



MINISTRY OF AGRICULTURE,
IRRIGATION AND WATER DEVELOPMENT



Government of Malawi

We All Need The Shire

MALAWI NATIONAL GUIDELINES: INTEGRATED CATCHMENT
MANAGEMENT AND RURAL INFRASTRUCTURE

VOLUME I: Procedural Catchment Management Guidelines



Cover Page Pictures (Left to right, top to bottom):

Source of photos: authors.

- i. Maria and her permaculture, Kasankha Bay
- ii. A successful farm along North Rukuru river west of Karonga, practising forest protection, conservation agriculture principles and general resource protection.
- iii. Sapling protection of new tree, preventing free roaming goats from eating the sapling.
- iv. Fish from the Lake Chilwa
- v. Children along the banks of the Shire River in Kasisi.
- vi. Irrigation scheme in Chingale catchment

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FOREWORD

The Government of Malawi has been working with its development partners to bring about economic growth and alleviate poverty in the country. One of the recent initiatives is the **Shire River Basin Management Program**. The program is a flagship World Bank financed activity for Malawi, given the importance of the Shire River Basin in the economy of Malawi.

The overall Program Development Objective of the Shire River Basin Management Program (SRBMP) is to increase sustainable social, economic and environmental benefits by effectively and collaboratively planning, developing and managing the Shire River Basin's natural resources. The SRBMP will have an initial duration of 15 years.

The first phase project – the **Shire River Basin Management Program (Phase-I) Project** (SRBMP-I) commenced in September 2012, and will have a duration of five and a half years. The Project Development Objective and the Global Environmental Objective of the SRBMP-I are: **to develop Shire River Basin planning framework to improve land and water management for ecosystem and livelihood benefits in target areas**. The project will address the interlinked challenges of poverty and a deteriorating natural resource base in the Shire River Basin to reduce the process of environmental degradation and improve the productive potential of natural resources. The SRBMP-I is organised in three components:

- a. Shire Basin Planning,
- b. Catchment Management, and
- c. Water Related Infrastructure.

As part of the Catchment Management component, a project was undertaken to **develop national integrated catchment management and rural infrastructure development guidelines**. These Guidelines have been drawn up, and consist of two separate Volumes, which work together to provide the full picture of catchment management:

Volume I : which contains the theory of catchment management and the procedural guidelines, and

Volume II: which contains the more specific step-by-step guidelines for use by Village Development Committees and individuals.

These Guidelines were developed in consultation with many different stakeholders within the Malawi Government, Shire River Basin Management Program and stakeholders throughout Malawi, and represent a substantial collaborative effort. I wish to convey my thanks to all those who participated in the consultation processes, and made contributions to the final product that you hold in your hands today.

The next step in the project is the implementation of a training program in which stakeholders will be trained in the use of the guidelines. This 'road-testing' of the Guidelines will, no doubt, result in further adjustments and fine-tuning, culminating in a more robust and useful product.

It gives me great pleasure therefore to introduce you to Volume I of these National Guidelines for Integrated Catchment Management and Rural Infrastructure Development. Please use them, and pass them on to those who would benefit from their use, and your feedback on their usefulness and suggested improvements will be most welcome.

Ministry of Agriculture, Irrigation and Water Development
Government of Malawi

EXECUTIVE SUMMARY

This project was undertaken for the Ministry of Agriculture, Irrigation and Water Development of Malawi, as part of Phase I of the Shire River Basin Management Programme. Funding was provided by the World Bank, which is gratefully acknowledged. The scope of the project was for all of Malawi and the result is the National Integrated Catchment Management and Rural Infrastructure Development Guidelines.

The aim of this study is to develop national guidelines on integrated catchment management and rural infrastructure development. Integrated catchment management facilitates the management of all natural resources at a smaller scale that enables not only government but also land owners and stakeholders to become involved in the day to day management of the catchment, thereby ensuring sustainable and reasonable utilisation of the resources.

This project aims to provide national guidelines on the catchment management planning process as well as guidelines on the physical activities that have an impact on, or could improve catchment management at grassroots level.

Methodology

These Guidelines were developed by the consultants in consultation with many different stakeholders within the Malawi Government, and the Shire Basin, and across Malawi nationally, as part of the project's stakeholder involvement process. The guidelines themselves have been compiled and adapted using numerous sources, international examples and local guidelines, all of which are referenced in the text where appropriate. There have been several draft versions of the guidelines, which have benefitted from the constructive comments of many stakeholders, the Client, as well as the funders. These guidelines are therefore the result of an extensive collaborative effort, and the many contributions made by each individual and organisation are gratefully acknowledged and appreciated.

Structure of the Guideline Documents

The guidelines are comprised of two Volumes:

- | | | |
|-----------|---|--|
| VOLUME 1 | Theory and Procedural Guidelines | This VOLUME introduces catchment management principles, the need for catchment management, the institutions involved in catchment management and the catchment management planning process. It also contains more procedural-type guidelines that contribute towards the planning, implementation and sustainable management of catchments at large. |
| VOLUME II | Toolbox | VOLUME II contains the technical activity guidelines targeted at village level communities. These guidelines are the “bare bones” basic guidelines for practical catchment management at the village and community level. |

How to use the Guidelines

The two separate Volumes referred to in the previous section are written for two different target audiences, and yet need to be viewed as a whole to ensure that the catchment management picture is complete. This section contains an explanation on how the two Volumes relate to one another.

Volume I deals with overall catchment management planning, ensuring that national strategic priorities are addressed by incorporating them into village level plans. This Volume is directed at a target audience of high-level planners, skilled catchment management practitioners, and educated village field workers and extension officers. It is envisaged that these individuals will communicate the overall principles and strategies contained in this Volume to the relevant Village Development Committees in order to guide the

activities at a village level. In essence Volume I of the guidelines is focussed on the 'top-down' part of catchment management.

Volume II is concerned with the more detailed level of village level plans. The target audience is the Village Development Committees themselves, guided by a skilled extension officer. They are designed for day to day implementation by rural villages and communities with limited reliance on donor funding and outside intervention. Volume II contains detailed specific Guidelines for individual activities, as well as guidance on how Village Development Committees can participate in the broader context of catchment management in their areas, for example by becoming involved in the relevant Area Development Committees (ADC) and/or Village Natural Resources Committees (VNRMC).

Therefore, the purpose of Volume II is twofold. Firstly, the individual guidelines contained in it are intended to provide practical, step-by-step guidance on how to carry out the individual catchment management tasks, and, secondly, procedures and guidelines are contained in it whereby village level priorities and concerns can be communicated to higher-level planners.

By combining the efforts of the individual village level efforts with the national and regional catchment management priorities, all stakeholders can work together to improve the state of the country's natural resources, and enable more Malawians to improve their lives.

Volume I: Procedural catchment management

In 1995, the Malawian Government undertook the development of the National Environmental Action Plan (NEAP). In this process, nine key environmental issues were identified, namely: soil erosion, deforestation, water resources degradation and depletion, threat to fish resources, threat to biodiversity, human habitat degradation, high population growth, air pollution and climate change. Considerable work has been undertaken in Malawi since then to address these issues, and numerous aid and funding organisations have partnered with the Malawian Government to achieve this.

Regrettably, these recent studies have confirmed that the key issues raised in the NEAP are still apparent, and that environmental degradation is still evident. The key issues are discussed in **Volume I** in **Chapter 2**. The conclusion that is reached in the report is that these key issues are interlinked, and that poverty and high population growth are major causes. The guidelines developed in this project all relate back to these key issues, and seek to provide Malawians with the tools they need to bring about the changes needed at a catchment perspective.

The **principles and concepts of Catchment Management** are introduced in **Chapter 3**. These concepts include:

- The different scales that catchment management can be implemented on, from individual village level, to micro-catchments, catchments and up to entire River Basins.
- The concept of Integrated Catchment Management,
- Sustainability, and
- Reasonable utilisation.

Chapter 4 outlines the **Legislative and Institutional Framework** that catchment management in Malawi operates within. Since catchment management cuts across many sectors, geographic areas and political/administrative jurisdictions, this results in the functions and responsibilities of catchment management being spread across several institutional structures. This chapter outlines the key role-players in catchment management planning and implementation, focussing on the government and legislated institutions. A particularly useful part of this chapter is where all the different committees that can exist as part of local government are listed and discussed.

The five steps that make up **Catchment Management Planning** are discussed in detail in **Chapter 5**. These steps are:

- **Step 1: Initiation**, in which the CMP team is formed, and the catchment defined. Stakeholders and role-players are identified and engaged, and a vision, aims and objectives are drafted. Then the relevant committees are formed to take the process further.
- **Step 2: Investigation and Assessment**, in which, through a process of stakeholder engagement, and specialist studies, issues are identified and assessed, and the vision and mission statement for the catchment are finalised,
- **Step 3: Planning**, in which scenarios for development and management of the catchment are developed and analysed. These are then translated into strategies and actions and ultimately the implementation plan.
- **Step 4: Implementation**, in which the responsible parties identified in the implementation plan are tasked with implementing the activities identified. This may require including the activities into the business plans of government organisations, work plans of district and local institutions, or mobilising communities, villages and farmers. The Catchment Management Committee is tasked with monitoring the implementation of catchment management plan; similarly the AWU or VNRMC is tasked with monitoring implementation at the small catchment component levels.
- **Step 5: Monitor and Revise**, to ensure that implementation is on track, to measure short and long term impacts and to evaluate the impacts in order to modify the plan or its implementation (as necessary).

Participatory approaches for catchment management planning are outlined and elaborated on in **Chapter 6**. Nine different approaches are discussed, as listed below:

- Village meetings
- Participatory Rural Appraisal (PRA)
- Visual mapping
- Transect walk
- Semi-structured interviews
- One-to-one interview
- Action research
- Group work
- Rapid (Relaxed) Appraisal of Agriculture Knowledge Systems (RAAKS)

The CMP team or project team should select the approach / set of approaches that most suits their needs or type of information they require.

Chapter 7 provides a summary of the analytical tools and simulation models that are available for **Modelling** of water resources in catchments, and gives guidance on how the appropriate models should be selected. In the planning and management domain, the tools and models enable the evaluation of impacts and benefits of alternative water resources development and catchment management plans in order to inform scenario development and analysis.

Guidelines on Establishing Catchment Management Committees and Water User Associations (AWUs) are given in **Chapter 8**.

The National Water Resources Act, 2013 proposes the establishment of Catchment Management Committees to advise officers of the Water Resources Authority on issues of:

- Water resources conservation, use and allocation;
- The grant, adjustment, cancellation or variation of any licence and permit in terms of the Act, and
- Any other matters pertinent to the proper management of water resources.

The CMC is responsible for the catchment management strategy of its catchment, as well as the establishment and operation of Water User Associations (AWUs) at smaller catchment scales.

Chapter 9 discusses **Financing Catchment Management Plans**. There are two elements to financing a management catchment plan at catchment or village level. The first would be a need to raise finance to develop the plan itself; and then, once agreed and approved by all relevant stakeholders, finance would be needed to implement prioritised elements of the overall plan. Guidance is given on how to access the special grants that are offered to communities wishing to improve the environmental health of their landscapes and mitigate environmental degeneration in a sustainable manner.

Alternative Sources of income to help protect catchment areas are put forward in **Chapter 10**. A number of interventions have been developed with a view to increasing the options for generating income and food security and reduce reliance on resource degrading activities. These interventions are either natural resources-based income generating activities or tree planting for conservation purposes. Some examples that are discussed in the chapter are:

- planting of trees for commercial purposes and agriculture,
- bee keeping and processing, mushroom harvesting, fruit picking, flying ants (ngumbi), medicinal activities, fishing
- construction and use of fuel efficient stoves and fireless cookers.
- caring and maintenance of poultry for eggs or meat. The manure can be used as farm inputs which should help improve crop production.

Volume II: Village based catchment management

Volume II contains detailed specific Guidelines for individual activities, as well as guidance on how Village Development Committees can participate in the broader context of catchment management in their areas, for example by becoming involved in the relevant Area Development Committees and/or Village Natural Resources Management Committees (VNRMCs).

The purpose of Volume II is twofold. Firstly, the individual guidelines contained in it are intended to provide practical, step-by-step guidance on how to carry out the individual catchment management tasks, and, secondly, procedures and guidelines are contained in it whereby village level priorities and concerns can be communicated to higher-level planners.

Volume II starts with an introduction to the project, similar to that of **Section 1** of this Executive Summary. The **principles and concepts of Catchment Management** are then introduced in **Chapter 2** similar to Volume 1 but in a less technical manner. These concepts include:

- The different scales that catchment management can be implemented on, from individual micro-catchments, up to entire River Basins.
- The concept of Integrated Catchment Management,
- Sustainability, and
- Reasonable utilisation.

The **Village level catchment management planning** process is introduced in **Chapter 3**. The process and purpose of the Village Catchment Management Plan (VCMP) is to empower the people of the village to make decisions and take responsibility for and promote the collective action for the sustainable management and utilisation of their natural resources, especially water resources. This chapter outlines the process of identifying the problems and opportunities within the village scale catchment and how to compile a village catchment management plan to guide the community to sustainably manage their own resources.

Guidelines for setting up Village Savings and Loan Clubs are given in **Chapter 4**. The financial market is seen as playing a vital role in the rural development process as it increases access to credit by rural enterprises. Because farm production is seasonal, rural income is not spread evenly throughout the year, or years. There is therefore the need to hold over a portion of the income occurring in periods of 'plenty' to meet requirements during times when flows are low (for example during the rainy season). In the absence of appropriate alternatives, any savings are hoarded as cash. A properly functioning

Community Based Savings and Loans (CBSL) Group, will help to convert such cash holdings into deposits in the rural and formal financial systems.

These guidelines outline the process of organizing and managing a Community Based Savings and Loans Group (CBSL) generally known as “Bank Mkhonde”. It lists steps on how to start a CBSL, distinctive features, accountability structures, operational rules and linkages with formal banks so as to make the initiative more development oriented.

The technical guidelines follow on in **Chapter 5** to **Chapter 9**. These technical guidelines are grouped into several themes, as summarised below. Within each of these themes there are sub-themes that contribute towards the overall chapter theme. Within these sub-themes are detailed basic guidelines on methodology and application.

Chapter 5: Soil and Water Conservation / Erosion Control Measures.

Seven different sub-themes are grouped under this chapter, namely: Conservation Agriculture, Rangeland Management, Soil Fertility Management, Erosion and Runoff Control Measures, Gully Management, Stream / River Bank Management, and Sediment Trapping.

The technical guidelines contained in this theme range from guidelines on how to select which crops to plant, and how to prepare the ground for planting, to compost making and fertilizer selection. Guidance is provided on how to restore land that has already been impacted by soil erosion, for example by reclaiming gullies, and also how to prevent further erosion taking place by providing instructions on how to create ridges on the contours to trap water for crops. Instructions on how to trap sediment in order to prevent erosion along roads is also provided. The important concept of providing a buffer zone around rivers and wetlands is introduced, giving relevant guidance on how to implement this.

Chapter 6: Water Harvesting and Irrigation.

The seven sub-themes grouped under this chapter are: Water Use Efficiency, Water Harvesting and Recycling, Water Harvesting, Micro Water Storage, Small Dams, Infiltration, and Small Scale Irrigation.

Individual guidelines range from how to improve water use efficiency by installing drip irrigation, to making use of household “grey water”. Instructions are given on how to harvest rain water from the roofs of buildings and from roads, using swales. There are guidelines on how to construct water storage tanks both above and below ground, how to construct small dams, and diversion weirs in order to increase access and supply of water.

Chapter 7: Farm Management.

Two sub-themes are covered in this Chapter: Farm Management and Sanitation.

Guidelines regarding farm management relate to creating living fences and windbreaks from trees, and how to start and run a tree nursery to provide the trees for these purposes and for afforestation projects. There are instructions on how to maintain borehole pumps, and guidelines for improved grain storage. Guidelines relating to sanitation include the method for constructing a composting toilet, and an “Arborloo” latrine, as well as instructions on how to close a filled pit latrine.

Chapter 8: Natural Resources Management.

The six components of this chapter are: Forestry, Fishing, Wetlands (Dambos), Alien and Invasive Plant Management, Energy, and Waste Management.

Sustainable woodlot management and plantation forestry are described under the Forestry section. Guidelines for Natural Forest Management and Protected Forest Reserves are also given in this section. Furthermore information regarding which trees are beneficial for afforestation projects are provided.

Guidelines for sustainable fishing practices and small holder aquaculture are found in the section on Fishing. Instructions on the sustainable use of wetlands and the conservation of wetlands are included. Guidelines are given on the control of various Invasive alien plants. Where these plants can be useful,

guidelines are given on how this can be done in a responsible manner for Blue Gum trees, Pine trees, bamboo and *Prosopis* species.

With regard to energy, guidelines are given for the construction and use of many devices using alternative sources of energy, for example solar, wind and biogas. There are also guidelines on how to make devices energy efficient, in order to save energy. Lastly, there are guidelines on the management of household and market waste.

Chapter 9: Disaster management.

Fire Management, Health and Emergency Response are the three sub-themes dealt with in this chapter.

In the section on fire management, guidelines are given regarding the practical ways in which wild fires can be prevented and controlled, as well as the construction and use of fire-fighting tools. Information on the prevention of and response to a number of water-borne diseases is given, for example: Malaria, Bilharzia and Cholera. Finally, procedures for community responses to emergencies, floods and droughts are provided.

The guidelines included in this document, are guidelines, not fixed rules. They may need adapting to suit context specific situations. Adapting the guidelines is at the risk of the user.

