitation promotion & hygiene education.
- ***Piped Water Supply Manual for market Centres***: Guidelines for implementation of water supply in market centres.
- ***District Operational Manual;*** Manual on for planning and implementation of water supply and sanitation programmes in districts.
- ***Implementation Guidelines for Rural Water Supply and Sanitation;*** Guidelines for implementation of rural water supply and sanitation programmes.

- ***District Development Planning System Handbook;*** Guide for planning district development activities.

- ***Water Users Association Guidelines;*** Guidelines for formation of water users' associations
- ***Water Users Association Training Manual;*** Manual for training water users' associations.

2.0 SELECTING COMMUNITY WATER SUPPLY SYSTEM

There are a number of technologies that can be considered for a water supply for a given community. The aim of choosing a particular technology is to match the needs, resources and institutional capacity available to sustain the system. Choosing appropriate water supply system is the first thing to do before undertaking any project to ensure sustainability and effective use. Communities themselves should be involved in the choice of system they require and can sustain.

The following are the fundamental criteria for choosing successful community water supply system:

- Participation of the community in choosing type of technology ;
- Willingness of users to contribute in cash and in kind for both capital, operation and maintenance costs;
- Continuous availability of materials, tools and spare parts for the sustainability of the technology;
- Sources of water supply;
- Reliability of energy source;
- Skills and materials available to sustain the desired service levels;
- Appropriate organizational structure to sustain the desired level of service;
- Financial resources available for the desired level of service;
- Payment system that is most appropriate for user's ability to pay;
- Ways of hygienic waste water disposal;
- Level of service appropriate for all segments of the community.

2.1 Piped Water Supply System

Piped Water Supply is a system where water is conveyed from the source to distribution points through pipes. The System can vary in size depending on the extent of the use. When piped water supply system functions reliably, it offers a higher level of service in terms of coverage than point water sources such as boreholes.

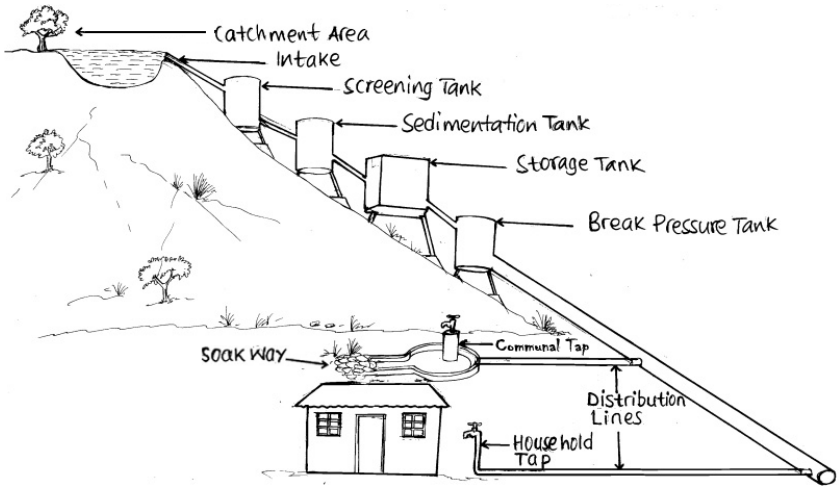

Figure 2:1 Components of a Water Supply System

Generally, piped water supply systems comprise the following components which should be properly designed, constructed and maintained:

- Source (Intake)
- Intake pipeline
- Reservoir tanks
- Treatment Works
- Transmission
- Tap points
- Energy Source

2.2 Principles for Water Source Selection

The following principles shall be considered when choosing a water source for piped water supply system:

- Quantity of the water source to meet the present and future demand;
- Reliability of the water source to meet the peak demand during different seasons;
- Quality of the water and treatment requirements;
- Type and reliability of energy available for the conveyance of water, preferably it should be by gravity;
- Catchment conditions;

- Participation of the community in choosing type of technology ;
- Willingness of users to contribute in cash and in kind for both capital, operation and maintenance costs;
- Continuous availability of materials, tools and spare parts for the sustainability of the technology;
- Skills and materials available to sustain the desired service levels;
- Appropriate organizational structure to sustain the desired level of service;
- Financial resources available for the desired level of service;
- Payment system that is most appropriate for user's ability to pay;
- Ways of hygienic waste water disposal;
- Level of service appropriate for all segments of the community.

2.3 Sources of Water for Piped Water Supply Systems

Piped water supply systems can be derived from a number of sources. Each source has its own advantages and disadvantages pertaining to capacity, investment costs, operation and maintenance costs and water quality.

A preferred source will be one which requires no or minimal treatment and can be delivered to the user by gravity. A source which requires no treatment but can be pumped would be the next choice. Sometimes depending on the cost, sources requiring treatment but no pumping would be preferred.

The optimum source of clean drinking water is a copious mountain stream where clean water can be abstracted. However, such sources are not readily available now since they have either already been over abstracted or are located in degraded catchment areas. Therefore, each piped water system should be provided with a treatment plant.

The following water sources should be considered for piped water supply systems:

2.3.1 Groundwater

Ground water can be used where there are high yielding aquifers to meet the intended demand. In cases where one borehole cannot meet the demand, a number of boreholes could be used. A thorough hydrogeological investigation is required in order to increase the success rates of site selection.

As a drinking water source, groundwater has an advantage that it usually requires no or minimal treatment. On the other hand, in many places it must be pumped to supply which adds cost and complexity to the project.

Spring is another source of ground water. Where spring outcrops are available with the required quantity, these could be considered first as a water source for the piped water project. Spring source provides water that would normally not require treatment and in most cases is at a height that favours flow by gravity as a source of energy.

River beds or river banks composed of granular material which are also known as infiltration galleries or river wells can be important ground water source to be considered for intake points of piped water supply systems. It is possible to abstract reasonable amount of clear water even from turbid streams.

2.3.2 Surface Water

The following are some of the sources of surface water:

Dam reservoir

Dam reservoir is a source that may be considered for piped water supply system if suitably protected catchment can be found and hydrological aspects are favourable.

This type of source requires treatment of water and in most cases pumping. The dam reservoir has an advantage of storing more water depending on the size and that initial treatment can start there. Where there are no perennial rivers, dam reservoirs is a feasible solution for water source.

Rivers or Streams

Rivers or streams provide another option for abstraction of water for piped water supply system. These sources invariably require treatment. Rivers and streams have a wide seasonal fluctuation in water quantity and quality. Worse conditions in quantity and quality have to be considered before choosing this option as a source.

2.4 Components of Piped Water Supply Systems

2.4.1 Reservoir (Storage)

Storage should be provided in piped water supply. There are two main types of reservoirs commonly used: service reservoirs and storage reservoirs. Service reservoirs are used to even-out the effect of peak demands and the storage reservoirs are used to provide some water reserves. The following should be considered when planning for storage:

- The service reservoirs should be sited as closer to the users as possible to minimize larger size of pipe network to cater for peak demands;
- The storage should be at a height that will provide the required pressures in the downstream distribution;
- Capacity should be in the order of one day's supply and more if intermittent supply is envisaged.

2.4.2 Transmission / Distribution

Transmission is the transportation of water from source to treatment plants and the distribution networks. Transmission can either be through pipelines or canals however pipelines are recommended.

Depending on the level of reliability a number of configurations of pipe network should be adopted .These could either be serial, branched or in a form of grid. Each configuration has advantages and disadvantages if you consider the capital cost of investment and reliability of the system when there is a breakdown or blockage.

The following should be considered in planning for transmission:

- The transmission should have the carrying capacity that is required to supply maximum demand of the day. Upgrading may be necessary in some of the old piped water schemes to meet this criteria;
- The operating pressure head in the transmission lines should not be less than 10 m;
- The transmission and distribution pipeline material should be selected to withstand the highest expected pressure in the network;

For the detailed engineering design reference could be made to relevant manuals.

2.4.3 Treatment

Once the source has been selected and variations in its quality assessed, decision should be made on the type of treatment required. The following should be considered when choosing the type of treatment plants in water supply system in rural and low income areas:

- Low cost;
- Use of minimum mechanical equipment;
- Avoid the use of chemicals if possible;
- Easy to operate and maintain.

For piped water supply systems the following treatment options should be considered:

- Screening;
- Aeration;
- Sedimentation;
- Rapid sand filtration;
- Roughing filtration;
- Slow sand filtration;
- Disinfection.

It is recommended in this manual that all surface water sources should include treatment component. Further, a deliberate effort should be made to construct treatment facilities in the existing piped water schemes.

2.4.4 Tap point

This is an end point of the system where users draw water. The following principles should be taken into account in selecting bib taps for use in community water supply:

- Simple manually operated taps are best;
- Bib taps should be sturdy and easy to use;
- Bib taps should be easy for the users to replace washers and install a new tap if necessary;
- The taps should be locally available; and
- Use water saving taps.

2.4.5 Drainage

Water is always spilled at stand posts and if pools are allowed to form they will become health hazards, providing a habitat for hookworms and breeding grounds for mosquitoes. To avoid this, stand posts should be provided with tap apron complete with soak way and soak pits for proper drainage of waste water.

2.5 Planning, Design and Construction

The following are the common stages of planning designing and constructing a piped water supply system:

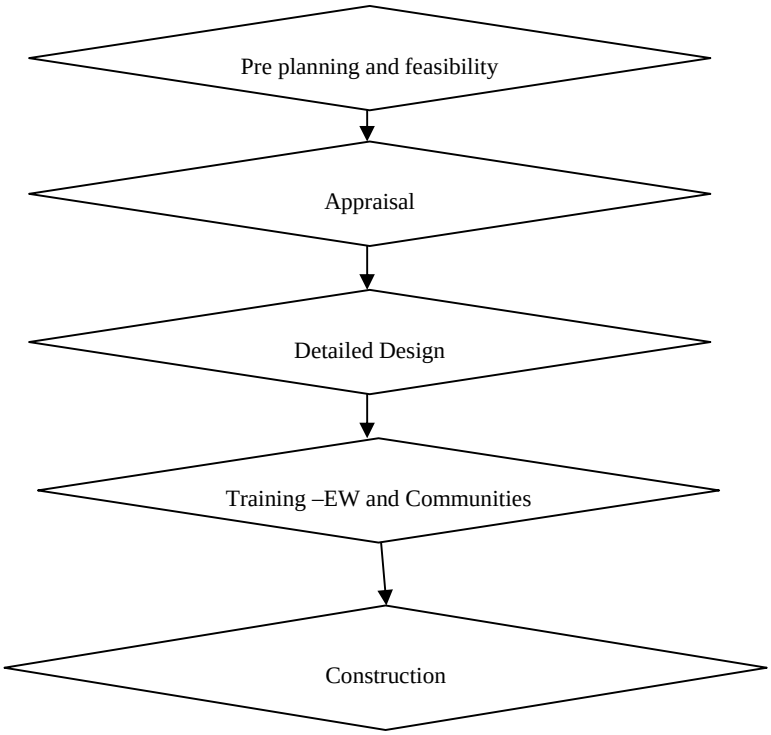

Figure 2:2 Stages of Planning, Design and Construction

2.5.1 Planning

Pre-Planning/Feasibility

Pre- planning involves assessing water resources, determining present and future demand, making initial judgment on options for technology types, levels of service and communities' capabilities to implement and sustain facilities. Cost estimates and work schedules are also established.

Pre- planning or feasibility should include among other issues:

Planning and collection of design data

- Inventory of existing technologies the communities use, with population figures and growth forecast using either the latest National statistical office data or others available;
- Map of the supply area with population densities, industrial/institutional requirements, elevations and other features;
- Water demand both present and future and description of other uses other than domestic;
- Reliability of water sources during different seasons, water quality and treatment requirements;
- Water source protection;
- Type of energy requirement and potential energy sources;
- Estimation of types and quantities of equipment and material requirement;
- Availability of spare parts.

Evaluation of data

- An evaluation/assessment of past community performance in community development activities;
- An appreciation of communities' willingness and ability to implement and sustain improved water supplies;
- An outline of viable maintenance support and spare parts distribution arrangements;
- An assessment of sanitation and hygiene practices and needs.

Policy issues

- Financing details and cost recovery proposals;
- Targets and objectives;
- Cost estimates;
- Arrangements for implementation and management;
- Arrangements for monitoring and evaluation.

Establishing program targets

- Specify time period for implementation with targets set to fit the available funds and human resources;
- Define targets which are realistic.

Setting out priorities

- Identify which communities should first receive the new facilities;
- Priority criteria for selection of communities should be publicized to avoid misunderstanding;
- Target communities should be aware of the criteria for attaining a high priority rating.

Assessing potential for community participation

- Establish which formal and informal community participation is available;
- Establish which organizations may help in promoting participatory approaches.

Involvement of the users

- Communities should be full partners in contributing wisdom, work, skills, materials and cash throughout the whole life of the project;
- Get views of women, community leaders, the poor, tribal and other distinct groups.

Preparation for hygiene and sanitation promotion

It is increasingly being recognized that improved water supply by itself is not a guarantee for decisive improvements to community health. Provision of improved sanitation facilities and good hygiene behaviour is also required to reduce the many transmission routes for water and sanitation related diseases.

Water Rights adherence

Before abstraction of water from either surface or ground water sources, Water Right has to be granted. The government established rules and regulations regarding application of Water Rights and Consents. The Water Rights shall be applied from Water Resources Board. All necessary information and application forms can be collected from the Board.

Detailed Planning

After the pre-planning/feasibility phase, the program will go on appraisal to ensure that it is soundly based. Appraisal is taken by other people other than those responsible for the preparation itself. When the appraisal is successfully completed and funds have been allocated, the program will be ready for detailed planning.

Similar step as those in pre- planning will be done but to a greater detail.

During the detailed planning stage, it will be made clearer on how construction, maintenance and financing will be carried out. Decisions at this stage should be made in close partnership between agency workers and the community. The community has to decide what it wants and can sustain.

Training of Extension Staff and Community Members

New skill and techniques for extension workers which are not generally part of their previous training are required. Newly recruited staff or existing staff have to be provided with appropriate skills in motivating and assisting the communities in the development of community based approaches.

At the planning stage a number of people in the communities should be trained for full participation to be possible. These people should be trained to ensure meaningful participation. The people should be identified by their communities after considering their reliability and skills.

These communities will be trained in the following aspects:

- Construction
- Operation
- Maintenance
- Repairs
- Financial management
- Hygiene education
- Sanitation promotion
- Monitoring and Evaluation

Relevant training manual should be used for the above activities.

2.5.2 Design for Piped Water Schemes

Major decision on the technology type and service level will have already been made when the design stage is reached. The task at this stage is to produce detailed designs which will:

- Incorporate practical details acceptable to all users (women, men, girls and boys);
- Allow construction to take place in an orderly and cost effective manner;
- Ensure that the installed system can easily be operated and maintained;
- Allow for flexible future extension and upgrading;
- Take into account environmental issues;
- The design should take into account cultural, social and other influences of the water supply. The decision should take into consideration full understanding of how the communities use and carry the water.

To ensure user acceptability of the design, the following points must be considered:

- Number and location of stand points;
- Design of the stand points and layout of the site to suit all the users;
- Additional provision for washing and animal watering if required;
- Future expansion areas.

2.5.3 Design Guidelines

The detailed engineering design guidelines on piped water supply can be found in Technical Design Manuals and other references listed in the Bibliography.