Five Annexures are provided at the end of Volume II. These cover the following subjects:

- Annexure 1: Co-operative Agreements (Forest Reserves)
- Annexure 2: VNRM Committees and Catchment Management
- Annexure 3: Community Disaster Risk Reduction Response Plans
- Annexure 4: Fire Hazard Assessment and Mitigation
- Annexure 5: Selecting Beneficial Trees

CONCLUSION

Both Volumes of these **Guidelines for Integrated Catchment Management and Rural Infrastructure** are useful tools to implement catchment management in Malawi. **Volume I** speaks to the more technical audience responsible for overall governance of the catchments, as well as technical professionals providing specific consulting services. This volume ensures that overall strategic catchment management goals are incorporated into smaller scale plans, for example at village level.

Volume II is aimed at a more 'hands on' level of audience, namely individual village organisations who are seeking to improve the livelihoods of the people in their village. The individual guidelines are specific and consist of step-by-step instructions on how to undertake the various tasks involved in responsible land care and the sustainable use of natural resources. There are also guidelines on how to create community catchment management plans, and how to feed these local goals upwards to the overall catchment management process.

The two separate volumes are designed to be used together by the catchment stakeholders in order to improve and conserve the current state of the catchment, and to ensure that the catchment continues to provide the necessary resources for livelihood in the future.

The guidelines and other related catchment management information is available on the project website:

<http://www.catchmentguidelines.org.mw/>

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LIST OF ACRONYMS AND ABBREVIATIONS

ADC	:	Area Development Committee
ADP	:	Area Development Plan
AEC	:	Area Executive Committee
ASWAp	:	Agricultural Sector Wide Approach
AWU	:	Association of Water Users
CCNRE	:	Cabinet Committee on Natural Resources and Environment
CMP	:	Catchment Management Plan
DAT	:	Development Advisory Team
DEAP	:	District Environmental Action Plan
DEC	:	District Executive Committee
DESC	:	District Environmental Sub-Committee
DSS	:	Decision Support System
DTT	:	District Training Team
EAP	:	Environmental Action Plan
EIA	:	Environmental Impact Assessment
EMA	:	Environment Management Act, 1996
FLS	:	Frontline Staff
GBI	:	Green Belt Initiative
GCM	:	General Circulation Model
GVH	:	Group Village Head
IFR	:	Instream Flow Requirements
IWRM	:	Integrated Water Resources Management
JICA	:	Japan International Cooperation Agency
MGDS	:	Malawi Growth Development Strategy
NEAP	:	National Environmental Action Plan
NEP	:	National Environmental Policy
NGO	:	Non-Governmental Organisation
NIDF	:	National Irrigation Development Fund
NRM	:	Natural Resources Management
NWDP	:	National Water Development Programme
NWRA	:	National Water Resources Act
PIC	:	Project Implementation Committees
RCM	:	Regional Climate Model
RCP	:	Relative Concentration Pathways
SADC	:	Southern African Development Community
SOER	:	State of the Environment Report
SSEA	:	Strategic Social and Environmental Assessment

SWOT	:	Strengths, Weaknesses, Opportunities and Threats
TA	:	Traditional Authority
UNDP	:	United Nations Development Programme
VDC	:	Village Development Committee
VNRMC	:	Village Natural Resources Management Committees
WRA	:	Water Resources Act, 2013
WMS	:	Welfare Monitoring Survey
WRIS	:	Water Resources Investment Strategy

GLOSSARY OF TERMS

(William Critchley is reviewing)

Carrying Capacity

Carrying Capacity is the maximum number of individuals that can be supported, fed or are able to survive in any specific habitat or ecosystem without causing the breakdown of the habitat or ecosystem.

Catchment

A catchment is defined as an area from which any rainfall falling on it will drain into a watercourse through surface flow to a common point. Can also be referred to as a watershed, river basin and drainage basin

Catchment management

Catchment management is the management of all the components of the hydrological cycle that operate within a catchment, as well as the human activities that impact on, and are impacted on, by the different components of the hydrological cycle. (Catchment management, viewed on 26 January 2015, from http://www.enviroopaedia.com/topic/default.php?topic_id=44)

There is a relationship between the state of a river's catchment and the quality and flow (quantity) of its water. In its turn the state of a catchment is decisively influenced by the state of the soil, which is directly related to the prevailing vegetative cover (Fuggie, R.F. & Rabie M.A., 2003 *Environmental Management in South Africa P 663*, Juta, Cape Town).

Eutrophication

Eutrophication is the enrichment of water with plant nutrients, mostly nitrates and phosphates, above what the system is adapted to receive. (Department of Agricultural Development, 1991, Pretoria, Soil Classification: A taxonomic system for South Africa). The increased nutrient levels in aquatic systems can stimulate organic growth, such as algae and may eventually lead to eutrophication when oxygen is depleted during decomposition. This in turn can affect the structure of the faunal and floral communities in the water by eliminating many species and possibly favouring others (Fuggie, R.F. & Rabie M.A., 2003, *Environmental Management in South Africa p 741*, Juta, Cape Town).

Grey water

Greywater is used household water sourced from baths, showers, bathroom basins and laundries, but excludes water from the toilet (black water) (SANS 10400, National Building Regulations and Building Standards Act (Act 103 of 1977, South Africa) as amended 2008). Greywater can contain pathogens, high concentrations of nutrients and other contaminants that can pose a risk to human health or the environment if used inappropriately. Effluent can thus, according to the Malawian Environmental Management Act of 1996 (Act No 23 of 1996), fall partly into this category of grey water because effluent is defined as waste water or other fluid originating from a domestic activity in the Act.

Mitigation

Mitigation is the action of reducing severity, seriousness or painfulness (Oxford dictionary) and in the environmental context refers to the implementation of practical measures to reduce adverse impacts (Department of Environmental Affairs and Tourism, 2004 *Environmental Management Plans; Integrated Environmental Management Information Series*, Pretoria).

Resilience

Resilience is recognized as the ability of a living system to restore itself to its original condition after being exposed to an outside disturbance (Miller, G.T., 2004, *Living in the Environment Principles, Connections and Solutions*, Wadsworth, Canada).

Sustainability

Sustainability is the ability of a system to survive for some specified (finite) time. The Malawian Environmental Management Act of 1996 (Act No 23 of 1996) stipulates that sustainable utilization means

the use or exploitation of natural resources which guards against the extinction, depletion or degradation of any natural resource of Malawi and permits the replenishment of natural resources by natural means or otherwise. The Malawi Growth and Development Strategy 2007 (MGDS) recognise that managing the country's natural resources is an aspect of environmental sustainability.

Building a sustainable community can be achieved by the following 9 guiding principles: (i) Respect and care for the community of life, (ii) Improve the quality of human life, (iii) Conserve the earth's vitality and diversity, (iv) Minimise the depletion of non-renewable resources, (v) Keep within the earth's carrying capacity, (vi) Change personal attitudes and practices, (vii) Enable communities to care for their own environments, (viii) Provide a national framework for integrating development and conservation (ix) Create a global alliance (Fuggle, R.F. & Rabie M.A., 2003 *Environmental Management in South Africa* p2-3, Juta, Cape Town).

Water conservation

The Malawian Environmental Management Act of 1996 (Act No 23 of 1996) stipulates that the term water includes the surface and underground water, drinking water and water in a river, stream, watercourse, public reservoir, well, dam, canal, channel, lake, swamp or open drain and water in a gaseous or solid form. The same act defines the term conservation as the preservation of natural resources and their protection from misuse, fire or waste.

In Malawi the legal instrument currently available for the regulation of water resources management is the Water Resources Act (1969) (Act No 15 of 1969) and its subsequent amendments. This act makes provision for the control, conservation, apportionment and use of the water resources of Malawi and for purposes incidental thereto and connected therewith. It stipulates that water should be managed and used efficiently and effectively so as to promote its conservation and future availability in sufficient quantity and acceptable quality.

1 Introduction

1.1 Aims and Objectives

The aim of this study is to develop national guidelines on integrated catchment management and rural infrastructure development. Integrated catchment management facilitates the management of all natural resources at a smaller scale that enables not only government but also land owners and stakeholders to become involved in the day to day management of the catchment, thereby ensuring sustainable and reasonable utilisation of the resources.

This project aims to provide national guidelines on the catchment management planning process as well as guidelines on the physical activities that have an impact on, or could improve catchment management at grassroots level.

These guidelines address the environmental issues identified in Malawi's National Environmental Action Plan (NEAP). However the underlying causes of population growth and poverty require greater governmental input, policy and regulation than the scope of these guidelines. The issue of uncontrolled population growth needs to be addressed in order to prevent a major disaster, and for Malawi to reach a point of sustainable utilisation of its natural resource base and the achievement of its constitutional responsibility in terms of section 13(d) of the NEAP.

1.2 Scope

The guidelines contained in this report provide techniques and methodologies to provide relief to the environment and natural resource base of Malawi. The guidelines are targeted at village-scale communities of the country. They are designed for day to day implementation by rural villages and communities with limited reliance on donor funding and outside intervention.

The guidelines are comprised of Two Volumes:

VOLUME 1 Theory and Procedural Guidelines **THIS VOLUME** introduces catchment management principles, the need for catchment management, the institutions involved in catchment management and the catchment management planning process. It also contains more procedural-type guidelines that contribute towards the planning, implementation and sustainable management of catchments

VOLUME II Toolbox VOLUME II contains the technical activity guidelines targeted at village level communities. These guidelines are the "bare bones" basic guidelines for practical catchment management.

1.3 How to use the Guidelines

The two separate Volumes referred to in the previous section are written for two different target audiences, and yet need to be viewed as a whole to ensure that the catchment management picture is complete. This section contains an explanation on how the two Volumes relate to one another.

As described in the previous section, Volume I deals with overall catchment management planning, ensuring that national strategic priorities are addressed by incorporating them into village level plans. This Volume is directed at a target audience of high-level planners, skilled catchment management practitioners, and educated village field workers and extension officers. It is envisaged that these individuals will communicate the overall principles and strategies contained in this Volume to the relevant Village Development Committees in order to guide the activities at a village level. In essence Volume I of the guidelines is focussed on the 'top-down' part of catchment management.

Volume II is concerned with the more detailed level of village level plans. The target audience is the Village Development Committees themselves, possibly guided by a skilled extension officer. Volume II

contains detailed specific Guidelines for individual activities, as well as guidance on how Village Development Committees can participate in the broader context of catchment management in their areas, for example by becoming involved in the relevant Area Development Committees and/or Village Natural Resources Management Committees (VNRMCs).

The purpose of Volume II is twofold. Firstly, the individual guidelines contained in it are intended to provide practical, step-by-step guidance on how to carry out the individual catchment management tasks, and, secondly, procedures and guidelines are contained in it whereby village level priorities and concerns can be communicated to higher-level planners.

By combining the efforts of the individual village level efforts with the national and regional catchment management priorities, all stakeholders can work together to improve the state of the country's natural resources, and enable more Malawians to improve their prosperity.

2 Key issues in Malawi

In 1995 the Malawian Government undertook the development of the National Environmental Action Plan (NEAP), in pursuit of its responsibilities in terms of the Malawi Constitution, Chapter III, Section 13(d):

To manage the environment responsibly in order to:

- a. Prevent the degradation of the environment;
- b. Provide a healthy living and working environment for the people of Malawi;
- c. Accord full recognition to the rights of future generations by means of environmental protection and sustainable development of natural resources, and
- d. Conserve and enhance biological diversity of Malawi.

In the process of developing the NEAP, key environmental issues were identified, these include: soil erosion, deforestation, water resources degradation and depletion, threat to fish resources, threat to biodiversity, human habitat degradation, high population growth, air pollution and climate change.

Figure 1 illustrates the linkages between these key environmental issues. Integrated Catchment Management seeks to understand the problems holistically and address them in a sustainable and system manner.

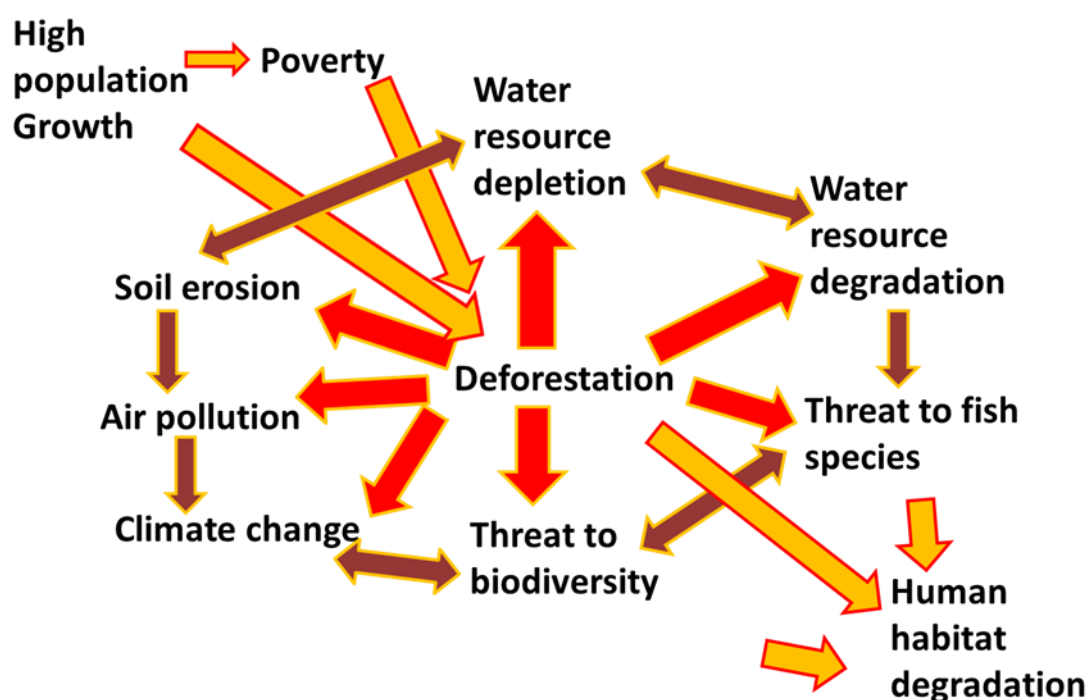


Figure 1: Cause and effect linkage of drivers and impacts of environmental degradation

Since 1995, considerable work has been undertaken in Malawi to address these issues, and numerous aid and funding organisations have partnered with the Malawian Government to achieve this. Some of these initiatives are listed below:

- National Water Development Programme (NWDP I 1995-2004, and NWDP II 2007-2015)
- Malawi Growth Development Strategy (MGDS I 2006-2011 and MGDS II 2011-2016)
- National Water Policy in 2005
- National Sanitation Policy in 2008

- Green Belt Initiative (GBI) 2015-2018
- Agricultural Sector Wide Approach (ASWAp)
- National Water Resources Assessment and Water Resources Investment Strategy (WRIS)¹
- Water Quality Management Project (2011-2013)
- National Water Resources Master Plan²
- National Forestry Policy in 1996
- National Forestry Act 1997
- National Forestry Programme in 2000
- National Land Resources Management Policy and Strategy in 2000
- National Irrigation Plan and Infrastructure Framework, 2014

These recent studies have confirmed that the key issues raised in the NEAP are still apparent, and that environmental degradation is still evident. The key issues are discussed in more detail below.



2.1 High population growth

The most recent population census in Malawi took place in 2008, and showed that there was a high population growth rate. The country's population was approximately 10 million in the 1998 census, and grew to 13.1 million in 2008. This is an overall growth of more than 30%, and an annual growth rate of 2.8% per annum over that period. This high growth rate, combined with a low rate of literacy, contributes to the high levels of poverty present in Malawi. Many people rely on natural resources for their livelihood, but there is a shortage of good quality arable land in the country. Malawi had a population density of 139 persons per square km in 2008, which is one of the highest in the world.

The Malawian National Statistics Office, has made population projections, based on the 2008 Census, which were published as the "Malawi Population Projection". This estimated that there would be 14.4 million people in the country in 2011, 22.4 million people in 2025, and 30.3 million people in 2035.

Land and other resources are threatened by the high demand for resources such as wood for fuel, subsistence agriculture and basic income generation. The growing population and its reliance on natural resources for survival are reducing both the volume and the yield of natural resources, as the carrying capacity of the land is reduced and soil fertility is reduced, i.e. there are insufficient resources to support the current generation, let alone future generations. The current population growth rate is unsustainable.

2.2 Poverty

Malawi is among the poorest countries in the world, with about 65% of its population classified as living in poverty, and 29% as living in absolute poverty³.

¹ **Water Resources Investment Strategy Component 1** – Water Resources Assessment, Main Report, April 2011. Undertaken by WS Atkins International Ltd in association with Wellfield Consulting Services for the Government of the Republic of Malawi, Ministry of Irrigation and Water Development, Second National Water Development Project (NWDP II). Funded by the World Bank. World Bank, 2011.

² **Project for National Water Resources Master Plan in the Republic of Malawi**. Undertaken by CTI Engineering International Co., Ltd., Oriental Consultants Co., Ltd and NEWJEC Inc. for the Ministry of Agriculture, Irrigation and Water Development (MoAIWD), Funded by the Japan International Cooperation Agency (JICA).

³ Malawi National Statistical Office, 2008.

2.3 Land degradation and soil erosion

Soil erosion is prevalent in Malawi. A recent estimate of the average rate of soil loss in Malawi was 20 tons/ha/year⁴, which was estimated to contribute to a reduction in crop yields of more than four percent per year⁵.