The following general guidelines are useful when considering a piped water supply;

- Hydrological data of the water source. The critical is the dry season data for river flows i.e. low flow measurement;
- Consider the investment and associated construction works, coverage area and population to be served;
- Present and future demand;
- The design should meet the daily peak demand;

- Water should be kept under sufficient pressure to flow from all outlets at the required rate in the pipe network;
- Topographical consideration, elevation of the intake and the terrain of the reticulation area;
- Taps should be located so that the one way maximum walking distance is not be more than 500m;
- One tap should serve at least 120 people
- Provide good drainage for the waste water;
- Investigation of the possible water right of people currently depending on that source for water.

2.5.4 Construction

Construction is the phase where the design takes a physical shape. There are a number of ways of tackling construction depending on the scope of work and capacity of people to take part. A wide variety of approaches to construction can be adopted. The following can be considered:

Community Participation

With proper training community members can participate in much of construction work. This approach strengthens sense of ownership. Construction activities can also be the starting point for training people to become caretakers. Good organization, a clear explanation of standards and adequate supervision are equally important keys to good community participation in construction works.

Figure 2:3 Community members participating in trench excavation

Direct labour

This method uses workers employed by the agency or other bodies. Planning of activities is easy since workers are employed. In most cases workers are equipped with construction equipment and tools. This method does not give sense of ownership as the case is when communities themselves are involved. Direct labour might become mandatory where the type of construction work is more complex and requires specialized skills.

Contracting

Larger construction projects where specialized operations will be required should be undertaken by contractors who have the necessary skills and experience. Since the contractors are in business of making money their interest are not necessarily those of the communities or agency therefore care should be taken to prevent short cuts through proper supervision. Community-contractor relations should also be promoted.

Mixed Systems

Mixed Systems can be used in larger projects where part of the work is done by communities and part is contracted out. For example communities can carry out the following tasks:

- Digging and backfilling of trenches;
- Laying of pipes;
- Clearing of access roads and other jobs that can be identified.

The other specialized work such as construction of concrete reservoirs could be contracted out.

3.0 THE POINT WATER SUPPLY SOURCES

Point Water Supply Systems can be developed from a number of sources: from groundwater through drilling of boreholes and construction of shallow wells, or from protected springs. Water from either a borehole or protected spring which can be distributed to one or two villages has also been considered as point water source in this manual.

3.1 Boreholes

Boreholes are generally appropriate considering that groundwater is readily available in most places. Boreholes give access to ground water in an aquifer and facilitate abstraction of water from a few meters to over 200m depth. The maximum depth is determined by type of pump or technology used. Generally the diameter range between 0.10m and 0.25m for the casing.

The following guidelines should be considered in the construction of boreholes:

- Hydrogeological investigation should be thoroughly conducted for proper siting;
- Drilling can be done by machines or by hand operated equipment;
- There are a number of well construction techniques including driving, jetting or drilling (boring). Drilling is the most common technique;
- No single water well construction technique is applicable for all conditions. The most appropriate technique will depend on hydrogeological, environmental, social, cultural, and economic conditions at the site of the proposed well;
- After the completion of each well, its performance must be assessed by conducting a pumping test which provides information about yield and drawdown of the well which are important factors in pump choice and setting;
- A proper combination of slot size, gravel filter and aquifer material, and extensive sand pumping before well development can considerably improve long-term performance;
- Water quality testing should be done before installation of a pump. This is to establish the water quality and a decision should be done whether to put a treatment facility or not, depending on the quality of the water;
- Water can be pumped to an elevated tank and gravitated to one or more villages. Solar and wind energy can be used. Pumping can be manually or by solar, wind, electricity or other forms of energy.

3.2 Main Components of a Borehole Fitted with hand pump

Boreholes usually consist of the following parts:

- **Concrete apron** -At ground level, a concrete apron is constructed around the borehole with an outlet adapted to the water abstraction method. This prevents surface water from seeping down the sides of the well, provides a hard stand and directs spilt water away from the well to a drainage channel.
- **Plain casing** - A lining below the ground, but not going into the aquifer, to prevent it from collapsing especially in unconsolidated formations. The lining is usually pipe material (mostly PVC and sometimes galvanized iron).
- **Perforated Casing** - Below water level in the aquifer sections, the pipe material is slotted to allow ground water to enter the well. A gravel filter layer surrounding this part facilitates the groundwater movement towards the slotted pipes and, at the same time prevents ground material from entering the well. In consolidated formation this gravel may not be required as the formation itself serves as filter material.
- **Hand pump** – the hand pump is usually fitted to the well after completion of the well construction. The type of pump to be fitted depends on several factors; (usage, ease of maintenance, cost, availability of spare parts etc). Many types and sizes of pumps are available for use in borehole water supply systems. The most commonly used pump for community supply in the country is Afridev while institutions such as health centres use Climax or Motorised pumps.
- **Drain** - to guide spilt water further away from the well, usually towards a soak away filled with large stones where the water can infiltrate back into the ground, or evaporate from the stone surfaces at a safe distance from the well.
- **Fence** - to prevent animals from entering and polluting the well and its surroundings.

3.2.1 Construction

Construction of a borehole can be done using mixed system to ensure ownership of the facility. The communities can take up some activities such as collection of bricks, quarry stone, clearing of access routes, siting and others while specialized jobs such as drilling, casing, pumping test and installation of pump should be contracted out.

3.2.2 Cost Implications for Borehole Construction

The cost of this technology varies considerably depending on depth, the ground formation, material used for lining, and type of pump used. The main components of drilled well that have initial investment costs are the following:

- Drilling;
- Supply and installation of casing;
- Gravel pack and well development;
- Pump test;
- Apron, drainage and soak away construction;
- Hand Pump and accessories supply and installation.

3.3 Protected Shallow Wells/Hand Dug Wells

Protected shallow wells are methods of groundwater withdrawal by simply digging a hole in the ground, to a depth below the ground water table by hand. Usually no special equipment or skills are required for their construction. The well should not be less than 0.8 m in diameter to give access for cleaning.

Due to their large diameter and volume, hand dug wells allows for both groundwater withdrawal and storage. Because of the storage capacity, water can be temporarily withdrawn at a higher rate than the recharge inflow into the well. The storage effect is particularly important when the users take the water mostly at peak rates during a few hours in the morning and the evening.

One advantage of a hand-dug well is that no specific expertise is required in its construction: it can easily be dug, lined, and maintained by the community. The depth to which a well can be dug largely depends on the type of ground and the fluctuation of the ground water table. An important factor is the stability of the ground and the cost of digging. The well should be protected by lining with bricks, masonry or concrete. Concrete could either be insitu or pre- cast rings and the well should be properly covered if no pump is installed. Shallow wells can be fitted with hand pumps.

3.3.1 Components of Hand Dug Well

The main components of a hand dug well are:

- **Inner lining –** This can be brick, stone or concrete. The lining provides protection against caving and collapse during construction and retains the walls after construction. Lining also provide seal against polluted water seeping from the surface into the well.
- **Wall head -** As a minimum provision the well lining should be extended at least 0.5m above the ground to form a head wall around the outer rim of the well.
- **Concrete Apron –** A concrete apron should be constructed on the ground surface extending about 1m all around the well. The concrete apron also seals any fissures between the well lining and the walls of the excavated hole and so prevents polluted surface water from seeping into the well.
- **A drain** - to guide spilt water farther away from the well, usually towards a soak away filled with large stones where the water can infiltrate back into the ground, or evaporate from the stone surfaces at a safe distance from the well.
- **A fence** - to prevent animals from entering and polluting the well.

  A hand pump – the hand pump is usually fitted to the well after completion of construction. The type of pump to be fitted depends on several factors; many types and sizes of pumps are available for use in hand dug wells water systems. The hand pumps that the Ministry responsible for water affairs recommends is Malda. However some hand pumps fitted on hand dug wells in some districts are Mark 5 and Nira pumps.

3.3.2 Cost Implication for Shallow Well Construction

The cost of this technology varies considerably depending on depth, type of structure, material used for lining, and type of pump used. The components that need to be included while estimating the cost are:

- Labour for digging the hole and construction of the other facilities.
- Wall lining material.
- Gravel pack between the wall of the hand dug well and the lining material.