Soil erosion has a negative effect on the site of erosion and leads to a loss of agricultural production. It also affects secondary areas because the soil particles are washed off the land into the rivers. This can cause sedimentation and siltation of rivers and reservoirs, as well as a reduction in water quality. Additionally infertile sand deposition may reduce productivity of fertile low-lying areas in the flood plain.

Since the majority of the population of Malawi rely on subsistence agriculture for their survival, it is vital that every effort is made to employ soil conservation measures and reduce the loss of this essential natural resource.

2.4 Deforestation



Extensive deforestation has taken place in Malawi, and is still increasing. This has been as a result of the growing demand for domestic fuel wood for energy, heating and cooking; and also due to clearing of forests to meet the need for agricultural land. Wood is also used for curing in the tobacco and fish industries, brick burning and beer brewing.

The rate of deforestation for agricultural expansion is declining because of the limited arable land left to be deforested (unfortunately not due to sustainable management). In 1968, average landholding size was 1.5 ha, whereas in 2010 it was estimated to be 0.8 ha⁶.

Regrettably, afforestation programmes are not meeting the increasing demand of fuel wood. Communities are therefore forced to make use of the low growth-rate indigenous forests on customary land, where harvest rates exceed sustainable yields. There is a demand for charcoal as a cheap energy source, so those needing to supplement their income use this wood to make charcoal, selling it to provide much needed income.



In the face of the pressure to provide income, this illegal deforestation continues, and contributes to excessive deforestation of natural forests and even protected areas, and limited forest protection and growth. This deforestation increases the incidence of soil erosion and reduced crop yield as discussed in the previous section.

There is also pressure on forests from industries using wood for fuel, for example the tobacco industry. Attempts by government to enforce the establishment of wood-lots for this purpose have not been successful. This pressure makes it difficult for these institutions responsible to protect and manage customary forests to do so.

⁴ **Economic Valuation of Sustainable Natural Resource Use in Malawi.** Ministry of Finance and Development Planning, UNDP/UNEP. Authors: Gil Yaron, Ronald Mangani, John Mlawa, Patrick Kambewa, Steve Makungwa, Austin Mtethiwa, Spy Munthali, William Mgoola, John Kazembe. (See Section C7, page xv).

⁵ As above.

⁶ **Malawi Climate Change Vulnerability Assessment.** Produced for the United States Agency for International Development by Tetra Tech ARD, through a Task Order under the Prosperity, Livelihoods, and Conserving Ecosystems (PLACE) Indefinite Quantity Contract Core Task Order (USAID Contract No. AID-EPP-I-00-06-00008, Order Number AID-OAA-TO-11-00064).

2.5 Water resources degradation and depletion



Malawi has an abundant supply of surface and ground water which, up to 2010, allowed for sufficient water abstraction volumes for water requirements during average dry seasons, with shortages only occurring during drought dry seasons⁷. This situation will no longer be the case in the future, due to increased water requirements from the increasing population, combined with the steady degradation of the catchment and climate variability. This indicates that, if the predicted level of development goes ahead, some form of water resource development, such as storage, lake water use or transfer, or rain water harvesting will be needed.

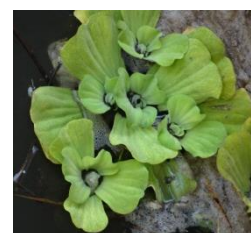
The Water Resources Assessment component of the Water Resources Investment Strategy (WRIS)⁸ identified three risks to water resource availability, namely:

- **Risk of sediment ingress**

The above mentioned study assessed the risk of sediment ingress into watercourses to be relatively high across the whole of Malawi. This affects the availability of water because silted rivers have reduced capacities and are susceptible to flooding. The silt can bury habitat for fauna and flora, as well as have a negative impact on hydropower generation capability.

- **Risk of infestation from alien weeds**

The risk of infestation by invasive aquatic weeds was found to be medium to very high in most areas of Malawi⁹. There are four major invasive aquatic species of concern in Malawi namely *Eichhornia crassipes* (water hyacinth), *Pistia stratiotes* (water lettuce), *Salvinia molesta* (giant salvinia, kariba weed), and *Azolla filiculoides* (red waterfern).



These weeds form dense mats in nutrient-rich aquatic ecosystems as floating weeds and they threaten biodiversity through altering the microclimate and displacing indigenous aquatic flora and fauna¹⁰. Invasions of aquatic weeds are associated with a range of impacts on water quality, as listed below:

- Dense mats can impede water flow in rivers and irrigation canals, which increases the rate of siltation in rivers, lakes and reservoirs.
- These mats can also inhibit the diffusion of air into water, resulting in lower dissolved oxygen concentrations.
- This, combined with the increased amounts of organic detritus that collect beneath these floating mats, can increase sediment accumulation rates and accelerate eutrophication processes. Increased eutrophication can be lethal to fish and other biota in the water.
- Aquatic weeds also increase evapotranspiration from a water surface. Water hyacinth can increase evaporative water losses by at least 40 – 50% through transpiration from its leaves.
- Invasions by aquatic weeds have been linked to increases in water-borne, water-based and water-related diseases. Water hyacinth infestations have been linked to increases in schistosomiasis (bilharzia) and have also been shown to adsorb cholera viruses from contaminated water.

⁷ **Water Resources Investment Strategy Component 1** – Water Resources Assessment, Main Report, April 2011. Undertaken by WS Atkins International Ltd in association with Wellfield Consulting Services for the Government of the Republic of Malawi, Ministry of Irrigation and Water Development, Second National Water Development Project (NWDP II). Funded by the World Bank. World Bank, 2011.

⁸ As above

⁹ As above

¹⁰ **“National Biodiversity Strategy and Action Plan”**. Published by Environmental Affairs Department, Lilongwe, Malawi, 2006

- *Salvinia molesta* provides habitat for mosquitoes, which are vectors for diseases such as dengue fever, elephantiasis, encephalitis and malaria.

Dense floating mats also interfere with water transport especially where it blocks access to the water for fishing vessels and canoes, and clogs commercial harbours (as experienced in Lake Victoria). It interferes with fishing by entangling fishing lines and nets. It also interferes with freshwater supplies by blocking intake points, screens and filtration plants.

Water hyacinth is a major concern for hydropower production on the Shire River where it has interfered with the operations of the barrage at Liwonde and has disrupted hydropower production at the Nkula Falls and Kapichira Falls further downstream. Water hyacinth first appeared in the Shire River in the 1960's and by early 2000 has been observed in Lake Malawi and all the major river systems reaching all the way to the Songwe River and Karonga in the north¹¹.

Lake Chilwa, a Ramsar site that supports important populations of 153 species of resident and 30 species of palearctic (migratory) water birds, is threatened by water hyacinth, salvinia, water lettuce, and red water fern¹². Here it was found that the massive mats of interlocked plants changed the water chemistry, impeded light penetration and decimated indigenous flora, and negatively affected fish and invertebrate biodiversity, and overall aquatic ecosystem integrity.

- **Water quality risks.**



The quality of both surface and groundwater resources in Malawi was found to be generally tolerable for a wide number of uses¹³. In some areas, however, water quality is often too poor to enable use for irrigation without additional pre-treatment, or for domestic potable use. The high sediment loads are likely to cause damage to the irrigation equipment. Fortunately the highest sediment loads coincide with the wet season when there is less irrigation required. Sedimentation also negatively affects water quality, increasing the levels of sediment, suspended solids, and turbidity in the water. This leads to increased water treatment costs. Additionally, sediments enhance nutrient cycling and may cause negative water quality impacts such as eutrophication.

In 2011, the percentage of Malawians using unimproved pit latrines was 88.6%, made up of 66.8% of urban dwellers, and 91.8% of rural dwellers¹⁴. The growing population also leads to unplanned settlements with improper sanitation and waste disposal. Pit latrines near water sources, livestock and industrial discharge contaminate ground and surface water, resulting in biological contamination. "While the application of agro-chemicals has led to pest control and increased food production, it has equally contributed towards the degradation of water resources¹⁵. Chemical contamination through run-off from agriculture containing fertilizers and pesticides and improper disposal of industrial waste promotes eutrophication, damages ecosystem health, causes fish mortality and increases the threat to human health.

The long term prediction from the WRIS¹⁶ was that, if significant water quality protection and catchment management was not introduced in the country, significant deterioration in both the surface and

¹¹ "Progress with Biological Control of Water Hyacinth in Malawi". Proceedings of the Second Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth, Beijing, China, 9–12 October 2000. Phiri, PM, Day, RK, Chimatiro, S, Hill, MP, Cock, MJW, Hill, MG and Nyando, E (2001).

¹² "National Biodiversity Strategy and Action Plan". Published by Environmental Affairs Department, Lilongwe, Malawi, 2006

¹³ **Water Resources Investment Strategy Component 1** – Water Resources Assessment, Main Report, April 2011. Undertaken by WS Atkins International Ltd in association with Wellfield Consulting Services for the Government of the Republic of Malawi, Ministry of Irrigation and Water Development, Second National Water Development Project (NWDP II). Funded by the World Bank. World Bank, 2011.

¹⁴ **Welfare Monitoring Survey (WMS), 2011** conducted by the Malawian Agriculture Statistics Division of the National Statistical Office (NSO) between September 2011 and February 2012.

¹⁵ NEAP, 2001.

¹⁶ **Water Resources Investment Strategy Component 1** – Water Resources Assessment, Main Report, April 2011. Undertaken by WS Atkins International Ltd in association with Wellfield Consulting Services for the Government of the Republic of Malawi, Ministry of Irrigation and Water Development, Second National Water Development Project (NWDP II). Funded by the World Bank. World Bank, 2011.

groundwater quality would occur, and as a worst case, the raw water quality could be unsuitable for use in most sectors by 2035. The study further stated that: "Given the nature of the risks highlighted above, the potential pressures on water resources highlighted in this report, and the importance of these resources to the plans for economic growth and poverty alleviation in Malawi, it is difficult to overstate the vital importance of incorporating sustainable land and catchment management practices as an integral part of Malawi's long-term investment strategy."

2.6 Threat to fish resources



Threat to fish resources has increased due to degradation of the lakes and rivers through poor agricultural and water management practices. These bring about sedimentation, water pollution and prevention of fish migration due to construction and deposition (shallower water levels). Additionally the introduction of non-indigenous fish and water weeds is an increasing threat.

Furthermore the growing population increases the demand for fish products, which leads to increases fishing efforts and subsequently over-fishing, non-compliance with "off-season" regulations and inappropriate and damaging fishing methods. This causes the decline in catch rates and decline of populations of endemic anadromous fish and genetic structure of the stock. The situation is further worsened by community expansion into and utilisation of ecological niches, destroying breeding areas.

In the mid-1990s, significant declines in 12 species of fish were recorded in Malawi¹⁷. In the past three years, there seems to be an increase in the overall catch tonnage, with some species increasing (e.g. Usipa or *Ungaulicypris sardella* and Chambo) but others continuing to decrease¹⁸. The inability to enforce, inadequate adherence to, and the contradictory nature of the legislation limits sustainable fish stock management.

2.7 Threat to biodiversity

Threats to biodiversity have increased with the increase in population and the associated need for agricultural land and livestock rangeland. This has forced most faunas into national parks, game and forest reserves. These reserves are however, subject to poaching as well as to community encroachment. Some fauna and flora species are found only outside of protected areas and are therefore highly threatened.

Livestock has a high density in rangelands, especially in the northern regions of the country. This is likely to decrease biodiversity through unsustainable overgrazing. Biodiversity is also threatened by human activities and encroachment into habitat areas. Bushfires are a threat to biodiversity as they occur in all areas of the country between April and November annually.

2.8 Human habitat degradation

Human habitat degradation takes place due to the increased population and the pressures associated therewith. Urban dwellings are overcrowded as a result of high migration and low income levels. This is expected to worsen in the future. The pressure for housing leads to unplanned, unauthorized squatting in areas with no roads, water supply and sewerage disposal. Access to drinking water, particularly clean water, is hampered by significant operational problems in both the rural and urban areas, while human wastes and effluent contaminate surface and ground water resources through poorly sited, poorly maintained or nonexistence of pit latrines.

¹⁷ "Malawi Climate Change Vulnerability Assessment". Produced for the United States Agency for International Development by Tetra Tech ARD, through a Task Order under the Prosperity, Livelihoods, and Conserving Ecosystems (PLACE) Indefinite Quantity Contract Core Task Order (USAID Contract No. AID-EPP-I-00-06-00008, Order Number AID-OAA-TO-11-00064).

¹⁸ Project for National Water Resources Master Plan in the Republic of Malawi. Undertaken by CTI Engineering International Co., Ltd., Oriental Consultants Co., Ltd and NEWJEC Inc. for the Ministry of Agriculture, Irrigation and Water Development (MoAIWD), Funded by the Japan International Cooperation Agency (JICA).



Solid waste poses a threat to human health if incorrectly managed or dumped in unsuitable areas. This can also contribute to the spread of malaria mosquitos by providing habitat in which the mosquitoes can breed. Mining pollution results in localised and unfilled pits, quarry dust, disfigured hills, coal dust, subsidence, trenching, site clearing, dumping of refuse and potential

radiation exposure. Working in these environments poses significant health risks through heightened exposure or concentrations to toxic materials where ventilation is inadequate resulting in inhalation of fine airborne particulates. The frequencies of industrial inspections ensuring safe working environments are hampered by lack of and inadequately trained personnel and financial resources.

Development in the transport sector contributes in part to deforestation, with road construction through natural afforested areas and excavation of quarries for sand, stone and gravel for construction and maintenance purposes resulting in clearing of forested areas. This contributes to erosion of cleared areas and siltation due to increased run-off and disturbed soils. Abandoned pits can furthermore become breeding grounds for mosquitos with stagnant captured water. Deficiency of pollution control is due to the lack of enforcement of legislation, procedures and specifications for disposal of toxic liquid industrial wastes. Urban centres are challenged with inadequate sewerage and solid waste collection, disposal systems and facilities, and in some cases the facilities are non-existent.

2.9 Air pollution



The main contribution to poor air quality in Malawi is a result of burning of charcoal¹⁹, the main fuel source of Malawi. As more households need to increase their cash income because of insufficient agricultural yields, they increasingly turn to charcoal production as an income generating activity, so this looks set to continue to increase²⁰.

Additional contributions to air pollution include emissions from industries and cars, and tyre burning in urban areas. Wildfires in the rural areas, particularly between May and November also pollute the air. Quarrying and mining activities are increasing in scope and as such enhance the total air pollution created.

2.10 Climate change

Every management strategy should account for the current and future impacts of Climate change as manifest locally to the region. Climate change, through direct and indirect human activities (such as slash and burn land clearing practice, unsustainable deforestation and excessive fossil fuel usage) on a local scale, is changing atmospheric character and dynamics on a global scale. These unsustainable practices result in changes experienced at the local level. Generally warmer temperatures and more frequent heatwaves are expected. Rainfall are patterns becoming more erratic in terms of drought occurrence, rainfall onset and cessation dates affecting agriculture planning. Meteorological event intensities change resulting in more prevalent and extreme rainfall events



¹⁹ "Malawi Climate Change Vulnerability Assessment". Produced for the United States Agency for International Development by Tetra Tech ARD, through a Task Order under the Prosperity, Livelihoods, and Conserving Ecosystems (PLACE) Indefinite Quantity Contract Core Task Order (USAID Contract No. AID-EPP-I-00-06-00008, Order Number AID-OAA-TO-11-00064).

²⁰ As above

increasing flood likelihood and excessive soil erosion. Evapotranspiration regimes are altered which impact the flora and shifts the biosphere capacity, increasing pressure on marginal species. Ultimately biological diversity is reduced. These changes also have societal impacts through agriculture yields, as well as on the forestry and fishing industries. Climate changes may indirectly alter human health and settlement distribution with disease vectors changing in response to temperature and moisture availability.

Several assessments have been undertaken to determine the effect of climate change on Malawi, as listed below:

- United Nations Development Programme (UNDP): General Circulation Model (GCM) - country report for Malawi²¹
- Malawi Climate Change Vulnerability Assessment²², as well as
- Climate change components in the WRIS²³, and
- The most recent National Water Resources Master Plan in the Republic of Malawi²⁴.

Studies show uncertainty in the severity of the likely changes to occur in the near future, they do agree on the direction of change from the present mean climate that will be experienced in Malawi. These changes are warmer day and night time temperatures with longer and more frequent and intense heatwaves with longer duration²⁵. The rainfall will increase and be more intense during the wet season of November to April and diminished during the dry season of May to October. The total annual rainfall will remain similar to the present, but more rain will fall as heavy storm events, increasing the risks of flooding, drought and environmental degradation. This will change the flow dynamics of the catchment, proper sustained catchment management implementation is therefore essential.

These projections for Malawi are made through the detailed analysis of the output from General Circulation Model, Regional Climate Model and downscaled models initialised with the foreseeable global thermal pathways. These data provide a robust description of the near future (2050) and far future (2085) climate characteristics (more detail on modelling in 7.7 Integrating Climate modelling into the Hydrological analysis).

2.11 Conclusion

The above description of the key environmental issues in Malawi shows that there are strong linkages between most of them, as illustrated in Figure 1. The high population growth, together with poverty, is a cause and not an effect of environmental degradation. Similarly all the environmental issues have an impact on human habitat. This flow of cause and effects is indicated by the yellow and red arrows, illustrated in Figure 1.

It is clear that there is a need to intervene and reverse the degradation of the environment in order to improve the lives of the majority of the people of Malawi. This project is aimed at working with those that are most vulnerable to the effects of environmental degradation in order to reverse the trend and improve the livelihoods of those who depend on the land to sustain them.