- Apron, drainage and soak away.
- Hand Pump and accessories.

NOTE: Although shallow wells are sources of water supply for other purposes, they are not recommended sources of safe drinking water. In view of this, all stakeholders in the sector should consider providing other sources of safe drinking water supply.

3.4. Springs

Springs can be exploited by developing as water point source or can be a source for piped water supply to one or more villages. Transmission can either be by a gravity-fed or by pumping.

3.4.1 Spring Tapping and Protection

The type of construction to be adopted for tapping a spring may differ from one site to the other mainly due to type of spring, size and location.

Springs can be tapped with drains consisting of graded gravel pack with open joints placed over an impervious layer. The drain must be placed so deep that the saturated ground above them will act as storage reservoir compensating for fluctuation of the ground water table. The water collected by a drain discharges into a storage chamber which is mostly called the "spring box".

The drainage system and the storage chamber should be constructed in such a way that contamination of the collected water is prevented. Graded stones should be piled up before construction of the chamber. These serve to make a wall, and will prevent the washing away of soil.

The chamber should be fitted with removable manhole cover for the purpose of cleaning and access for maintenance work, the manhole cover has to be sealed after cleaning and maintenance work. Similarly, the air vent, overflow pipe and drains must be provided with screens to avoid entry of pollutants. A diversion ditch has to be provided to prevent surface runoff from entering the chamber to avoid contamination of the spring water.

3.4.2 Components of Spring Tapping Structure

The main parts of a spring water collection system include:

- A drain under the lowest natural water level;
- An outlet to tank or collection point;
- An overflow pipe just below the cover slab;
- A protective structure providing stability and
- A seal to prevent surface water from leaking back into the stored water.

For low yield springs it would be advantageous to consider construction of a collection tank for night flow storage. For design details reference should be made to appropriate manuals.

3.4.3 Cost Implications for Spring Tapping

Spring tapping structures range from a simple weir structure (open) to more complex constructed (closed) systems. There is also a range of sizes depending on the flow and aerial extent of a given spring.

The main components of spring collection system which have initial investment cost implications are the following:

- Excavation and backfill of the spring site and pipe trench if any;
- Headwall or tapping box;
- Pipe work;
- Concrete work or Masonry work.

3.5 Rainwater Harvesting

Rainwater harvesting should be considered in areas where there is relatively high rainfall during certain times of the year and little or no rainfall during other times. Adequate provision is required for interception. Rainwater should be collected and stored in household tanks, reservoirs, dams.

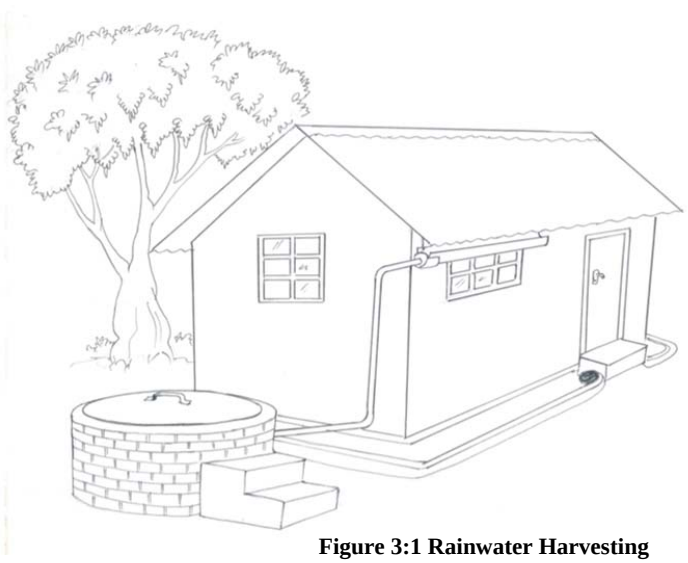

Figure 3:1 Rainwater Harvesting

The water can be pumped to an elevated tank and gravitated to one or more points. Depending on circumstances the catchment of the water can be ground, rooftops, road drainage and others. The surfaces of these sources contaminate water; therefore rainwater should only be used for domestic purposes after treatment.

3.6 Water Quality

Each water point provided should meet the following minimum water quality standards:

SOURCE TYPE/LOCATION	Malawi Standards (MS 733:2005)
pH Value	6.00 – 9.5
CONDUCTIVITY (µs/cm at 25ºC)	3500
TOTAL DISSOLVED SOLIDS mg/l	2000
CARBONATE mg/l	
BICARBONATE (as HCO_3^-) mg/l	
CHLORIDE (as $C1^-$) mg/l	0 – 750
SULPHATE (as SO_4^{2-}) mg/l	0 – 800
NITRATE($NO3^-$) mg/l	0 – 100
FLUORIDE (as F^-) mg/l	0 – 3.0
SODIUM (Na^+) mg/l	0 – 500
POTASSIUM (K^+) mg/l	
CALCIUM (Ca^{2+}) mg/l	0 – 250
MAGNESIUM(Mg^{2+}) mg/l	0 – 200
IRON (Fe^-) mg/l	0 – 3.0
MANGANESE (Mn^{2+}) mg/l	0 – 1.5
TOTAL HARDNESS mg/l	0 – 800
TOTAL ALKALINITY	0 – 800
SILICA	
TURBIDITY (NTU)	0 – 25
SUSPENDED SOLIDS	0 – 20
VOLATILE SOLIDS	
BIOCHEMICAL OXYGEN DEMAND	0 – 20
CHEMICAL OXYGEN DEMAND	
FAECAL COLIFORM/100ml	0 – 50
FAECAL STREPTOCOCCI/100ml	0 – 50

4.0 IMPLEMENTATION STRATEGIES

The effective implementation strategies for water supply systems ensure sustainability of water supplies through active community participation, sanitation and hygiene promotion, catchment protection and environmental management and institutionalising a multi-sectoral collaborative effort. The strategies apply to both piped and point water sources.

4.1 Strategies

Implementation strategies for water supply and sanitation systems are as follows:

4.1.1Demand Responsive Approach (DRA)

A demand-responsive, approach should be followed so that communities receive assistance to put in place institutions and develop capacity for implementation of their water supply and sanitation systems. DRA ensures that the community initiates and makes informed choices about service options and how services are delivered.

4.1.2Community Empowerment

Development of a Water Supply System should be based on 'Community Water Management' autonomy in line with the Decentralization Policy (1998). Empowerment involves running of the systems by the communities themselves including procurement of the equipment and services, setting up and collection of operation and maintenance funds to ensure continuous financial self -sufficiency of service delivery and operation and maintenance. In piped water supply programmes, this can best be achieved through promotion of Water Users Associations which can be registered as ***Trusts.***

4.1.3 Participatory approach

Participatory approach entails involvement of all stakeholders, including the private sector and communities to improve efficiency in service provision and enhance sense of ownership and responsibility.

4.1.4 Sustainability

Sustainability considerations should be given priority in the development of water supply and sanitation systems**.** The provision of potable water supply to communities is aimed at ensuring

good health for the communities and unless water supply is provided in a sustainable manner, this goal will not be achieved.

4.1.5 Cost Recovery and the right to access

Access to water is a right; however it is also recognized that water is an economic good, and its service must be paid for. Any Water Supply and Sanitation development project should be based on cost recovery for operation, maintenance and replacement costs in order to ensure sustainability. Hence there should be cost-sharing arrangement in the development of a water supply system. Capital contribution by the communities in form of cash and in kind should be promoted to ensure ownership of the facilities. Percentage for cash contribution shall be discussed and agreed by the community. For point water sources communities should contribute cash of not less than 5% of capital cost to achieve cost recovery while for piped water supply systems, service providers and communities should agree on the amount of contribution including cash utilisation during the planning stage.

4.1.6 Integrated approach

Planning for piped and point source water supply systems should be integrated with hygiene and sanitation promotion to maximize the health benefits of providing potable water to communities.

4.1.7 Transparency and Accountability

The planning and implementation of piped and point source water supply systems should ensure that the rules and procedures are well understood and adhered to by all stakeholders.

4.1.8 Gender Considerations

The planning and implementation of piped and point source water supply systems should ensure participation of both men and women in decision making processes and project implementation.

4.1.9 Participatory Monitoring and Evaluation

A proper Monitoring and Evaluation (M & E) system should be established to monitor and evaluate performance. M& E should be carried out in a participatory manner to build user capacity in monitoring and disseminating of the results so that the program can be improved through feedback.

5.0 IMPLEMENTATION AND MANAGEMENT ARRANGEMENTS

Effective implementation and management of piped and point source water supply systems is crucial to ensure sustainable service delivery. Therefore, it is important to engage various stakeholders at all stages of implementation at national, district and community levels.

Stakeholders can play leadership, management, technical, operational and learning roles in the programme. In playing these roles, they will be responsible for any number of functions, activities and results. Clearly defined roles and responsibilities create a working environment in which partners feel comfortable and committed to achieving results.

Details of institutional roles and responsibilities are contained in the District Implementation Guidelines.

5.1 Management Options for Piped and Point Water Supply Systems

Several management options should be considered for the planning, implementation, operation and maintenance of piped and point water supply systems.

The common management options in piped and point water supply and sanitation systems are as follows:

- Management through Committees.
- Management through Cooperative Societies.
- Management through Trusts.
- Management through Water Users Associations.

5.1.1Management through Committees

Committees are formed at different levels for each water supply and sanitation system. The common types of committees are as follows:

- Main Committee is established for the water supply system at scheme level;
- Section Committees are established at each section of the distribution system, usually at the Area Development Committee level;
- Branch Committees are established along the branches in the reticulation system;
- Water Point Committees are established at each water point.

- Catchment Management Committees are also established to provide leadership in catchment protection and conservation;
- Project Committee are established at the project level.

Committees established for these systems are normally not legal entities. The committees manage the water points on voluntary basis with financial contribution from water users.

Some of the members in these committees should be trained to carry out simple preventive repairs and ensure that the pump or water point is properly operated by the user community members.

Area mechanics should be established through private sector participation to provide maintenance services for water points at an affordable cost to the communities. Area mechanics will be selected and trained in advanced repairs of hand pumps.

5.1.2 Management through Cooperative Societies

Cooperative Society system can be established in piped water supply schemes. Cooperatives are registered by the Registrar of Cooperatives in the Ministry responsible for Trade.

Under this system, members are not ordinary members but shareholders. The Cooperative Societies are legal entities mandated to manage the scheme and its assets. Financial contribution by members is obligatory to ensure sustainability of the water supply system.

For day to day management of activities, the Cooperative may engage full time paid staff.

5.1.3 Management through Trusts

Trust Management system can be established in piped water supply schemes. Trusts are registered under the Trustees Incorporation Act (1989). A Board of Trustees (BoT) is appointed to administer the affairs of the schemes on behalf of the communities.
The main objectives of a Trust for a water scheme are to provide potable water to communities within a scheme and to ensure proper operation and maintenance of the water scheme. Among other things Trustees are responsible for:

- Raising and receiving funds and donations for the Trust;

- Cooperating with government and donors, organizations and other agencies in matters relating to the objectives of the Trust;
- Administering, holding, managing and investing any Trust funds.

A full time paid management and staff should be engaged in order for the Trust to function effectively

The Ministry responsible for water affairs has adopted Water Users Association (WUA) as a management option for piped water supply systems.

The responsibilities of the WUA include:
- Facilitating and overseeing water supply services in a scheme;
- Guiding planning of their water supply system;
- Contracting and supervising a local utility operator to handle routine operations and maintenance;
- Arranging for long term technical assistance to assist local utility operators to improve efficiency, resolve problems; and
- Expanding the system over time.

Details of the establishment, roles and responsibilities of the Trusts, Cooperative Societies, Water user associations and their associated committees including types of training are contained in the WUA manual.

5.2 Training and Capacity Building

Sustainable water management at the community level will be the critical project outcome and the one against which the validity of project results will ultimately be assessed. This can only be achieved through capacity building and training at all levels. The specific objectives of capacity building and training are to orient stakeholders on their roles, responsibilities and approaches of the piped and point water supply sources programme and also develop knowledge, skills, attitudes and team work needed by stakeholders at different levels to carry out their respective roles.

In addition, the training program will assist new service providers to:

- develop the business and organizational skills needed to operate in the private sector;

- facilitate the development of training skills at different levels so that stakeholders at each level can assist with the training of those below them in the system;
- Provide certification for certain skills as part of a system of ensuring quality control over the services delivered;
- Use training events as part of the process of strengthening piped and point water supply methodology through analyzing problems identified by stakeholders and redesigning the approaches.

Capacity building outlined in the District Implementation Guidelines for Rural Water Supply and Sanitation should be adopted and suitable training manuals should be used.

6.0 OPERATION AND MAINTENANCE

Once the construction of a water system is over, the system enters the longest phase of the project cycle and this is the operation and maintenance phase.

Operation – refers to the running and handling of a water supply system. Different operational activities are performed depending on the type and complexity of the facility. Operational guidelines as laid down by designers and manufacturers should be followed in specific components of the system.

Maintenance - refers to an activity or a set of activities that ensures that a water supply system is in proper working condition.

Maintenance can be grouped as follows:

Preventive maintenance – regular inspection and servicing to preserve assets and minimize breakdowns;

Corrective maintenance – minor repairs and replacement of broken and worn out parts to sustain facilities;

Crisis maintenance – unplanned responses to emergence breakdowns and user complaints to restore a failed supply.

Rehabilitation - entails the correction of major defects and the replacement of equipment to enable the facility to function as originally intended.

Maintenance costs a lot of money although crisis maintenance alone appear less costly in the short term. However, continuing crisis maintenance leads to frequent breakdowns, unreliable supply, poor service levels, and lack of user confidence. Reliance on crisis maintenance may ultimately lead to complete system failure. It is therefore recommended that preventive maintenance should be emphasized.

When maintenance is no longer technically feasible or economically viable to keep the facility in working condition or the system has reached its design lifespan, rehabilitation should be considered.

6.1 Spare Parts Supply Chain

Unreliable supply of spare parts affects the operation and maintenance of water and sanitation facilities. Spare parts availability should be one of the main factors for deciding the suitability of a particular technology. A supply system should be identified including storage of fast moving parts.

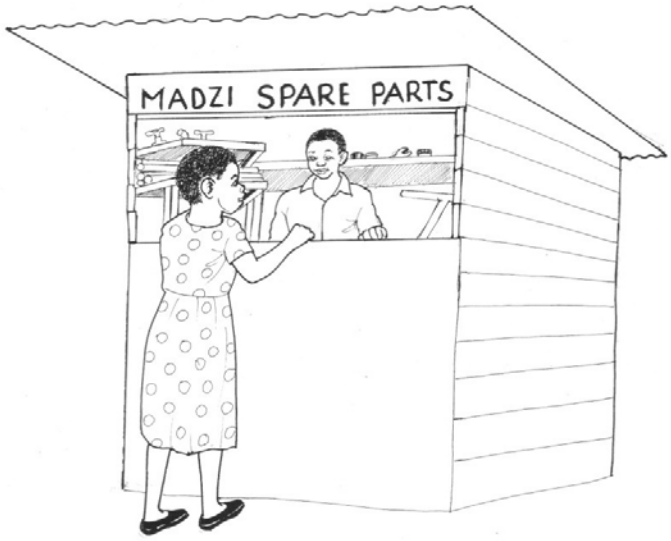

Figure 2.2: Spare parts Shop

6.2 Sources of Funds for Operation and Maintenance

The method of funding Operation and Maintenance must be appropriate to the type of water supply and the social economic circumstances of the users.