²¹ As quoted in: **Project for National Water Resources Master Plan in the Republic of Malawi**. Undertaken by CTI Engineering International Co., Ltd., Oriental Consultants Co., Ltd and NEWJEC Inc. for the Ministry of Agriculture, Irrigation and Water Development (MoAIWD), Funded by the Japan International Cooperation Agency (JICA)

²² **“Malawi Climate Change Vulnerability Assessment”**. Produced for the United States Agency for International Development by Tetra Tech ARD, through a Task Order under the Prosperity, Livelihoods, and Conserving Ecosystems (PLACE) Indefinite Quantity Contract Core Task Order (USAID Contract No. AID-EPP-I-00-06-00008, Order Number AID-OAA-TO-11-00064)

²³ **Water Resources Investment Strategy Component 1 – Water Resources Assessment, Main Report, April 2011**. Undertaken by WS Atkins International Ltd in association with Wellfield Consulting Services for the Government of the Republic of Malawi, Ministry of Irrigation and Water Development, Second National Water Development Project (NWDP II). Funded by the World Bank. World Bank, 2011.

²⁴ **Project for National Water Resources Master Plan in the Republic of Malawi**. Undertaken by CTI Engineering International Co., Ltd., Oriental Consultants Co., Ltd and NEWJEC Inc. for the Ministry of Agriculture, Irrigation and Water Development (MoAIWD), Funded by the Japan International Cooperation Agency (JICA)

²⁵ **“Malawi Climate Change Vulnerability Assessment”**. Produced for the United States Agency for International Development by Tetra Tech ARD, through a Task Order under the Prosperity, Livelihoods, and Conserving Ecosystems (PLACE) Indefinite Quantity Contract Core Task Order (USAID Contract No. AID-EPP-I-00-06-00008, Order Number AID-OAA-TO-11-00064)

3 Catchment Management Principle and Concepts

Land and water degradation, together with their subsequent impacts on water resources and resultant impacts on users, cannot easily be separated or managed independently of one another, Figure 2. This implies that a co-ordinated and integrated planning approach and subsequent action is required. This applies for all scales of catchment management and through all levels of institutions from individual land users, through Traditional structures to District and National Ministries.

The left side in Figure 2 illustrates the good state of both land resources and water resources, whereas the right hand side illustrates the poor state of these resources. The utilisation and management of land and water resources should be done in an integrated manner in order to ensure the sustainability of both.

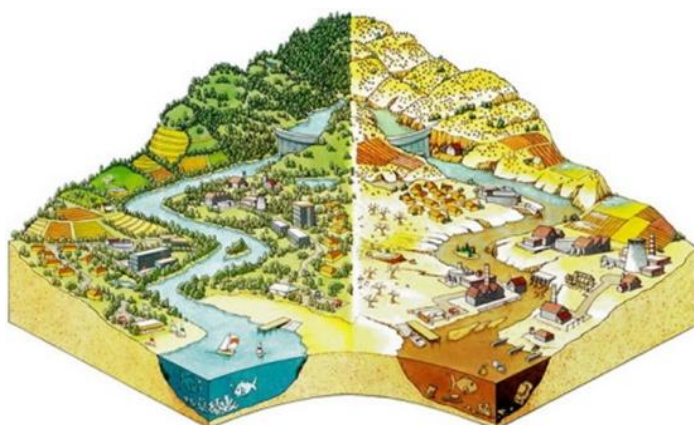


Figure 2: Illustration of good and poor state of both land and water resources in a catchment. (Source: Waterwatch Queensland)

In its widest possible sense, Integrated Catchment Management (ICM) recognizes the need to integrate all environmental, economic and social issues within a catchment (at any scale) into an overall management philosophy, process, strategy and plan. Thus ICM is aimed at deriving the greatest possible outcome of sustainable benefits for future generations and local communities in the areas of concern, whilst protecting the natural resources upon which these communities rely.

Often, water resource management paradigms have assumed that sustainability of water resources can be achieved merely through focused efforts to control water use and protect the integrity of water resources within a catchment context. However, in more recent times, it has been acknowledged that this approach ignores the complex issues of land use patterns and the varied roles played by stakeholders, which impact on the water use and water resources. Therefore a more integrated and coordinated approach across all aspects of natural resources management and land use is needed, hence the need for Integrated Catchment Management.

In order to achieve integrated catchment management and derive the best outcome of benefits, while protecting resources, requires careful consideration and planning. However, a catchment management plan also requires both the physical implementation of activities in day to day practices and livelihoods, as well as a strong legislative, regulatory and institutional framework to support the planning process and implementation.

3.1 Concepts and Principles

There are several concepts and principles that are important to catchment management. These are discussed further in this chapter.

3.1.1 Catchment and River Basin Scale

A water resource at a particular location is the product of runoff or groundwater recharge that originates in, and reflects conditions and events throughout, a geographically defined drainage area known as a catchment (“local scale”) or basin (large scale, multiple catchments). The way human beings use and abuse land inside the catchment has a decisive impact on the quantity and quality of the water resource and on the health of the aquatic ecosystems reliant on that resource. In this way the hydrological cycle, land-use and aquatic ecosystem functioning form a continuum bounded by the extremities of the catchment. This calls for recognition that naturally occurring water can usually be effectively and efficiently managed only within river basin (regional scale management) or catchment (local scale management) boundaries, because of the need to technically account for all aspects of the hydrological cycle, including the way human beings change aspects of the cycle by land use.

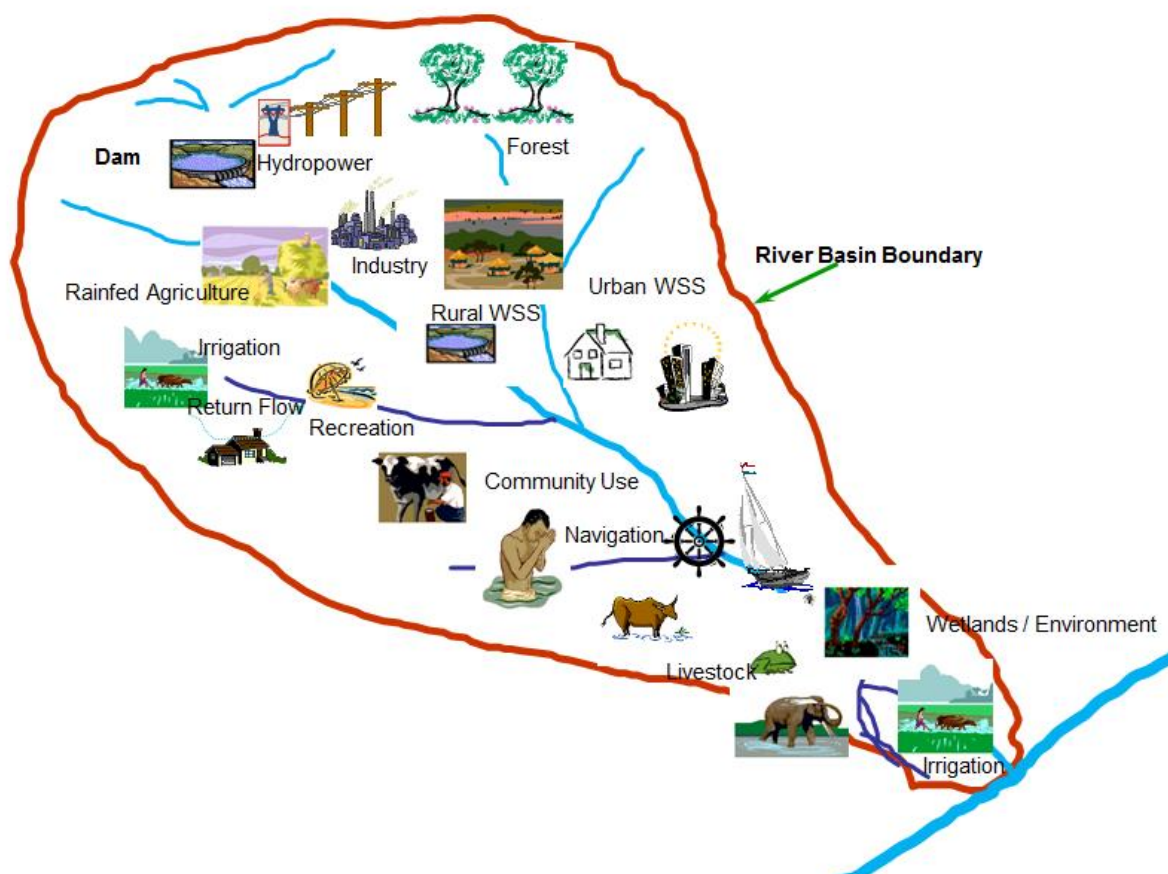


Figure 3: Illustration of water and land use activities within a catchment

Several difficulties arise in this concept. Firstly, people are not settled according to catchment boundaries. Secondly, more than one Tribal Authority or District Council may fall into a catchment, and conversely, one Tribal Authority or District Council’s administrative area may cover more than one catchment area.

3.1.2 Integrated Catchment Management

Catchment management is a philosophy, a process and an implementation strategy with a set of actions, to achieve a sustainable balance between utilisation and protection of water resources in a catchment. Catchment management recognises the interdependence of land-use, water and the environment, and aims to manage these components in an integrated manner in order to ensure the sustainable utilisation of environmental resources and the protection of such resources.

3.1.3 Sustainability

Sustainability in the use and development of natural resource systems means that the system has a high level of resilience (can cope with and recover from stresses and shocks, and maintain or enhance its capability and assets), both now and in the future, while not undermining the natural resource base.

Sustainable use of resources therefore must deliver basic environmental, social and economic services to all residents of a community without threatening the viability of the natural, built and social systems upon which the delivery of these systems depends. The key to achieving sustainability is adopting a long-term and forward-looking approach to improving the quality of life of human beings. This ensures that future and cumulative impacts of current development activities are anticipated and managed for continued productivity.

It is essential that water and land resources be developed in a viable manner to accommodate future generations and to meet their resource needs. It is generally accepted that sustainable development requires a process and ultimately consensus-building among all stakeholders. This must be inclusive of all role-players, government institutions, stakeholders, clients, non-governmental organisations and community based organisations as partners who together define the problems, design possible solutions, collaborate to implement them, obtain specific products, and monitor and evaluate the outcome.

3.1.4 Reasonable Utilisation

In order to ensure that natural resources are not depleted or ruined, development must be balanced between economic and social benefits whilst also protecting the resource base that supports them. People want access to more reliable domestic water supply, better sanitation, water for livestock and irrigation, timber and fuel from forests and good soils for productive agriculture.

Many of these activities, singly and in combination, can result in adverse impacts on the catchment itself and on the natural resource base of the catchment such as impacts on groundwater recharge, streamflow, flood flows and soil erosion. Water for environmental services especially in wetlands and securing the biodiversity in the plants and wildlife, are all very important to protect and improve the present access to water and land resources.

Reasonable utilisation of natural resources must be encouraged so that that development and resource use do not waste or diminish the resource, as for example, discharge of wastewater and pollutants into the catchment.

Reasonable utilisation of resources must be done for improving the livelihood of people but also to ensure that future generations can also benefit from it.

4 Legislative and Institutional Framework

4.1 Introduction

The activities of catchment management, and the implementation of catchment management plans, is not limited to the responsibility of one institution. Catchment management cuts across many sectors, geographic areas and political/administrative jurisdictions; therefore functions and responsibilities of catchment management are spread across several institutional structures. This section briefly outlines the key role-players in catchment management planning and implementation. Donor agencies, NGOs, and the private sector are also important stakeholders, and will be identified with the catchment management planning process. This section focuses on the government and legislated institutions.

4.2 Overall Framework

The Constitution of the Republic of Malawi, 1995, has defined the role of the State and lays a strong foundation for policy and legal reform in environmental governance. Section 13(d) declares that:

“The State shall actively promote the welfare and development of the people of Malawi by progressively adopting and implementing policies and legislation aimed at achieving the following goals:

Section 13(d) To manage the environment responsibly in order to:

- i. Prevent the degradation of the environment*
- ii. Provide a healthy living and working environment for the people of Malawi;*
- iii. accord full recognition to the rights of future generations by means of environmental protection and sustainable development of natural resources; and*
- iv. Conserve and enhance the biological diversity of Malawi”*

The constitution therefore sets, as a guiding principle, integration of environmental sustainability alongside social and economic sustainability considerations in national and sectoral policy discourse and planning towards sustainable development of the country.

Malawi developed a shared vision for the long term development of the country which was adopted in 1998. It is apparent that in this vision the main rallying point was the need for sustainable development, development that does not compromise the ability of the natural resources base to provide for the future generation. The Vision 2020 challenges Malawians to aspire for a nation which is: “God-fearing, secure, democratically mature, **environmentally sustainable, self-reliant** with equal opportunities for and active participation by all, having social services, vibrant cultural and religious values and being a technologically-driven, middle income economy by the year 2020”

Elaborating on its aspirations and options for environment and natural resources management the vision dwells on addressing environmental challenges identified in the National Environmental Action Plan (NEAP) such as controlling water, forestry, land degradation, arresting deforestation, prevention of degradation and depletion of water resources, developing fisheries, restoring and conserving biodiversity, developing human settlement, controlling air pollution and managing climate change issues, eradicating poverty and controlling population growth and political advocacy for proper management of natural resources and environment.

4.3 Environment

As an umbrella policy, the National Environmental Policy (NEP) adopted in 1996 and revised in 2004, aims at ensuring that all sector policies do embrace the principles of sustainable development. As a framework instrument, the NEP guides different lead agencies in so far as their activities affect the environment and natural resources management, including how to minimize impacts of environmental

degradation. Its aspirations under different sectors are considered relevant to enhance ideals of sustainable water, forestry, and land management are summarized in the overall goal of the policy that states that “the overall policy goal is the promotion of sustainable social and economic development through the sound management of the environment and natural resources”. Specific objectives are:

- Ensuring that national and district development plans integrate environmental concerns, in order to improve environmental management and ensure sensitivity to local concern and needs;
- Increased public and political awareness and understanding of the need for sustainable environmental protection, conservation and management;
- Involvement of local communities in environmental planning and actions at all levels and empower them to protect, conserve and sustainably manage and utilize the nation’s natural resources;
- Managing, conserving and utilizing the country’s biological diversity, (ecosystem, genetic resources and species) sustainably for the preservation of national heritage; and
- Promoting the sustainable use of water, forestry, land resources of Malawi, primarily, but not exclusively, for agriculture purposes by strengthening and clearly defining security of tenure over water, forestry, land resources.

The 2004 National Environment Policy prescribed the policy and institutional arrangements necessary for effective delivery of sustainability agenda and provides the basis for Environmental Impact Assessment and environmental management plans.

The Environment Management Act (1996) (EMA) gives strength to the principles outlined in the NEP 2004 to the extent that wherever sectoral legislation conflict with the EMA, the later shall take precedence. It provides for the creation of regulations on the aspects of environmental management, so that gaps or inconsistencies in sectoral legislation may be easily rectified. It created, for the first time, a firm legal framework for environmental impact assessment (EIA) and environmental audit. Following this, national and sector specific EIA Guidelines were developed and approved. These formed the main instruments for ensuring environmental, social and economic sustainability of intervention in all sectors.

Most importantly, the 1996 EMA established a National Council for the Environment with considerable powers to mediate in situations of conflict, and it accorded to the Environmental Affairs Department responsibility for the co-ordination of environmental monitoring interventions and investments in the environment/natural resources sectors and environmental framework for policy development across many sectors, so the EMA provides a legal framework for the development of new sectoral legislation.

In 2004 the NEP was revised which among the main innovations establishes the National Environment Protection Agency that will have more powers as an independent national environmental watchdog. This necessitated the review of the 1996 EMA, which was reviewed and has been in draft form for over six years.

The Cabinet Committee on Natural Resources and Environment (CCNRE) is the highest environmental policy and decision-making body. Its objectives is to advise Cabinet on the protection, conservation and sustainable utilization of renewable and non-renewable natural resources and the environment to ensure equitable utilization and enhance socio-economic development of the people of Malawi. In relation to decentralization, the CCNRE specifically advises Cabinet on institutional strengthening for decentralized environment and natural resources management.

The Parliamentary Committee on Environment and Natural Resources (PCENR) is a forum for discussing environmental issues at the legislator level. Its role in decentralized natural resources management is to promote the participation of local communities especially women and youth in the management and conservation of natural resources and the environment, based on the principle of democracy and good governance.

4.4 Forestry

The Forestry Act, 1997 provides for the management of trees and forests under customary and private water, forestry, land as well as in protected areas. It provides for establishment of Forest Management

agreements between communities and the Department of Forestry that enhance co-management of forest resources. Forest Management Agreements lay the foundation for sustainable forest management. It also provides for penalties for forest offences as well as seizure of forest products and articles by forestry officers and police officers. The excessive deforestation that has occurred in Malawi is a serious risk to the state of the catchments.

Section 32 of the Forest Act provides for the management of forests on customary land.

32.(1) The Minister may make rules which shall apply to make rules for all customary land outside forest reserves and protected forest areas.

(2) In particular and without prejudice to the generality of the foregoing power, such rules may –

(a) provide for the protection of water catchment and fragile areas, rehabilitation of degraded areas and any other activity which would be conducive to good land husbandry;

(b) facilitate the establishment and management of forest by village natural resources management committees for the benefit of local communities;

(c) encourage District Councils, non-governmental organizations and the private sector to contribute towards the provision of forestry extension services, as well as the establishment and management of plantations in accordance with guidelines provided by the Department of Forestry;

(d) provide for the establishment and maintenance of nurseries to provide seedlings for tree planting programmes;

(e) authorize the payment, of grants, or bonuses out of public funds for the encouragement of forestry;

(f) provide for the declaration of endangered or essential tree species and their management;

(g) prescribe a mechanism for sharing costs and benefits between the Department of Forestry and village natural resources management committees in regard to forest produce confiscated from customary land forests.

33. Any rules made by village natural resources management committees (VNRMC) shall be approved by the Minister.

34. (1) Any person who or community which protects a tree or Right to forest, whether planted or naturally growing in any land which naturally that person or community is entitled to use, shall acquire and growing trees retain the ownership of the tree and forest with the right to sustainable harvest and disposal of the produce

(2) Any tree or forest owner under subsection (1) may seek the advice of the Director of Forestry on the management and utilization of his tree or forest.

In particular section 32(2)(c) provides for the protection of water catchments and fragile areas, rehabilitation of degraded areas and any other activity which would be conducive to good land husbandry – these are the essential principles of catchment management. The agent for implementing this section of the legislation is the Village Natural Resource Management Committees.

4.5 Water Resources

The overall policy goal of the 2005 National Water Resources Policy is to ensure sustainable management and utilization of water resources, in order to provide water of acceptable quality and of sufficient quantity, and ensure availability of efficient and effective water sanitation services that satisfy the basic requirements of every Malawian and for the enhancement of the country's natural ecosystems. It aims at addressing all aspects of water including resource management, development and service delivery. It recognizes that quality and quantity of water is much affected by human activities in catchment areas.

The policy addresses issues of sustainable management through catchment protection but leaves the responsibility to relevant sectors such as the Departments of Water, Forestry, Land, Resources

Conservation through their policies to implement such initiatives. This gives the impression that the policy does not consider natural resources management as a core business of the Water Department, rather it just has to provide conducive policy environment in which other sectors can play their roles in natural resources management.

The Water Resources Act, 2013 (NWRA) provides for the establishment of the National Water Authority to replace the National Water Resource Board and paves the way for the establishment of Catchment Management Committees. The strength of this for natural resources management is that the Authority will have powers to enforce planning and management requirements for sustainable utilization of resources in the Shire River basin, and other river basins.

The Act, section 25, proposes the establishment of Catchment Management Committees (CMC). *The CMC shall in relation to the catchment area for which it is appointed, advise officers of the Water Resources Authority (“authority”) at the appropriate regional office concerning –*

- a) *Water resources conservation, use and allocation;*
- b) *The grant, adjustment, cancellation or variation of any license and permit under this Act; and*
- c) *Any other matters pertinent to the proper management of water resources.*

Subject to the relevant Catchment Management Strategy [and plan] (CMS), a CMC may also undertake, on its own initiative and with funding received pursuant to section 31 (Water Resources Act, 2013), water resources conservation activities and works.

The catchment area designated under a CMC may include two or more sub-catchments. The CMC is therefore a broad scale institutional arrangement.

The members of a CMC is comprised from the following persons:

- a) Representatives of ministries, departments or other public bodies responsible for matters relating to water resources in the catchment area;
- b) Representatives of any regional development authorities and local authorities whose areas of jurisdiction or any part thereof fall within the catchment area concerned; NOTE: A local authority area may be split across more than one catchment area.
- c) Representatives of farmers within the catchment area concerned;
- d) Representatives of the business community operating within the catchment area concerned;
- e) Representatives of the non-government organizations engaged in water resources management programmes within the catchment area concerned; and
- f) Other persons who have demonstrated competence in matters relating to the management of water resources.

NOTE: there is no specific mention of Association of Water Users (AWUs) or the role of TAs in CMCs.

The CMC shall encourage and facilitate the establishment and operation of AWUs and for conflict resolution and cooperative management of water resources in catchment areas.

For the purpose of establishing an AWU, a group of water users shall comprise any user of water from a common stream or other source irrespective of the purpose of that use. The purpose of an AWU shall be for one or a combination of the following purposes:

- a) To manage, distribute and conserve water from a source used jointly by the members of the association;
- b) To manage groundwater resources in a Groundwater Conservation Area established under Part VI;
- c) To acquire and operate an abstraction license or a discharge permit under this Act;
- d) To resolve conflicts between members of the association related to the joint use of a water resource;
- e) To collect water user charges and fees on behalf of the Authority; and
- f) To represent the special interests and values arising from water used for a public purpose, such as in an environmental or conservation area.

The scale of a AWU is much smaller than a catchment. An AWU can be comprised at a stream, village, sub-catchment scale. Several AWUs would report/feed into the larger scale CMC. The Village Natural

Resource Management Committees could register, in addition to being a VNRMC, as an AWU. They would however need to amend their constitutions to include the requirements of the AWU. Note also that an AWU is not limited in membership to a VNRMC, it can be broader. This however does not mean that the other members of the AWU have any input in the functions and operations of the VNRMC (should they register in addition; however, if they combine their constitution they would).

Similar to the CMC, there is no mention of the role of TAs in the functions of the AWU.

The Irrigation Act, 2001 makes provision for the sustainable development and management of irrigation protection of the environment from irrigation related degradation, establishment of the National Irrigation Board, the Irrigation Fund and other matters related to irrigation development in Malawi.

It mandates farmers to maintain irrigation canals, drains and other associated infrastructure in their holdings and prohibits people from engaging in practices which are destructive or potentially destructive to the catchment area of a river that provides water for irrigation. It prohibits livestock grazing, setting or causing to set fire on irrigation schemes or farms. Recognizing the destructive effect of fire, puts the responsibility for averting, fighting or extinguishing fire on irrigation schemes. It prohibits any actions that are destructive to the catchment.

Several irrigation schemes around Malawi are registered as an AWU.

4.6 Local Government

The Local Government Act, 1998 supports the implementation of the decentralization Policy by giving powers to the authorities for planning and development of the areas under their jurisdictions. It devolves authority and relocates capacities from the central to the local assemblies. The Local Assemblies have responsibility to ensure sustainable management of natural resources in their jurisdiction. However, devolution of authority has been slow and implementation of programmes is constrained by human and financial resources limitations.

The Local Government Act, 2009 (Amended), Provides for the formulation of development plans for local authorities including environmental development. Specifically, it stipulates that:

"6.-(1) The Assembly shall perform the following functions:

(c) to promote infrastructural and economic development through the formulation, approval and executions of district development plans";

"2 1.-(1) an assembly shall have a dully to draw up plans for social, economic and environmental development of the area for such period and in such form as the Minister may prescribe.

(2) Development plans shall be prepared in conjunction and consultations with other agencies having a public responsibility for or charged with production plans for development whether generally or specifically and affecting the whole or a substantial part of the Assembly".

The Local Government Act further provides for local governance structures through which these guidelines should be implemented. The Act establishes local government area for administration of local government such as district, town, municipality and city assemblies. The Act stipulates that:

"4.-(1) For the administration of local government, there shall be local government areas which shall comprise the areas respectively described in the first column of the First Schedule".

The Act mandates the council, in addition to other functions, to undertake environmental protection services, as stated in Second Schedule "additional Functions of Assembly" as follows:

2.-(1) An Assembly may:

(a) Establish, maintain and manage services for the collection and removal and protection treatment of solid and liquid waste, and the disposal thereof within its area and may compel the use of its services by anybody of persons to whom the services are available.

(b) Compel and regulate the provision, construction, use, maintenance and repair of drains, latrines and receptacles for solid and liquid waste and the connection of any premises with any public sewer or drains;

- (c) *Require the use of any sanitary services under its control and regulate the methods of dealing with night soil or solid or liquid waste of any description whatever: Provided that nothing in this paragraph shall require an Assembly to accept for disposal for any solid or liquid waste which in the opinion of the Assembly are hazardous or are likely to be deleterious to the operations of any sewage treatment, plant or water, forestry, land fill site or which contaminate any ground water.*

The Act also provides for establishment of committees and sub-committees (Section 15(l)) at district and sub-district levels. Those of particular importance to the implementation of these guidelines are discussed further.

4.6.1 District Executive Committee

The District Executive Committee (DEC) is the technical arm of the District Council composed of representatives from all government ministries and departments, NGOs represented at the district and co-opted members. It is responsible for implementation of all aspects of the District Development Planning System (DDPS). The District Commissioner or in his absence the Director of Planning and Development chairs this committee.

The functions of DEC are to:

- Provide technical advice to the District Council on Socio-Economic Profile (SEP) development of the district;
- Facilitate the mobilization of resources for social-economic development;
- Appraise community project proposals;
- Monitor and co-ordinate the implementation of community projects;
- Produce the Social Economic Profile for the district in which the State of Environment Report is a chapter;
- Produce the District Development Plan where Environment Action Plans are integral; and
- Build awareness on development issues at both district and community levels.

Specific activities for catchment management, especially from the Catchment Management Plan should be incorporated in the District Development Plan.

4.6.2 District Environment Sub-Committee

The District Environment Sub-Committee (DESC) is the DEC focal point on issues of the environment. It acts as a multi-disciplinary forum for environmental management and comprises environmental and natural resource management (NRM) sector district officers. The Director of Planning and Development chairs the DESC with secretarial services provided by the Environmental District Officer. The functions of DESC are as follows:

- Assess and analyze the status of the environment and produce the State of the Environment Report (SOER) and DEAPs for the District Council;
- Provide technical advice to the District Council on issues of the environment and natural resources;
- Appraise micro-projects and facilitate their development;
- Conduct awareness campaigns on environmental and natural resources management; and
- Develop capacity on sustainable environmental management at community level so that issues of environment are integrated into decision-making process and planning systems.

The DESC should drive the process for the development of sub-catchment and micro-catchment plans.

4.6.3 The Development Advisory Team

The Development Advisory Team (DAT) is responsible for supervising the implementation of projects and programmes. Its functions are to:

- Co-ordinate activities of all projects assigned to the team;
- Conduct monitoring and on-going evaluation visits for all projects and projects sites;
- Recommend technical modifications to projects as may be required; and
- Submit regular reports to the DEC/District Council regarding the project status.

The DAT should monitor the implementation of the District specific activities identified in the Catchment Management Plan.

4.6.4 District Training Team

The District Training Team (DTT) is responsible for conducting all training required at the Districts. Its functions are to:

- Co-ordinate training activities assigned to the team;
- Assess district training requirements; and
- Submit regular reports to the DEC/District Council regarding the project status.

Any capacity building and training activities identified in the Catchment Management Plan, that are applicable to the District should be implemented by the DTT.

4.6.5 Area Development Committee

Area Development Committee (ADC) under the current (ongoing) institutional structure, are decision – making institutions located at area level (at the levels of the Traditional Authority). Development decision-making bodies comprise the ADC.

The composition of ADC includes:

- Traditional Authority (TA),
- Group Village Headmen, *This should also include the Village Head as well as the land owners*
- Sub Traditional Authority,
- Members of Parliament,
- Councilors, and
- District Council representatives.

The ADC has the following environmental management tasks:

- Responsibility for State of Environment and Outlook Report (SOER) and Environmental Action Plan (EAP) processes at area level;
- Identification and prioritization of environmental issues that need immediate mitigation actions;
- Development of EAPs (at TA level) and subsequent micro-projects;
- Facilitate formation of Village Development Committees (VDC) Environmental working groups;
- Collate and approve VDC EAPs;
- Mobilize community resources and solicit funds; and
- Monitor SOE and implementation of EAPs.

The ADC must be involved in the development of the sub-catchment, micro-catchment and village action plan, as the plans will require their input, and they will be responsible for some of the activities identified within the plans. The relevant ADC actions identified in the catchment plans will need to be incorporated into the Environmental Action Plans (EAPs).

4.6.6 Village Development committee/Community Development Committees

Village Development Committees (VDCs) are at the village levels (i.e. at the levels of the Group Village Headman). The advisory executives are the front line staff at VDC level. The VDC has the following environmental management tasks:

- Organize Natural Resources Management (NRM) meetings in the villages;
- Lead the EAP process at village level;
- Co-ordinate Community Based Natural Resources Management (CBNRM) activities with the ADC and communicate feedback from ADC; formulation of micro-projects addressing environmental issues and solicit funding for such activities through the DDP;
- Facilitate the mobilization of community resources for CBNRM self-help projects; and
- Supervise and monitor SOE and implementation of NRM micro-projects at VDC level.

In cities and municipalities the functions undertaken by VDCs are done by Community Development Committees (CDCs) under one neighbourhood led by an elected chairperson.

The VDC / CDC are important stakeholders in the development of the micro-catchment and village action plans. They will also be responsible for coordinating the implementation of village-specific activities identified from the catchment management planning process.

4.6.7 Area Executive Committee

The Area Executive Committee (AEC) is the technical body of the ADC. It comprises frontline staff (FLS) and plays the advisory role to the ADC. As executive body, it is responsible for day-to-day technical advice on projects within the area and even lower to the VDC.

The AEC has the following environmental management tasks:

- Facilitate the SOER and EAP processes at area level;
- Facilitate the process to develop micro-projects.

The AEC will be involved in the development and implementation of the catchment management plans.

4.6.8 The Project Implementation Committee

Project implementation committees (PICs) are project specific committees responsible for overseeing implementations of projects at district and sub-district levels.

The PICs will need to implement relevant specific projects identified from the catchment management planning process.

4.6.9 Linkage between District Environmental Sub-Committee and environmental planning at local level

The District Environmental Sub-Committee (DESC) provides guidance for all sectors such as water, forestry, agriculture, health, education, fisheries, industry and civil society to come up with an integrated District Environmental Action Plan (DEAP), which are further developed into Area Development Plans (ADPs) and Village Development Plans (VDPs) as illustrated in Figure 4.

The catchment management planning process, whether at catchment-wide or Water Resource Area scale, or at Village Action Plan level, the planning process must tie into the Village and Area development plans. The specific activities identified in the planning process requiring implementation within the village or district must be included into the Village and Area Development Plans, in order to ensure integration of the planning processes. This will also help in securing resources for implementation of such activities.

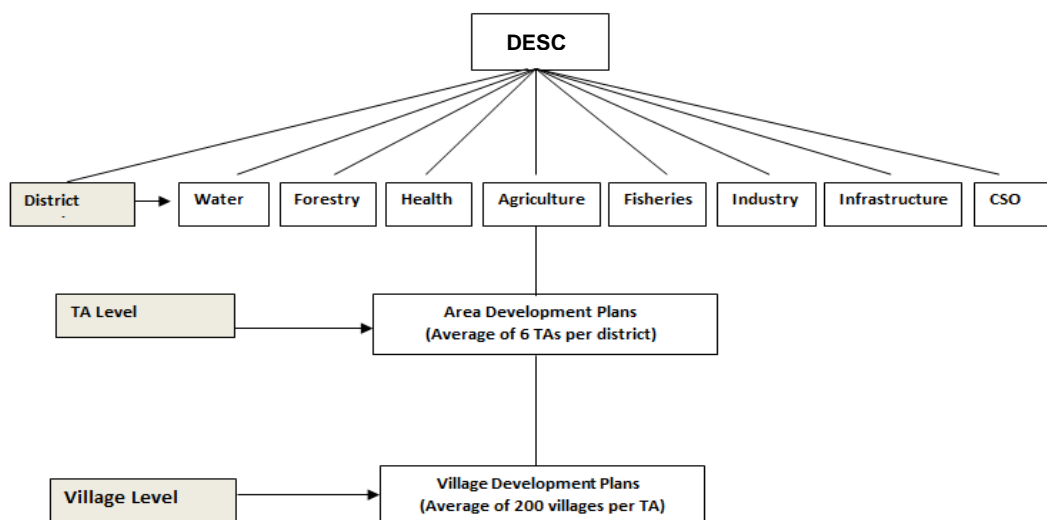
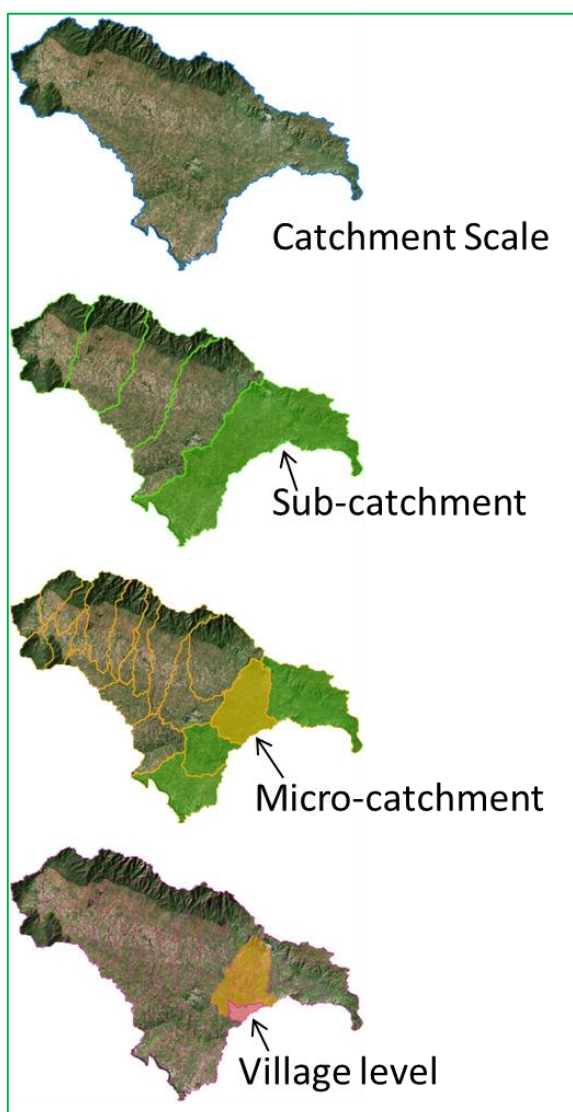


Figure 4: How DESC is aligned to DEAP and area and village development plans

5 Catchment Management Planning



Sustainable catchment management relies on human planning and implementation. Local farmers, other land users and the general community who depends on the land must be involved from the very beginning of the planning process, since they will need to implement the activities and live with the results. Catchment management involves the management of land by using and implementing appropriate biological and physical measures in such a manner that the results are economically, environmentally and socially acceptable. Natural resources development, conservation and management constitute the foundation of catchment management and planning.