Funding sources which could be considered for operation and maintenance are summarized in the table below:

TYPE OF FUNDING		**METHOD**
COMMUNITY FUNDS	Voluntary fund raising	Funds for simple water systems may be collected periodically when required through meetings, households collection and festivals.
	Income from Community facilities	Communities with their own sources of income like communal farms, a proportion of income may be set aside for O & M.
	Cooperative /Trust funds	Profit from cooperative activities or trust funds may be used for O & M.

WATER TARIFF (RATES)	Flat rates	Flats rates paid by users usually per house hold at a communal tap, communal borehole or house connection.
	Graded rates	Different categories of water users may pay different rates depending on water use and category e.g. Institution or Industry may pay different rates from individuals in the community.
	Water metering	Connections are metered and user pays per volume consumed.
	New water connection fees	All new water connection applicants pay fees before they are connected.

7.0 FINANCIAL MANAGEMENT

Financial management entails planning, organizing, controlling and monitoring the financial resources of a project or an organization to achieve its objectives. Management and accounting of resources for the Piped and Point Water Supply programmes shall be in compliance with the general framework of the Government Financial Management System, which is governed by the Public Finance Management Act (2003), Public Audit Act (2003), Public Procurement Act (2003) and other relevant Acts. Financial guidelines from the associated development partners and Treasury Circulars and Instructions should also be used. The objective is to achieve financial prudence, transparency and accountability in the management and accounting of the project resources.

7.1 Principles of Financial Management

The following principles will guide and help the project teams in the implementation of the Piped and Point Water Supply programmes:

- Custodianship - refers to the stewardship or safekeeping of the project's resources. Custodians hold the assets and funds in trust and must make sure that they are used in accordance with the Acts and any contractual agreements entered into.
- Accountability – refers to the moral or legal duty, placed on an individual, group or organization, to explain how funds, equipment or authority given by a third party has been used.
- Transparency - all financial information must be recorded accurately and presented clearly, and can be easily disclosed to those who have a right to ask for it.

- Consistency - the systems employed should be consistent over the years so that comparisons can be made, trends analyzed and transparency facilitated.
- Integrity - honesty and reliability of an organization, and the individuals within it, have to be beyond question. There must be no doubts about how funds/resources are being utilized, the records must be a true reflection of reality and proper procedures set up and followed by all staff.
- Non-Deficit Financing - do not borrow or undertake an activity when there are no funds.
- Standard Documentation - the system of maintaining financial records and documentation should observe accepted accounting standards and principles. Financial records should be able to be understood by any relevant person and/or accountant.

7.2 Planning and Budgeting

Financial planning is both a strategic and operational process linked to the achievement of objectives. It involves building both longer term funding strategies and shorter-term budgets and forecasts.

Financial planning does not start with budgets and numbers. Effective budgets can only be produced as a result of good underlying plans. It is impossible to start a financial forecast without a clear idea about what is it that you want to do and how you intend to do it.

7.2.1 Plans

Plans may be sub-divided into several, more specific and detailed plans for each activity, function or project. Plans should have a shorter time focus (about one year) and are the basis for budgets.

7.2.2 Budget

'A budget describes an amount of money that an organization or one has or plans to raise and spend for a set purpose over a given period of time.'

A budget has several different functions and these include:

- Planning
- Fundraising
- Project implementation
- Monitoring and evaluation

Types of Budget

Two main types of budget that are being used:

- The Income and Expenditure Budget
- The Capital Budget

The Income and Expenditure Budget

The income and expenditure budget sets out the anticipated running costs (also referred to as recurrent costs) of the organisation and shows where the funds will come from to cover the costs. The annual income and expenditure budget is often broken down into shorter periods (half yearly, quarterly, or even monthly) to assist with monitoring progress.

The Capital Budget

A capital budget lists the expenditure you intend to make for the coming years on capital projects and one-off items of equipment that will form part of the organization's *Fixed Assets*. As these usually involve major expenditure and non-recurrent costs, it is better to list and monitor them separately. Examples of capital expenditure include:

- Building construction
- Major renovation works

7. 2. 3 Approaches to Budgeting

There are several different approaches to build a budget. Some of the approaches that can be used are:

Incremental budgeting

This approach bases any year's budget on the previous year's actual, or sometimes budgeted figures with an allowance for inflation and known changes in activity levels.

A frequent criticism of this approach is that it does not encourage fresh thinking and may perpetuate existing inefficiencies.

Zero-based budgeting

An alternative approach is to start with a clean sheet – a zero base. Zero-base budgeting (or ZBB) ignores previous experience and starts with next year's targets and activities. ZBB requires justification of all the resource requirements.

This process may suit projects whose income is activity-based. Zero-based budgets are said to be more accurate since they are based on the detail of planned activities (recommended to be used).

Activity-based budgeting

This describes an approach to budgeting where the budget is built up from a detailed activity plan. It is similar to ZBB. It is similar to ZBB (also recommended to be used).

7.3. Key Factors in Community Financial Management

Proper management of funds will ensure that facilities operate sustainably and create trust at community level. The following are some of the key factors to be considered in community financial management:

7.3.1 Accountability

Handling of funds should be as transparent as possible to build confidence of the people in the management of their funds. Bank statements, water supply financial account should be available for people to see. Independent committee of user representatives should be established to audit the accounts.

7.3.2 Accurate costing

Accurate estimating of cost of activities should be worked out. This is important because it will give realistic costs for budgeting and tariff setting. The following costs should be considered:

- Personnel – management, technical, administrative staff, caretakers, operators, etc.
- Materials and spare parts
- Transport
- Private contractors – repairs, rate collection, private artisans
- Other expenses – office and administrative overheads such as stationary, bank fees etc

7.3.3 Collection of payments

Contributions should be collected when people are able to pay and may therefore be irregular. The method of collection should not be disproportionately costly to the revenue collected.

7.3.4 Safe keeping of money

Bank accounts must be opened and maintained to ensure safety of money collected from users.

7.3.5 Fund administration

The administration of funds requires issuing of receipts for payments and expenditure and careful keeping of records.

7.3.6 Financial and administrative skills

The administration of funds will require men and women with administrative skills. Retired officers have some administrative skills which can be utilized in the communities. Women have shown to be good treasurers.

7.4 Tariff Setting

A water tariff is a rate at which users are charged for water. If cost recovery aims at satisfying an increasing demand for water then the tariff should reflect the cost of operation and maintenance (O&M) as well as the cost of the expansion of water supply facilities. A community needs the costs of running their water supply system to set a water tariff and draw a budget.

7.4.1 Tariff Formulae

Particular formula may be used depending on what costs are intended to be recovered. The choice of one tariff will depend on the technology used, but mostly on the capacity and willingness to pay of the communities.

Minimum Tariff = [Operation costs + Administrative costs + Maintenance Costs (Functional costs)]/ No. of people served.

Efficiency Tariff – this will include costs of replacement or extension of the services. An agreed percentage in many cases 25% is used:

= (Functional costs + 0.25 Functional costs) / No. of people served.

Environmental Tariff – This tariff will include cost for the protection of the water sources.

= (Functional costs + 0.25 Functional costs + Cost of Protection environment) / No. of people served.

Total Efficiency Tariff – This tariff includes recovery of all the above cost and the initial investment costs. This is usually done by the community reimbursing an agreed percentage every year. The initial capital contribution by the communities can be used for this purpose for the first years.

= (Functional costs + 0.25 Functional costs + Cost of Protection environment + Investment recovery) / No. of people served.

Additional costs such as depreciation or inflation can be included in this if the project decides to recover them as well and the communities agreed to it.

7.5 Accounting and Bookkeeping

Accounting is the art of communicating financial information about a project to users such as stakeholders, Government, Development Partners and Managers. The communication is generally in the form of financial statements that show in money terms the economic resources under the control of management during implementation of the project.

Bookkeeping is the recording of transactions in a book. It originates from manual record keeping (transactions recorded in books) although it also applies to electronic recording of transactions.

Financial Statements

During implementation financial reports shall be produced together with the physical progress reports to assist in monitoring of the project and compare the actual expenditure against the budget. The financial reports can be produced monthly, quarterly, and annually.

7. 6 Stores Management

Stores management is a system of planning, organizing, coordinating, and controlling of all activities involved in store keeping and stock control so that they can be used efficiently, effectively and economically.

7.6.1 Reasons for keeping stock

There are three basic reasons for keeping stock (inventory):

- Time - The time lags present in the supply chain (i.e. from supplier to user at every stage), requires that you maintain certain amount of inventory to use in this "lead time"
- Uncertainty - Inventories are maintained as buffers to meet uncertainties in demand, supply and movements of goods.
- Economies of scale - Ideal condition of "one unit at a time at a place where user needs it, when he needs it" principle tends to incur lots of costs in terms of logistics. So bulk buying, movement and storing brings in economies of scale, thus inventory.

7.6.2 Types of stock

- Buffer/safety stock;
- Cycle stock (Used in batch processes, it is the available inventory excluding buffer stock)

7.6.3 Purchasing Process

Purchasing Process includes as usual 8 main stages as follows:

- Requisitioning;
- Approving;
- Studying Market (quotations/ inviting bids);
- Making Purchase Decision;
- Placing Orders;
- Receipting Goods and Services Received;
- Accounting for Goods and Services;
- Receiving Invoices and Making Payment;
- Debit note in case of material defect.

Larger quantities are purchased through the Internal Procurement Committee (IPC) following the procedure listed above.

7.6.4 Receipt of Goods

All goods received shall be properly inspected, checked and reconciled to valid Purchase Orders/technical specifications.

All goods for the Project shall be properly accounted for by raising a Goods Received Note (GRN).

7.6.5 Procedures

Receive a delivery note from the supplier and match it with the related Purchase Order/technical specifications.

Inspect the goods by checking the following:

- Quantity received shall match the quantity ordered.
- Specification of goods shall agree to that on the Order.
- Description of goods shall agree to the Order.

Technical personnel shall test and verify technical goods before receipt and sign the supplier's delivery note to acknowledge receipt of the goods.

Raise a GRN in duplicate and include the following:

- Date goods are received;
- Purchase Order number;
- Supplier's delivery note number;
- Quantity of goods actually received.

Sign the GRN as evidence of satisfaction of goods received.

Match the GRN with the purchase order.

Send original copy of the GRN and a copy of the purchase order to the accounts office for matching with supplier invoice. The documents are used for payment and updating records.

Each item of stock shall be recorded on a separate bin card.

7.6.6 Issuing goods

- No goods shall be issued from stores without approval.
- The officer requiring the goods shall fill a stores requisition form or a job order which has to be authorized by the supervisor/authorizing officer.
- Stores staff shall maintain a list of authorizing officers to counter check / authenticate approvals.
- Recipient of goods shall acknowledge receipt by signing a Stores Issue form prepared in duplicate a copy of which shall be retained by the stores staff.
- Once issued the bin card should be updated immediately.
- Stocks shall be issued on a First In First out (FIFO).

7.6.7 Stock Taking

It is the act of carrying out checks on items in stores to establish if procedures are followed and stock is being managed efficiently. This can be undertaken by internal auditors, external auditors and management depending on the need.

7.7 Fixed Asset Management

Fixed assets procured under the projects will remain projects property until the end of the project and therefore requiring separate fixed asset registers to ensure that all assets are correctly and accurately reflected in the books of the Project and that all assets are identifiable, recorded and regularly verified.

For proper safeguard and control of project fixed assets, the following procedures shall be adhered to:

- A fixed asset register shall be maintained to record all project fixed assets. The register should show:
  - Type of asset
  - Description of asset
  - Date of purchase
  - Cost
  - Payment details
  - Location/user

  - Make/model
  - Registration/serial number
- The register should be divided into categories of fixed assets e.g. motor vehicles, office equipment and furniture.
- Fixed assets shall be recorded in the fixed assets register at the time of purchase.
- The ministry responsible for water affairs shall physically verify the existence of all fixed assets on a regular basis. The results of the physical verification shall be compared to the register.
- The independent auditor shall physically verify all fixed assets as part of annual audits.
- Depreciation shall not be provided on fixed assets in accordance with GoM accounting policies.
- All fixed assets should be adequately insured.

7.8 Audit

An audit is an independent examination of records, procedures and activities of a project or an organization which leads to a report outlining the auditor's opinion on the state of affairs.

There are two kinds of audit:

- The Internal Audit
- The External Audit

7.8.1 Internal Audit

An internal audit review is undertaken at the request of the managers of the project or based on internal audit team plans; it focuses on systems and procedures, and utilisation of resources.

An internal audit will include a range of checks as part of the independent review, including:

- Financial accounting systems and procedures;
- Management accounting systems and procedures;
- Internal control mechanisms.

7.8.2 External Audit

An external audit is an independent examination of the financial statements prepared by a project or organisation. It is usually conducted for statutory purposes (because the law requires it). It can also be for investigative purposes (e.g. to look for a fraud).

An audit results in an audit opinion as to the 'true and fair' view of the:

- state of affairs of the project or organisation and
- operations for the period

The purpose of external audit is to verify that the annual accounts provide a true and fair picture of the project's or organisation's operations and finances; and that the use of funds is in accordance with the aims and objects as outlined in the projects.

8.0 CROSS CUTTING ISSUES

Cross cutting issues should be considered at all stages of the project cycle to ensure sustainability of the water and sanitation facilities. The following are common cross cutting issues which should be taken into account.

8.1 HIV and AIDS

The magnitude of the HIV and AIDS pandemic has to be recognized. Water and sanitation programs should integrate HIV and AIDS prevention and mitigation measures. The strategy should be implemented in collaboration with other sector agencies and NGOs working on HIV and AIDS programs within the context of the national HIV and AIDS strategy.

8.2 Gender

The implementation strategy of the project should place a lot of emphasis on equal participation by men and women in all key community decisions and commitments on sub projects and their related activities. A gender-sensitive approach should be implemented to ensure that communities' decisions take into account the different priorities and interests of both men and women in addressing water and sanitation problems. Other vulnerable groups like the elderly, disabled and child-headed household should be taken into account.

All stakeholders in project implementation process should be oriented on gender issues to ensure active participation of both men and women in the project.

8.3 Environment

Environmental measures should be incorporated into all activities to ensure that activities do not affect the environment. All facilities should be designed, constructed and operated to meet the national environmental guidelines, including appropriate facility siting, adequacy of construction standards, catchment protection, water quality norms, adequate wastewater disposal, community orientation and training in environmental issues and hygiene education to ensure effective use of facilities. Communities should be sensitised to safeguard their water sources from contamination and degradation.

9.0 MONITORING AND EVALUATION

Monitoring is a continuing function that aims to provide stakeholders and decision makers with regular feedback and early indications of progress or lack thereof in the achievement of intended results. Monitoring tracks the actual performance or situation against what was planned or expected according to pre-determined indicators and targets.

A key objective of Piped and Point Water Supply Sources Program is to provide sustainable service delivery. The Monitoring and Evaluation system for the program should be designed in such a way that it can assess the extent to which sustainable service delivery is being put in place and what modification or additional work is needed to achieve sustainability. It has to involve participatory mechanisms (regular stakeholder meetings, self-assessments) so that stakeholders are strategically involved in monitoring and evaluation in order to facilitate the use of their experience to share what is working and what is not and to jointly search for solutions to challenges.

M&E provides a systematic assessment of the functioning of an O&M system and its benefits to the community. Participatory monitoring should be encouraged in the water supply systems. Regular collection of information concerning performance should be done in a participatory manner. The data should be submitted to the national database for necessary updates. Extension Workers should be trained to assist in this activity.