Catchment management planning shouldn't be done just for areas suffering degradation. It should be a proactive tool for improving yields and sustainability of nature resources to support the people of the whole catchment that rely on them every day.

Catchment Planning is a participatory planning practice. It requires the input from all the stakeholders. There are various participatory planning techniques to ensure the involvement of the whole community and for planning at various scales – village-scale up to catchment-scale planning level. The catchment scales are illustrated in Figure 5. The area of a catchment varies from catchment to catchment. The approximate areas of catchments in Malawi are:

- Catchment scale (35,000ha; district level)
- Sub-catchment scale
- Community (4,500ha; GVH)
- Village scale (500ha, in-field activities)

Figure 5: Various catchment scales

The level or detail of catchment plans also varies depending on the scale of the catchment, for example at the Village Scale, the plan will only include site-specific or very localised but very defined activities (Village Action Plan); whereas at the Catchment or Water Resource Area scale the plan will be much broader in scope and quite comprehensive with sector and scenario analysis. These broader Catchment Management Plans should contribute to informing the type of activities that should be happening at the village level, but the context specific activities are captured in the Village Action plan

The methodology outlined in this guideline is inclusive of all scales of catchment management planning. The broad methodology outlines planning and the broad catchment scale. Although all the steps are not applicable at the Village level scale it is useful to understand how the broader catchment plan is derived, and how the information from the broad catchment management plan needs to filter down through the various catchment scales to the Village Action Plans, and *vice versa*. The specific tasks for compiling a Village Action Plan are identified in this methodology.

The Catchment Management Strategy/Plan has a specific role within the Catchment Management Process, and represents but a single, though crucial, step and element of the wider process. It records a vision for the catchment and formalizes the understanding of the water, land, social and aquatic ecology issues or concerns in terms of that vision. As the outcome of “interests-focused” bargaining, rather than “rights-focused” bargaining, it states how such issues or concerns will be addressed through agreed management strategies within a specified time period in that specific catchment, and outlines an associated legislative, procedural and technical framework for implementation. It reflects stakeholder commitments and requires legal status, either as a contract or as a legal proclamation.

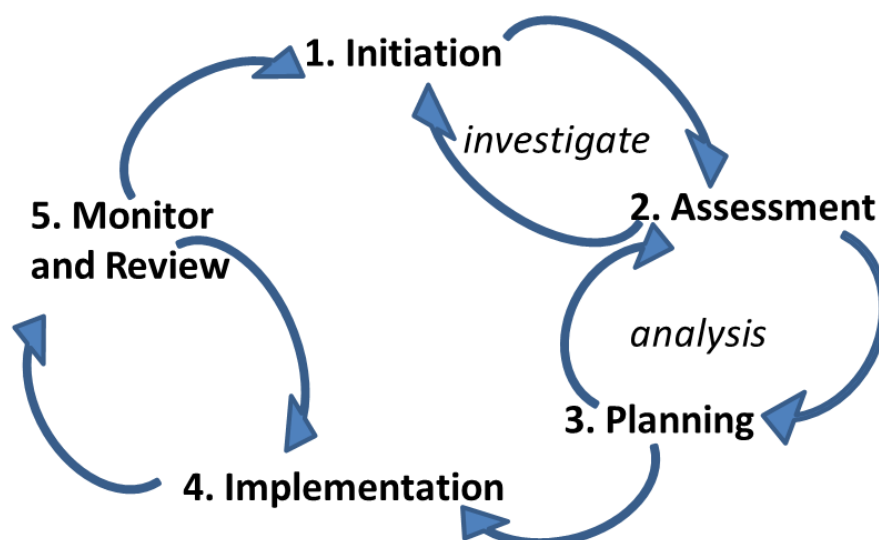


Figure 6: Catchment Management Planning Process

NOTE: These steps imply a certain amount of chronology, but a vast overlap between steps is inevitable and, indeed, desirable, to accommodate feed-back between tasks and steps. *The catchment management process is, at its very nature, continuous, recursive, perpetual and ultimately iterative.*

5.1 Step 1: Initiation

The order of Step 1 and Step 2 are interchangeable, depending on the context specific trigger for developing a Catchment Management Plan (CMP). The plan development process may be triggered by a formal process e.g. establishment of a Catchment Management Committee or by an issue e.g. water supply shortage. The Initiation Step gets the ball rolling.

Activities include:

1. Establish the CMP team
2. Define the catchment area
3. Determine stakeholders and role-players
4. Engage Stakeholders
5. Draft a vision, aims and objectives
6. Establish a CMC / AWU / VNRMC as applicable

These are discussed in more detail below. Any procedures or specific methods are included in the PART 3 guidelines.

5.1.1 The Catchment Management Plan (CMP) Team

Depending on how the Catchment Management Plan development process has been initiated, i.e. by the water users or by the Ministry, the CMP team should comprise a set of experts to support and follow-up

the development of the CMP work and technical issues. **Additional experts can be assigned** as they are needed. Composition of the core CMP team typically includes:

- 1 Soil Conservation Expert
- 1 Forestry/Agro-forestry Expert
- 1 Agronomist (plant management, IPM)
- 1 Water Harvesting /Irrigation / stormwater Expert
- 1 Food Security Expert (Economist/Socio-economist/Agro-economist)

The CMP team is tasked with managing the development of the Catchment Management Plan. The CMP team does not necessarily become the Catchment Management Committee.

5.1.2 Define the catchment area

Using a 1:50 000 topographic map and the collective knowledge of the stakeholders, begin by marking the drainage area of the catchment. The drainage boundary is the highest point between 2 rivers or streams, such that rain on one side drains in one direction and rain on the other side drains in the other direction. Where a formal map is not available, then draw your own map, indicate features on the map such as meeting places, villages, large trees, rivers, roads, rocky areas, etc. such that all stakeholders can visualise the map. The catchment area may not include an entire village or district. It should be decided by the stakeholders whether to include the rest of the village into one CMP, rather than split it across catchment areas. By keeping the village unified will help with resource allocation and implementation of the CMP later on. The map indicates the area that the plan will be applicable to.

The catchment area, approximately 35,000ha, will be further divided into smaller areas for management and implementation. Sub-catchments will be smaller hydrological units within the catchment, micro-catchments will be approx. 4,500ha, and village action plans for village-level and in-field activities.

During the course of developing the CMP, further details will be added to the map, including issues, resources, features, etc.

5.1.3 Determine stakeholders and role-players

It is important to identify who should be engaged in the process of developing the CMP. As catchment management includes a broad range of activities, this can be a lengthy process. In the process it is also important to work out who is a stakeholder e.g. directly affected, and who is an interested party; i.e. who needs to be engaged with, versus who to include in participatory activities. This will also help to determine suitable stakeholder engagement and public participation methods. Refer to Chapter 6 for Participatory Approaches for Catchment Management Planning.

A broad range of stakeholders are seen to have an interest in management of catchments in Malawi. Institutional mapping and analysis will lead to identification and prioritisation of the main stakeholders in the catchment.

Stakeholders include a range of types of groups, all with their own interests and concerns. The stakeholder list should be considered a living document: it should be updated regularly in recognition that new entities and people may engage with catchment interventions.

- State groups will include central government, local (district) government and parastatal entities like the agricultural marketing board. Traditional leadership, although civil, is appointed through state institutions.
- Non-state groups will include the private (commercial) sector and local industry associations, the non-government and civil society groups, research bodies, local populations within and downstream of the target area, NGOs and the general public.

The responsibilities of the various identified stakeholders should be identified as well. This will help later in the implementation plan as to who will be responsible for which activities.

Output

- An inventory/database of the various stakeholders, institutions, and other interested and affected parties relevant to the catchment area, their level of responsibility.
- An inventory/database of the on-going activities in the catchment area.

5.1.4 Stakeholder engagement

Stakeholder engagement is a critical step throughout the development of catchment management plans at all scales of catchment planning.

Participatory approaches and techniques are detailed in PART 3.

5.1.5 Draft a vision, aims and objectives



A vision outlines what the Catchment area plan wants to achieve, or how it sets the context in which it will operate. It is a long-term view and concentrates on the future. It can be emotive and a source of inspiration. The objectives are steps towards achieving the vision. The objectives start to identify the key areas and actions necessary in order to achieve the vision. As one further unpacks the necessary steps and actions needed to achieve the vision, the base or contributing elements increases, as illustrated in Figure 7.

Figure 7: The broadening base of strategic planning

In the group of stakeholders, draft a vision. The vision sets the scope of the catchment management plan, i.e. what are you trying to achieve. A vision is a statement of where you are heading—your future / desired state – in order to formulate a picture of what you are trying to achieve. The vision is a “destination” and the catchment management plan is the “roadmap” to get there. The vision is a statement or catchment phrase. The vision is supported by aims and objectives, which are SMART goals. (**S**pecific, **M**easurable, **A**chievable, **R**ealistic, and **T**ime-based).

To develop the vision, start by identifying:

- where you currently are? (e.g. state of environment and livelihoods, availability of resources, etc.)
- where you want to be?
- what needs to happen to get there?

The vision will be finalised later on in the CMP process, but a first draft is needed to help “steer” or guide the CMP development process.

A vision is appropriate at all catchment scales.

5.1.6 Establish a CMC / AWU / VNRMC as applicable

A review of catchment and sub-catchment institutions will need to be conducted. IWRM principles advocate that major river systems are best managed by adopting the hydrological river Catchment as a management unit. This necessarily implies that existing institutional frameworks, linkages and networks may need to be modified and to work using new arrangements and procedures, as the political administrative boundaries do not necessarily align with the hydrological boundaries. This can have profound impacts upon the gathering, management and communication of information. The establishment of Catchment Management Institutional bodies will go some way to address this disconnect in boundaries. The Catchment Management Committee (CMC) will manage catchment management within the hydrological catchment, but the members of the committee should include District representatives to integrate with the political administrative aspect as well.

At the catchment scale the catchment management plan will be administered by the Catchment Management Committee (CMC). The CMC includes representation by AWUs. AWUs currently tend to represent specific projects, such as an irrigation project or a water supply projects. AWUs can and should also be established for overall water resource management and catchment management for sub- and

micro-catchments, not just project specific. At the micro-catchment and village level, the Village Natural Resource Management Committees (VNRMC) can be registered as an AWU. Further, catchment management activities can be undertaken by the VNRMC.

If no institutional structure is in place, then one of the components of the plan will need to be the establishment of an institutional structure. If the process is being driven at a village level, then establishment of a VNRMC is appropriate. If the plan is for the broader catchment such as a Water Resource Area (WRA), then a CMC should be established. See PART 3: Establishing a CMC for more information on this process.

Establishing a CMC should not be a limiting factor to developing a catchment management plan.

5.2 Step 2: Investigation and Assessment

Studies are undertaken to investigate and understand the physical and socio-economic cause-and-effect relationships governing the key water-related problems in the catchment, and to evaluate the administrative environment in terms of water, land and environmental management requirements.

Activities include:

1. Stakeholder engagement
2. Issues identification
 - a. Institutional assessment
 - b. Social assessment
 - c. Economic assessment
 - d. Environmental assessment
 - e. Water resources assessment
 - f. Water-related infrastructure assessment
3. Sector assessments
4. Risk assessments
5. Information management
6. Resource review (SWOT)
7. Finalise Vision / Mission statement

5.2.1 Stakeholder engagement

Stakeholder engagement is an ongoing activity throughout the CMP development process.

An intensive community mobilization and sensitization campaign is needed – at District, Group Village, and village levels. This should also help solicit relevant local knowledge and experience, current constraints and opportunities, and evolve a future vision for the targeted areas.

5.2.2 Issues identification

There are several themes and topics that need to be investigated and assessed in order to establish a baseline on which to build the catchment management plan. The collected information helps the users to understand the status quo of the catchment, as well as what the drivers, issues and impacts are that affect the catchment as a whole. The issues identification stage will consist of:

- The collection of data relating to the various aspects of the catchment. This will involve the assembly of existing documents and reports, field and site visits to provide base information for the CMP and to fill any gaps in the existing data. This will include interviews and meetings with key stakeholders.
- A review of the institutional arrangements and responsibilities and a determination of the key stakeholders and their various 'agendas' which might impact on the project. These can be political, economic or social aspects during the life of the project.
- An analysis of the existing situation in the CMP including any political or legal requirements or issues.
- Assessment of the social and economic status of the catchment and its constituent parts.

- Assessment of the environmental issues, impacts and sensitivities in the catchment and its component parts.
- Assessment of the water resources in the catchment and its component parts.
- Identification of potential links to other programs, projects or initiatives.
- Preliminary identification of district-level water-related infrastructure in targeted catchments through review of available reports, aerial photographs, images and maps.

Outputs

A report on the status quo or baseline of the catchment area and its component parts, describing and illustrating the existing situation of the catchment.

5.2.2.1 Field visits

Reconnaissance visits will be conducted by the CMP team (the team compiling the CMP) to verify the available information and develop the team’s understanding of the situation in the catchments. These site visits will be conducted to complete a thorough evaluation of water, land and environmental resources, water infrastructure, as well as institutional, social, agro-economic and other livelihood factors, and to have detailed consultations with the stakeholders at district and local levels.

Conduct a transect or walk through to identify all issues affecting the demarcated catchment area. Mark all issues on the map. For each issue, discuss and determine the impact of the issue, the extent / spatial influence of the impact, the magnitude of the impact and the duration of the impact. Also try and identify what is causing the issue (source) and activities that could remedy or prevent the issue. These can be captured in a table format, see Table 1, so they are easy to read.

Table 1 Example of issue identification table

Issue	Impacts	Extent / spatial influence	Magnitude	Duration	Source of the issue	Potential remedies
Erosion donga on farm x	<ul style="list-style-type: none"> • Loss of soil • Loss of land to farm • Flooding of adjacent field 	Farm specific	Natural processes Farming activities	ongoing	Stormwater from the road	<ul style="list-style-type: none"> • Divert the stormwater from the road. • Re-fill donga hole.

5.2.2.2 Institutional Assessment

The analysis of policies and institutional arrangements will need to be conducted from a catchment wide perspective with a view towards alignment with national and SADC level policy and strategy as well as the need to fulfil the IWRM implementation principles. This will focus on the status at:

- Regional/transboundary level, linked to water (or other) agreements between Malawi and its neighbours, particularly under the auspices of the Zambezi Basin Commission and state practice;
- National level, particularly within the water and related sectors; and
- Sub-national catchment level, through initiatives and bodies operating in the catchment.

In particular, consideration should be given to:

- The SADC Regional Water Policy & Strategy, SADC Protocol on Shared Watercourses (where applicable), and the Southern Africa Vision for Water, Life and the Environment, as well as international treaties or conventions ratified by Malawi;;
- National water, agriculture, forestry, economic and environmental policies and legislation, and the institutional arrangements established/operational in the catchment to implement these;
- The water authorisation systems and mechanisms for water allocation, water management and water infrastructure development.

The institutional mapping will describe the policy-legal-institutional environment in the catchment and will fully describe the institutional environment, the rules of engagement and arrangements between different actors. This analysis will provide the identification of key institutional barriers and enablers to good water

and natural resource governance in the Catchment, and represents a key element of the chain relationships to be developed.

5.2.2.3 Environmental assessment

Environmental Assessment includes the identification of issues and impacts, followed by an assessment to prioritise the most significant and to identify how all impacts should be avoided or mitigated. Those impacts which cannot be mitigated (residual impacts) should be addressed in an Environmental Management Plan which prescribes ongoing management actions to minimise and monitor the effects of the impacts.

Typical impacts associated with catchment management include:

Impact	Issue
Catchment hardening	Surface hardening as a result of development, including roof and road surfaces result in loss of wetlands and natural drainage patterns, loss of natural habitat at a catchment level leading to increased runoff volume and rate.
Fragmentation	Loss of biological corridors and natural connectivity through diversion and in-filling/farming of riverine wetlands and canalisation. Ecological linkages between systems are lost, through deforestation, and massive erosion gullies.
Direct loss of aquatic habitats	Encroachment of land use results in the loss of floodplains impairs the functionality of river banks, erosion, sedimentation.
Over-abstraction from surface and groundwater	Leads to low flows and the desiccation of river edge plants, which reduces natural flood protection and increases erosion.
Impoundments (dams)	Impacts on downstream flow regimes, reduces low flows and can result in vegetation inundation due to the reduced flood events.
Introduction of: <ul style="list-style-type: none"> Terrestrial alien and invasive vegetation Aquatic alien vegetation Alien fish and other animals 	Impacts on ecological functioning of river systems, can increase turbidity of water and reduce ecological carrying capacity of species important for livelihood support.
Pollution (point and non-point sources). Key sources of pollution <ul style="list-style-type: none"> Road surfaces Industrial processes Waste water treatment works Construction and demolition activities Corrosion of materials Vegetation input Litter Spills Erosion 	Pollution affects water quality which in turn affects its usability and increases the cost of purification. It will also affect the ability of water bodies to support ecological functioning.
Removal of vegetation (deforestation and land clearing)	Increases open surfaces which will increase erosion, reduce the quality of water, increase runoff and reduce the buffering of flood events.