There should be two levels at which the operation and maintenance of community water supplies should be monitored and evaluated. Users should monitor and evaluate their own systems at the community level, with possible back-up from extension agents. Support agencies and the government should be concerned with a broader overall view of program performance.

9.1 Monitoring

Monitoring focuses on whether a project is being implemented as designed, providing timely information for ensuring that progress, quality, and effect of processes and procedures is maintained. Process evaluation examines how the project operates and addresses problems in service delivery. Effective monitoring and evaluation systems should be viewed as tools for helping stakeholders at various levels focusing to achieve sustainable service delivery.

9.1.1 Guidelines for successful O&M monitoring

- Keep it short and simple;
- Do not collect more information than is really needed;
- Collect information which is objectively verifiable;
- Ensure that the data collected is processed and used within the time, human resources and budget available;
- Aim for flexibility and avoid a top-down approach. Involve users and water committees in the process;
- Develop performance indicators which are accepted and understood by all stakeholders in the O&M system.

9.1.2 Developing Monitoring Indicators

Monitoring indicators should be developed at the start of the program to measure or point out progress, impact and effects. These indicators should be based on the project objectives. An indicator should show the extent to which the objectives of a water system or systems are being achieved.

The following types of indicator in monitoring O&M are proposed for use:

Performance indicators

These mainly relate to the functioning of the water system and the key components of an O&M system, such as the provision of spare parts. Each indicator has a performance target associated with it against which actual performance is compared.

Managerial indicators

Managerial indicators combine performance indicators with data reflecting the use of human and other resources for example, the cost of achieving a particular performance with a certain number of staff.

Policy implementation indicators

Policy implementation indicators monitor progress towards achieving the overall desired impact or long term goal of a sustainable O&M system.

Operational indicators

Functioning supply Points indicator (%) = Number in working order x 100/ Total number

The functioning supply points' indicator shows how many water points, taps or hand pumps, are delivering water. However, this must be further defined to establish what is meant by 'delivering water.' There is big difference between a tap running full all day and a trickle for one hour. The indicator must be fully defined and understood for each situation.

Reliability indicator *(%)* = Functioning time x 100 / Total elapsed time

The reliability indicator reflects the fact that a system which breaks down frequently, but can be quickly repaired, is 'more reliable' than a system which breaks down only once in a while but takes a long time to repair. What is important to the users is that a safe water supply is available for most of the time, no matter how often it breaks down.

Financial indicators

It is often difficult to obtain accurate financial information. Subsidies may be difficult to quantify and records may be inadequate. In addition, the underfunding of O&M will mean that the funds allocated will not reflect the actual funds required for effective O&M.
The simplest indicators include:

- The payment by users of water tariffs;
- The amount of funds in the water account, versus what is needed;
- Level of expenses, by category.

Personnel indicators

Personnel indicators can be applied to indicate the numbers of operators, maintenance teams, pump mechanics, or personnel trained who are in post and are working. These indicators could be compared with performance indicators to monitor efficiency.

Materials indicators

Operation and maintenance requires a range of materials and indicators can show the availability or accessibility of items such as spare parts. Suggested indicators include: the time required to obtain a spare part; the number of items in or out of stock; the number of repairs awaiting spares, and so on.

Work control indicators

The efficiency of maintenance personnel in responding to breakdowns can be shown by work control indicators. They refer to the time required to complete a repair or the number of items replaced on a preventive maintenance schedule compared to the number that should have been replaced.

Work control indicator = Backlog of repairs or planned spare parts replacements

9. 2 Developing Monitoring System

The first step in monitoring is to develop a Monitoring Plan. The plan will be based on the key activities outlined in annual implementation plan. For each activity there is need to decide on:

- Key results or outputs – what is expected from this activity.
- Measurable indicators.
- Data sources, collection methods, frequency, and who is responsible.

A problem with many monitoring systems is that they are imposed and as a result they are often unrealistic to put into practice and they do not give the information required therefore, participatory approach should be encouraged. A suggested approach towards improved O&M monitoring is to start with individual water systems to ensure that monitoring systems are

appropriate to the needs of users and field level managers. Relevant field data can then be conveyed to managers and planners provided it is processed and combined with additional information concerning the use of resources.

The following steps for the development of a field level monitoring system are proposed:

- At the local level, identify the basic O&M tasks, to include key tasks such as the provision of equipment and spare parts;
- Identify the information needed to manage staff at the local level;
- Identify basic O&M performance indicators;
- Test the indicator on a small-scale for a limited period to ensure that the intended users of the information give feedback;
- Carry out an evaluation to verify the monitoring data is significant in reflecting the actual status of O&M;
- Adapt the indicators and apply on a larger scale;
- Begin to build up a management information system, including the development of management and policy implementation indicators where appropriate.

9.2.1 Using the information

Periodically collected information will indicate overall trends in the O&M management system. This will help to anticipate problems and point to areas which need specific priority attention.

Establish targets and compare monitored performance against them. An example of performance indicators and how a monitoring system can be planned is shown in Table 1, below.

‘Safe values’ can be established beyond which action must be taken. These trigger values prompt action rather than allowing a situation to deteriorate.

In all cases, the monitoring analysis can only be as good as the information received. It is important to check the reliability of records and the accuracy of data collected in the field. The percentage of replies not received can also be used for monitoring. Avoid a one way flow of information by providing feedback to the data collectors.

Table 1: Sample plan for the monitoring of O&M performance

O&M Performance	*Target*	*who collects data*	*who verifies the data*	*Method of verification*
Functioning supply Points (%)	Percentage of supply points functioning to exceed 90% by (date)	Extension agent Operators	Extension agent Health dept.	Check data sheet with the actual situation in the village
Repair time	Maximum repair time Reduced to 2 days in All villages by (date)	Operators Water committee Member	Villagers Extension agent	Sample surveys
Essential spare Parts available at the market price	Quantity of spare sold to exceed (no.) by (date)	Sales outlet - shopkeeper	Supplier Manager	Check supply figures

(Source: Adapted from WHO, 1993)

9.2.2 Standardized monitoring systems

A standard system of monitoring should be used to allow the performance of individual systems and programs to be compared. This is desirable so that data can be easily consolidated and national trends, successes and problems can be identified.

9.2.3 Reporting

Reporting shall be done on regular basis. The frequency shall be agreed by stakeholders. This manual proposes a bi-annual reporting.

The report should clearly show technical issues, financial issues, performance of committees etc. This will help different categories of stakeholders to use the information according to their interests. For example engineers, accountants, community leaders will have different interests**.**

9.3 Evaluation

Evaluation is a process of collecting and analyzing information about a project in order to find ways to improve it or assess its achievements. Evaluations conducted within projects are usually aimed at improving the project and are focused on problem solving; whereas evaluations initiated from outside the project, frequently at the request of a donor, are mainly concerned with assessing the efficiency and achievements of a project.

There are two main purposes of an evaluation: To identify ways to improve or develop a project: in other ways “How can we do better?” or “How can we do more?”- with the manpower and materials available. Secondly to assess the achievements of a project, in other words “What has been done?” and “Was it worth doing?”, “Should it be continued?” or “Repeated elsewhere?”

In the water program, evaluation should be undertaken on completion of each sub-project phase. Stakeholders will conduct a sub-project evaluation, working together with the Water Committees and community. The evaluation will assess the following impact indicators:

- Level of satisfaction of water users with outcomes (rating from 1 to 5);
- Management/maintenance rating of the new Water Committees (1 to 5);
- Number of people with increased access to potable water; and
- Lessons learned.

An evaluation utilizes and supplements monitoring data. Periodic evaluation/ review of O&M shall be conducted to give opportunity to verify the validity of the monitoring system and the data that it produces.

Social and behavioural aspects cannot be dealt with effectively in a monitoring system but an evaluation can look at them in depth. These aspects include the interrelationships between O&M and other community activities, the dynamics within a community that affect O&M success, the inner workings of management committees and the broader community development goals which complement or can benefit from O&M management experience.

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