Each of the above issues, when identified, should be assessed to rank their importance and to identify actions that would reduce the significance of any environmental impact. This is often achieved by undertaking a risk assessment, either a descriptive risk assessment or a risk ranking.

5.2.2.3.1 Descriptive Risk Assessment

This is the simplest approach to risk assessment. Environmental hazards and hazardous events are identified through team participation in a brain storming exercise. Each identified risk is considered in

terms of the likelihood that it will occur, how serious it might be, along with consideration of the effectiveness of any existing control measures²⁶ that are in place to mitigate the risk, refer to Table 2. Each risk is discussed and compared until there is agreement on which issues are of greater or lesser importance, in the end creating a list with the most important risk at the top. It is beneficial to revisit the list at intervals to reconsider each risk in light of new information, better understanding of local conditions, and as the issue responds to changing environmental conditions.

Table 2: Descriptor meaning notes

Descriptor	Meaning	Explanation
Significant	Clearly a priority	Actions need to be taken to minimize the risk. Possible options (short-, medium- and long-term options) should be documented (as part of an improvement plan) and implemented based on community priorities and available resources.
Medium	Medium priority	Currently no impact on community health or environment, but requires attention in operation and/or possible improvements in the medium and long term to continue minimising risks.
Insignificant	Not a priority	Actions may be taken but not a priority, or no action is needed at this time. The risk should be revisited in the future as part of a risk review process.
Uncertain	Clarification required	Further data collection or studies are required to better understand the significance of the risk. Some actions can be taken in the meantime as deemed necessary to reduce risk based on existing information, community priorities and available resources.

5.2.2.3.2 Risk Ranking

Risk ranking is a more formal two-step approach to risk assessment which normally requires additional support from experts or local authorities with knowledge and experience in risk management. This method involves the quantification of the consequence or severity of the impact and considers the likelihood of its actual occurrence to determine the significance of the impact and its importance in relation to other impacts, see Table 3.

This method requires that definitions for consequence and likelihood are drawn up prior to undertaking the assessment to ensure that all risks or impacts are evaluated under the same conditions. As with Descriptive Assessment, consideration must be given to the effectiveness of any existing control measures when determining the consequences of an impact.

Each issue is then compared with the whole list to ensure their relative likelihood and consequence are appropriately categorised, refer Table 4. Issues are then mapped in a matrix to identify if they are of low medium or high significance, refer Table 5, and each level of significance is defined prior to the exercise in order to ensure consistency in the rating of each impact.

Table 3: Likelihood and severity definitions

Descriptor	Description
Likelihood	
Likely	Will probably occur in most circumstances; has been observed regularly (e.g. daily to weekly).
Possible	Might occur at some time; has been observed occasionally (e.g. monthly to quarterly or seasonally).
Unlikely	Could occur at some time but has not been observed; may occur only in exceptional circumstances.

²⁶ Activities or processes that can be used to prevent, eliminate or significantly reduce the occurrence of an impact or risk.

Descriptor	Description
Likelihood	
Severity / Consequence	
Major impact	Major health or environmental impact; illness in community associated with the environmental degradation; large number of complaints; significant level of community concern; significant breach of regulatory requirement.
Moderate Impact	Minor health or environmental impact (e.g. not health related, aesthetic impact) for a large percentage of the community; clear rise in complaints; community annoyance; minor breach of regulatory requirement.
No/minor Impact	Minor or negligible health or environmental impact (e.g. not health related, aesthetic impact) for a small percentage of the community; some manageable disruptions to operation; rise in complaints not significant.

Table 4: Likelihood-severity/ consequence risk matrix

		Severity / Consequence		
		No/minor impact	Moderate impact	Major impact
Likelihood	Likely	Medium	High	High
	Possible	Low	Medium	High
	Unlikely	Low	Low	Medium

Table 5: Risk ranking definitions to prioritise actions

Risk ranking	Meaning	Description
High	Clearly a priority: requires urgent attention	Actions need to be taken to minimize the risk. Possible options should be documented (as part of an improvement plan) and implemented based on community priorities and available resources.
Medium	Medium- or long-term priority: requires attention	Actions may need to be taken to minimize the risk. Possible options should be documented (as part of an improvement plan) and implemented based on community priorities and available resources. Or where the likelihood of a hazard occurring is low because effective control measures are in place but the consequences are major (e.g. microbial risks), special attention should be given to maintaining the control measures and their appropriate operational monitoring to ensure that the likelihood remains low.
Low	Clearly not a priority	Actions may need to be taken but not a priority, or no action is needed at this time. The risk should be revisited in the future as part of a review process. Or control measures are effective, and attention should be given to ensure that the risk remains low.

Typical catchment issues to consider in the environmental assessment include:

Key ecological drivers:

- Water quantity and flow regime – including surface and groundwater sources
- Water quality
- Geomorphological processes (erosion and sedimentation)
- Biological processes, affecting biotope quality and availability (e.g. algal abundance)
- Upstream / catchment processes

Key challenges affect management:

- Maintenance of hydrological regimes and the implementation of effective Instream Flow Requirements (IFR) for river systems.

- Maintenance of natural or near-natural water quality, and improvement of water quality in degraded systems.
- Maintenance of natural (or sustainable, in an altered environment) erosion and sedimentation processes.
- Maintenance of biological and hydrological linkages throughout the catchment and seasonal or permanent links with groundwater and wetlands.
- Maintenance of specific habitat quality and availability
- Maintenance of genetic integrity (including biodiversity)
- Co-ordination of management interventions at a catchment scale so as to maximise the potential for achieving and sustaining all of the above objectives.
- Integration of ecological and social objectives, so that the improvement in one sphere is not at the expense of the other.

Key issues, vulnerabilities and threats:

- Catchment hardening (loss of wetlands and natural drainage patterns, loss of natural habitat at a catchment level leading to increased volume and rate of runoff).
- Fragmentation / loss of biological corridors and natural connectivity through *inter alia* diversion and in-filling of riverine wetlands.
- Direct loss of aquatic habitats (including diversion, canalisation and dredging, and loss of associated floodplains) due to encroachment of developments.
- Removal or degradation of indigenous vegetation in the system.
- Over-abstraction from surface and groundwater.
- Impoundments
- Introduction to the system of:
 - Terrestrial alien and invasive vegetation
 - Aquatic alien vegetation
 - Alien fish and other animals
- Pollution sources affecting water quality – point and non-point sources
- Pollution sources affecting water quantity (e.g. stormwater runoff; discharge from waste water treatment works).
- Interbasin transfers
- Emphasis on development that compromise long-term ecosystem functions.

As part of the assessment the CMP team should prepare an environmental monitoring plan (EMP) that will form part of the CMP, and that:

- Ensures that the proposed programme is implemented without adversely affecting human health and welfare as well as the environment in general;
- Ensures that mitigation measures for all adverse impacts identified are implemented;
- Facilitates monitoring of key environmental variables and indicators within the target area so as to check effectiveness of mitigation with a view to instituting adaptive mitigation and management when necessary.

The environmental monitoring plan implementation will be an integral part of CMP implementation and will focus on:

- Implementation and Effectiveness of Mitigation Measures whose objective is to assess whether interventions (mitigation measures) have been implemented as recommended, and if they were having the desired outcomes. Unanticipated undesired impacts of the programme will also be monitored with the goal of undertaking adaptive mitigation measures.
- Compliance Monitoring: The objective is to ensure that specific conditions or standards, for example, periodic checks to determine whether levels of pollution are within limits specified in the

EMP as required by the various statutes. Thresholds for compliance monitoring will be guided by Malawian policies, laws and regulations.

For each of the identified impacts, indicators to be monitored, monitoring responsibility, and frequency of monitoring must be identified, refer to Table 6 for an example.

Table 6: Example of monitoring plan for a specific activity.

Project Activity	Adverse Impacts	Mitigation Measures	Responsibility for Mitigation	Monitoring Indicator	Responsible Party	Monitoring Interval	Budget
Forest restoration	Use of exotic species can change the original vegetation cover and or displace original biodiversity	Only indigenous tree species (native to the area) will be used in the restoration programme	DoF	Emergence of new exotic species in the restored area	DoF	Annual	Part of project costs, during the operation phase, Part of DoF monitoring costs

The purpose of evaluating aspects is to assess the potential of an issue to cause harm to the catchment. When assessing aspects you need to consider: pollution/impacts (positive and negative), resource use, and indirect (impacts from/to others that you may be able to influence).

Output

- Environmental Management Plan
- Monitoring Plan

5.2.2.4 Land resources assessment

Planning and implementation requires a thorough understanding of catchment management and the linkage of poverty and land degradation. Maintaining productive and stable farming systems – in the face of soil exhaustion and erosion from non-sustainable agricultural practices – presents a particularly difficult challenge. Whilst the economy is growing in the short-term, farmers are at risk from potential longer-term decline in land productivity as the natural resource base becomes degraded and loses its ability to recover. Without urgent remedial measures (e.g. soil conservation techniques), the spread of soil degradation is likely to escalate. The land use assessment must capture the relationship between land use practices, sustainable land use and the economy both at farm / household level and for the catchment as a whole so that it might be measured, understood and remedial actions designed. Understanding land use change is central to understanding drivers of land degradation and for assessing soil erosion risk.

The CMP team must meet with community and farmers organizations to verify and understand the agriculture / agronomy of the catchments, including land use and capacity, reconnaissance verification of soils information, land degradation, erosion hotspots, crops grown, livestock production and farmers preferences, and planned projects.

5.2.2.5 Water resources assessment

A water resources assessment will be conducted to determine water quality, pollution sources and threats, environmental flow requirements and quantify the potential water resources available for new irrigation development or improvements to existing systems and for domestic use.

Sources of available hydro-meteorological information may include:

- Flow data, daily or monthly, from dams and gauging stations;
- Rainfall (daily and hourly, if available) for intensity estimates;
- Temperature (daily max, min and average);

- Evaporation (pan or other direct measurement);
- Wind, relative humidity, dew point for theoretical estimates of evaporation, if necessary;
- Suspended sediment concentration records.
- Environmental flow requirements (including seasonal variations for spawning and migration).

Using watershed modelling information will be vital for data poor areas where empirically generated data is scarce.

5.2.2.6 Water infrastructure assessment

Existing water infrastructure for the catchment (e.g. small dams, roads, small bridges, small hydropower, major gully control, irrigation schemes, etc.) must be reviewed and system performance, e.g. water use efficiency and water productivity for irrigation schemes, assessed. Rehabilitation needs for the existing infrastructure need to be assessed. Additional infrastructure necessary for expanding and developing new areas need to be identified.

Suitable areas for new irrigation schemes and dams must be identified. Criteria to screen and prioritize potential interventions include water and land availability, previous development in the area and farmers' interest and demand.

It is useful to map the identified development opportunities in the catchment area. Other useful catchment information to include on the maps are: rivers, gauging stations, rain gauges, abstraction weirs, dams, as well as existing sector activities (e.g. mines, irrigation schemes), villages, environmentally sensitive and protected areas, current and future land use type and soils information in terms of agricultural potential. This information is critical for the development of water resources planning tools used to assess the impacts of future development options.

The field visits and stakeholder meetings are critical in the formulation of appropriate and cost effective solutions, since it is during this stage that the concepts will be formulated. The consultation process with the farmers and communities will also assess the opportunities and constraints to development. These may include water availability, water loss/inefficiency, land and soils, land tenure issues, equity of water distribution, rehabilitation/expansion plans, potential for increasing gross margins, availability of inputs, availability of construction materials, environmental concerns, strength of farmers' organisation, labour availability, initiative and technical knowledge.

Output

Inventory or database of potential sites for water-related infrastructure, including existing infrastructure, rehabilitation requirements, and proposed new sites for infrastructure investment.

5.2.2.7 Economic assessment

The economic assessment will need to look at the economic context of the catchment, i.e. the intra- and inter-economies operating within the catchment and between the catchment and other areas. Other aspects such as identifying the key income generators in the catchment, what threats there are to this, and what other potential income generating activities exist within the catchment, will also need to be evaluated. The assessment will also identify funding agencies operating in the catchment area and funding sources.

Value chain analysis

The value chain analysis is to scope agriculture-related value chain opportunities for each catchment and sub-catchment, taking into consideration things like: agricultural systems, soils, climate, transport, population centres, comparative advantages, specific market opportunities and potential for contract farming or similar market-driven production arrangements as well as existing relevant success stories. The value chain analysis will address the demand for production of key crops in the catchment and its component parts from buyers, processors, traders and exporters, as well as the current production, consumption and imports. Value chain activities that promote alternative income generation (rather than reliance on sale of charcoal) can be proposed as part of the catchment management plans.

5.2.2.8 Social assessment

The overall objective of carrying out a social assessment is to identify positive and negative impacts of the proposed catchment management activities on the environmental and social fabric of the catchment. This can be done by:

- Compiling village/micro-catchment profiles, including demographics, gender, age, health, income generators and land-use.
- Assess characteristics of household food insecurity and resilience.
- Map community natural resource assets.
- Through the assessments, identify the positive and negative impacts of proposed catchment management activities with regard to environmental and social sub-sectors.
- Establish the level of awareness and capacity on social and environmental issues at community and district level to identify capacity building needs for effective implementation of environmental and social issues.

5.2.2.9 Information Management

Remote sensing, GIS and other analytical tools provide the platform through which relevant data and information can be generated that support the development of successful catchment strategies. A spatial data requirement assessment should be undertaken at the start of the project in consultation with the various stakeholders to determine what the core spatial data needs are for the various phases of the project. This will optimise the process of sourcing, collation and assessment of project relevant spatial data. It will also ensure the efficient production of the required knowledge products.

Once all relevant spatial data have been sourced, collated and assessed, it needs to be captured and managed in a knowledge base and established in a geo-database environment. The spatial knowledge base enables the user to integrate, analyse and visualise all applicable spatial data and streamline the creation of relevant knowledge products required for sector assessments, state of catchment reports, vision development, scenario development and supporting relevant modelling and Decision Support System (DSS) tools.

A spatial data inventory and accompanying metadata must be created for all spatial data captured in the spatial knowledge base. This will allow spatial data to be easily searched and optimise the future use of the data sets. The knowledge base and accompanying spatial data inventory will allow for all relevant information to be shared with the National Spatial Data Centre.

Remote sensing data can be digitised and analysed by GIS tools to give precise outputs in different formats. The principal areas for application of GIS and remote sensing are land-use planning and management such as the management of natural resources (land, water, agriculture and fishery).

All readily available and relevant information for each of the catchment must be collected. Much of this information will come from existing data sources including the MASDAP and other studies. Where possible this information must be captured in a spatial database with associated metadata. Non-spatial data and information should also be kept and managed in a data inventory and database.

Data to be assessed include, but not limited to:

- The Natural Environment
 - Geography and Soils
 - Climate
 - Biodiversity
 - Protected Areas
- Socio-Economic Conditions

- Demography
- Settlements
- Health
- Education
- Gender and poverty
- Main economic activities and growth projections
- Land Use
- Infrastructure
- Sector/Area development plans and options
- Water Resources Management
 - Institutional and legal Setup
 - Water resources (Meteorology, Surface and Groundwater)
 - Existing hydromet data and network
 - Water demand
 - Existing Hydraulic structures / Bulk Water Storage and Supply
 - Water quality and sediment transport
 - Future problems to address

The issues identification tasks are relevant to all scales of catchment management planning, but not necessarily to the same level of detail. The broader catchment requires more complex issue identification and assessment; whereas for the village level, fairly basic/simple issue identification will suffice.

5.2.3 Sector assessments

Since agriculture is almost always the largest user of water, agricultural water use strategies are critical and need to be linked to broader agricultural initiatives. However, there is the danger that planning processes may be treated simply as opportunities for advocacy, where water agendas are promoted without linkages to other sectors and priorities. Therefore water resource planning, especially at the catchment scale, must be linked to the country's overall sustainable development strategy and public administration framework.

A catchment plan requires input and buy-in from all sectors that impact on or are impacted by water resources development and management, e.g. health, energy, finance, tourism, industry, agriculture and the environment.

The objective of the individual sector assessments is to determine the current status of each sector in the catchment, including the current and future water demands, and their impacts to the environment and water resources e.g. effluent discharge and return flows.

The current status of the relevant sectors need to be reviewed. The individual sector assessments are also critical in determining the current and future water demands for the sector in the catchment and the final water balance for the catchment under different scenarios. The following sectors, *inter alia*, should be considered:

- water - includes uses, water quality, groundwater availability, flood risks, and water requirements, storage potential, water supply;
- environment - including protected areas, sensitive areas, areas under threat;
- agriculture – existing and potential irrigation schemes, dry agriculture, livestock, etc.;

- forestry – natural, community and plantation;
- energy;
- fisheries;
- tourism;
- transport - includes navigation;
- land use practice and management;
- mining;

For each of the identified sectors or activities, the assessment will need to describe and quantify the characteristics of activities in these sectors as they relate to water quantity, quality and ecosystems both at present and in the future. Climate change impacts also need to be assessed as these cut across all of the above mentioned sectors and are particularly important in terms of future development plans and water resources planning in Malawi.

The information compiled from the sector assessments will inform the scenario development. As part of the sector assessments the social, economic and environmental impacts and implications of the proposed sector developments must be reviewed. This impact review can be done by desktop modelling rather than indepth Strategic Social and Environmental Assessment (SSEA). However, the final proposed developments (i.e. in the Plan) will be subject to indepth SSEA or Initial Environmental Examination (IEE) as part of their authorising processes and implementation.

A sector assessment is not required at the village level. However, when one is done at the catchment scale, the information and proposed actions will need to be disaggregated to the village level plan, especially in areas where specific programmes, projects and activities are required.

5.2.4 Risk assessments

Similar to the issue risk assessment in the Environmental Assessment task, the risk assessment evaluates the likelihood, consequence and potential mitigation of potential risks. The risks can be issues identified in the various assessments or potential developments or catchment management activities.

5.2.5 Resource review (SWOT)

Analysis and options

This is the main analysis phase. It comprises:

- The analysis, correlation and checking of data. It is important that the data used are complete and reliable for any conclusions to be meaningful.
- The use of simple analytical tools, such as SWOT (Strengths, Weaknesses, Opportunities and Threats) and STEEPLED (which is an extended version of PESTEL analysis, examining the Social, Technological, Economic, Environmental, Political, Legal, Ethical and Demographic factors) for scanning components of strategic management and identifying the government and stakeholder's key objectives for catchment management. The opportunities, issues and constraints relevant to achieving those objectives, need to be identified.

SWOT analyses can include the analysis of available land, agricultural yield, availability of water (includes access and quality), sensitive areas, erosion, flood risk, drought risk, health, population density, capacity, capability, etc.

5.2.6 Finalise Vision / Mission statement

Visioning is a key step in democratising and decentralising water resources management. The stakeholders collaboratively determine the vision to encompass the particular catchment characteristics. The process of determining the vision is an iterative process, and it can be refined over time, and it should be re-visited when the CMP is updated or reviewed.

The vision statement provides the basis for developing a series of overarching SMART goals or objectives in relation to the principles of equity, efficiency and sustainability, within the context of the catchment area.

The goals or objectives then direct the development of the various sub-strategies and activities for implementation. The vision is a general statement of a desired future state, usually captured as a catch phrase. The goals and objectives are more specific and can even be prioritised in order to achieve the vision effectively. The vision is the link between the status quo of the catchment and the strategies aimed at managing and improving the natural resources in the catchment to support human welfare, environmental sustainability and economic activities. For example, the National water and sanitation sector mission statement is “Water and Sanitation for All, Always”.

Ultimately the Vision and Objectives are the summary of the component parts of the strategic plan.

The catchment vision is ultimately achieved by negotiation between the stakeholders. This requires a good understanding of the catchment (both current and future) including the opportunities and impacts of activities within the catchment. This is provided by the assessments and analysis of the information. Once the vision has been drafted, the driving forces for scenario development can be discussed.

5.3 Step 3: Planning

Using the information and understanding of the catchment garnered through the assessment tasks and stakeholder engagements, the next phase of the CMP development is to develop and analyse scenarios for development and management of the catchment. These are then translated into strategies and actions and ultimately the implementation plan.

Activities include:

- i) Scenario planning
- ii) Scenario analysis
- iii) Strategies and Themes
- iv) Detailed design
- v) Implementation Plan

5.3.1 Scenario planning

Water, and its associated infrastructure, is a crucial ingredient for many sectors – energy, agriculture, industry, mining, etc. – and for the management of water resources – preventing or mitigating the impacts of floods, drought, erosion, pollution, and coping with existing climatic variability and future climate change. Because its benefits and costs are often far reaching and are not limited to a single sector, water infrastructure planning demands a broad-based, long-term approach that weighs investments in terms of economic efficiency, social equity and environmental sustainability (the principles of IWRM). Scenario planning is a mechanism for assessing these cross-sectoral interactions.

A forecasting system, such as scenario planning will help to highlight priorities for action and resource allocation as well as identify potential impacts or constraints. They also provide a framework within which trade-offs – if necessary – can be made between objectives. Further, infrastructure development proposals are to be effective and not simply a competition for resources and attention, they should not be treated as just financial allocation processes. The most important contribution of effective strategic planning processes is usually the communication between different participants and their alignment around a common set of goals and vision.

Scenario development helps to reduce the consequences of high impact but unpredictable occurrence of certain future events. High impacts but predictable driving forces e.g. population growth and climate change will appear in all scenarios because they are almost certain to happen and therefore there is no need to speculate on them. By varying the state of the driving forces will highlight different development strategies. It is the development strategies that then inform the required development programmes and projects, and implementation activities to support the selected strategies and the preferred scenario.

The framework for scenario planning charts the following steps:

- i) Define the driving forces for change/assumptions
- ii) Bring drivers together into a viable framework
- iii) Produce 7-9 initial mini-scenarios including a base scenario
- iv) Reduce to 2-3 scenarios
- v) Draft the scenarios
- vi) Identify the issues arising and actions needed to achieve the desired outcome.

Note: Most existing sector reports and development plans for Malawi, including the Water Resources Investment Strategy, have already carried out scenario development to compile specific development plans. These existing scenarios should be used in step (iii) to inform the mini-scenarios. This will also facilitate integration of the catchment plans with the existing national and sector development plans.

The **base scenario** is the projected future with the state of the current driving forces remaining unchanged. At the Stakeholder workshops it will be necessary for the stakeholders and CMP team to select the driving forces to use in the scenarios. Potential driving forces could include: environmental degradation (includes sediment ingress and aquatic alien infestation), agricultural development to support development of an export market, infrastructure development (irrigation, hydropower and storage). The resultant impacts of these driving forces form the metrics to select the appropriate scenario i.e. impact to water availability (in terms of quantity and quality), impacts to environment, economic benefits (productivity, costs) and social impacts (upliftment, employment).

Climate change will impact many countries principally through water resources. Water resources management structures must therefore be able to cope with the pressures that will occur. In order to start accommodating climate change into planning frameworks, the existing climate change scenarios will need to be accommodated into the scenario development, e.g. Climate Change and agriculture scenarios for Malawi²⁷. Therefore climate change should be identified as a certainty variable like population growth and not as a driving force between scenario characteristics.

Figure 8 illustrates the differences between four alternative development scenarios discussed in the Climate Change and agriculture scenarios for Malawi²⁸. These or other future scenarios already developed for Malawi could provide the basis for the development of the catchment scenarios.

²⁷ Food and Agriculture Organisation of the United Nations (FAO-EC), 2013

²⁸ As above



Figure 8: Illustrative scenarios developed for assessing the potential impacts of climate change on the agricultural sector in Malawi²⁹

Having developed the general catchment vision and scenarios above, these need to be translated into future development opportunities in each of a number of key thematic areas or sectors. These will form the bases for the individual sector development plans incorporated into the CMP. They also inform the requirements for the development of analytical tools and modelling for the comparison of scenarios.

Sectors to be considered for translating the vision into specific **development scenarios** include:

- **Social:** future population growth and spatial distribution (i.e. urban or rural migrations, population density)
- **Environmental:** biodiversity (including loss of bees), land use change, deforestation, streamflow impacts, climate change impacts, etc.
- **Economic:** economic growth projections, mining and hydropower opportunities, bio fuels, etc. Sub sectors will be considered including, mining, agriculture, manufacturing, power and industry.
- **Infrastructure:** likely or planned developments in terms of new dams, treatment plants, irrigation schemes or other infrastructure development necessary to support the identified catchment vision.

For the comparison of alternative development scenarios it is important to identify key parameters and indicators that can be used to quantify and contrast the potential impact of alternative development scenarios. These are also important for the development of analytical tools and models. While the specific development scenarios described above could be considered as the inputs or boundary conditions for the scenario analysis, the indicators are measured in terms of the outputs.

The indicators can be quantitative (measurable) or qualitative (statement). These indicators should also be grouped according to general goals or development objectives. An example of possible indicators are

²⁹ Food and Agriculture Organisation of the United Nations (FAO-EC), 2013

given in the table below. These indicators must be limited in number to facilitate easy interpretation of the results and must be agreed upon with the stakeholders in advance of the development of the analytical tools as these tools will be developed to report on the identified indicators

Goals	Criteria	Possible Indicators (measurable)
Economic Development	Sustainable economic growth	Agricultural benefits (yield)
	Increased farm income	Hydropower benefits (output)
	Increased energy production	Increased income generation
	Poverty alleviation	Reliability of water supply
Social Development	Water supply and sanitation	Water supply and sanitation
	Reduced threat of water borne disease	Health (reduced child mortality rate)
	Increased employment opportunities	Potential for job creation
	Minimize resettlement	Number of people impacted and potentially requiring resettlement
Environmental Sustainability	Minimize adverse project impacts	Sensitive areas impacted
	Minimum flow provision	Minimum stream flows
	Biodiversity protection	Benefits to sensitive habitats
Implementation	Financial Feasibility or Risk	Financial Requirements
	Economic Feasibility or Risk	Economic rate of return
	Public acceptability	Stakeholder views and acceptability

Scenario planning is very relevant at the catchment wide scale, as it guides development and investment strategies in the catchment as a whole. The activity of scenario planning is not applicable at the village level. The outcomes of scenario planning at the catchment scale should disaggregate down to the village level, especially with specific programmes, projects or activities that need to happen at the applicable village level.

5.3.2 Scenario Analysis

A number of alternative development scenarios will be identified through the individual sector assessment and the catchment visioning process. The potential impacts of these alternative development scenarios can be simulated by identifying the critical “levers” in the individual simulation models. By changing these levers (e.g. by increasing the number of dams, or through improved catchment management practices), then alternative development scenarios can be modelled to investigate how these might meet the competing demands of current and future generations in each catchment.

Not all alternative development scenarios can be modelled due to the limitations of the models, and given the limits of time and budget only a small selection of alternative development scenarios can normally be considered. The modelling of too many alternative scenarios is also confusing to the end user. For this reason it is recommended to limit the number of alternative development scenarios to a maximum of five with the possible consideration of alternative climate change scenarios (e.g. a wet and a dry scenario). The models are used to model the future water resources situation out to 15 to 40 years in future depending on the required planning horizon for the development of the CMP. The results of the different development scenarios are then evaluated through the development of the visualisation and reporting tools.

The analysis of the potential development scenarios informs the development of the CMP. The outcome of this process will develop a strategy for the catchment under review. The next step is to translate this strategy into actions and compile the catchment management plan. A Strategy is essentially the set of options determined to be the best measures for addressing the issues affecting water resources

development and management in the particular catchment. Strategy formulation thus provides the occasion and opportunity to analyse strategic options for the catchment.

5.3.3 Strategies and Themes

From the outputs of the scenario analysis, the stakeholder engagements and catchment assessments, key themes will start emerging, for example:

- ❖ **Creating an enabling environment (institutional)** which addresses the criteria of capacity building, financial support, governance accountability, institutional structures, knowledge growth and training, legislative frameworks, stakeholder participation and water resources management.
- ❖ **Catchment water management** addresses the criteria of Peace, regional cooperation and water resources management.
- ❖ **Water supply and sanitation** addresses the criteria of future generations, improved sanitation, poverty reduction and water supply.
- ❖ **Livelihoods and socio-economic development** addresses the criteria of equitable and reasonable utilisation of water resources, future generations, improved livelihoods, poverty reduction, sustainable social and economic development and water resources management.
- ❖ **Environmental protection, land and disaster management** which addresses the criteria of adaptation to climate variability and climate change, environmental and water resource protection and environmental rehabilitation.
- ❖ **Capacity Building and training** which addresses training and building capacity and capability in catchment management, planning, as well as specific activities identified within the catchment management plan.

The strategic objectives start to flesh out the catchment vision according to the themes identified, i.e. what needs to be achieved in terms of each theme. Each theme may have one or more strategies.

For example:

Strategic objective

The strategic objective is:

“Provide adequate access for various water uses and acceptable sanitation facilities”

Water supply and sanitation strategies

The strategies to achieve this objective are:

- a. Improve access to a sustainable water supply of sufficient quantity and quality from appropriate and sustainable sources.
- b. Provide improved sanitation facilities.
- c. Ensure effective water supply and sanitation asset management.
- d. Ensure wastewater treatment in urban areas and industries.

5.3.4 Detailed Designed

An IWRM approach promotes coordinated development and management of water, land and related resources so as to maximise economic outcomes and social benefit to the users, whilst ensuring the necessary protection of the natural resources. This is a participatory approach and should include

representation of key stakeholders and water users, without compromising the sustainability of the natural environment.

A CMP is neither a conventional investment plan nor a list of capital investments required to meet water requirements. It should rather outline the changes that are required and the benefits of those changes towards ensuring appropriate and sustainable development, and equitable distribution of the resulting benefits. The IWRM-based CMP provides an integrated strategy for the sustainable water resource management in the catchment.

One of the key criteria when drafting a catchment management plan is to develop it in such a way that is easily translatable into action plans that can be pursued in parallel. Most strategic plans address high level initiatives and overarching goals, but don't get translated into day-to-day projects and tasks that will be required in order to achieve the plan.

The detailed design task requires identifying specific activities and actions that are needed in order to achieve the strategic objectives and catchment vision. When identifying the specific activities, check whether other actions are needed to take place in order for the activity to occur, for example getting building materials and training prior to building dam wall. Once the list of activities for each strategy has been identified, the CMP team can then group similar or related activities; coordinate activities that are reliant on other actions; and prioritise the activities. Also identify if the activities are part of a bigger project or programme, and group them as such.

5.3.4.1 Prioritisation

Using criteria that enable an integrated approach to prioritisation is needed. It is proposed that a multi-factorial analysis method be used in order to cater for the variety of factors that will influence prioritisation. These criteria must be agreed upon during stakeholder engagement sessions during the CMP development process, but based on the available data and an understanding of the needs of the catchment. For example:

- Extent of resource requirements
- Available capacity and capability
- Contribution to improved yield
- Contribution to poverty reduction
- Contribution to health
- Contribution to improved environmental health

The prioritisation methodology should be defensible and based on objectively measurable criteria.

The prioritisation would make maximum use of maps and ranking tables that enable an interactive discussion and comparison of sub-catchments. Information available spatially, such as the spatial extent of erosion classes, catchment water flow, available soil moisture and agricultural potential, population density, community flood vulnerability, infrastructure, land use change, aquatic plant population densities are examples of factors that may be presented spatially. High priority activities should include a few “low hanging fruit” to build confidence in the plan, i.e. activities that will bear quick rewards with little effort or resources. In terms of sequencing, some activities may need to be implemented first, prior to other activities, and several activities may occur simultaneously. This may also influence the ranking or prioritisation of activities.

5.3.4.2 Catchment and Sub-Catchment Planning

The overall policy goal for water resources management is to ensure that all citizens in Malawi have access, at affordable costs, to water resources in sufficient quantities and acceptable qualities at the time and place the water is required. The water resources should be used in the social and economic endeavours of water supply and sanitation, irrigation, hydropower, navigation, tourism and enhancement of environment and bio-diversity. The multi-purpose nature of interests in use of water resources, the competition in exploiting the limited water resources development potential and limited investment

opportunities, and the cumulative effect of land use practices on water resources, strongly support the need for integrated development and management of water resources.

The CMP needs to comply with the objectives of the National Water Resources Master Plan. These must be taken into consideration during the preparation of the catchment scenarios and the draft CMP. It is also important that the final CMP is integrated to, links to and builds on other national plans and strategies – including poverty reduction strategies, national strategies to meet the Millennium Development goals, strategies required by key environmental conventions (e.g. National Biodiversity Strategy and Action Plan, National Plan to Combat Desertification and Ramsar requirements).

The CMP provides the framework for the development options of a catchment with individual sector or thematic grouped development plans. The catchment management plan will not only identify potential opportunities but also outline the requirements for these to be developed in a sustainable way.

Unlike an investment plan which lays out a definitive sequence of actions and decisions, a catchment management plan aims at developing a framework for continuing an adaptive process of strategic and coordinated action (both “hard” and “soft” developments).

The CMP describes the current and desired future water resources situation and outlines the overall roadmap for the development and management of the catchment based on the status quo assessment and analysis of alternative development options and scenarios undertaken in previous tasks.

An indicative outline of a CMP report is given in the Box Below:

Draft outline for a Catchment Management Plan (CMP) Report

- 1. Introduction**
 - a. Objectives and purpose of the CMP
 - b. Policy and legal context
- 2. Description of the catchment**
 - a. Natural resources
 - b. People, economic activities, important social aspects
 - c. Present development and use of water
- 3. Strategic Social and Environmental Assessment (SSEA)**
 - a. Issues, vulnerabilities and threats in the catchment
 - b. Potential mitigation measures
- 4. Water resources assessment**
 - a. Rainfall, evaporation, runoff and streamflow
 - b. Groundwater – occurrence, recharge, characteristics
 - c. Flood risk, historical occurrence and impacts
 - d. Drought – historical occurrence and impacts
- 5. Water Demand and Water Balance**
 - a. Present water use and infrastructure
 - b. Projections of future water demand
 - c. Water balance – issues
- 6. Alternative catchment scenarios**
 - a. Vision and Planning objectives
 - b. Development options
 - i. Modifications of existing water infrastructure and use
 - ii. Investment in new infrastructure or rehabilitation
 - iii. Mitigation of adverse impacts of development
 - iv. Catchment protection and water conservation
 - v. Water management options, operating rules
 - vi. Multi-criteria evaluation of alternative plans
- 7. The Catchment Management Strategy**
 - a. The consensus catchment strategy
 - b. Implementation Plan
 - c. Financing Strategy
 - d. Roles and responsibilities
 - e. Monitoring and Evaluation
 - f. Information management
 - g. Capacity building

After having conducted the assessments and analysis, the CMP team will have a broader understanding of the issues in the catchments and the feasibility of potential measures. The CMP team may discuss with the communities how they would like to see their village in the future and may prepare maps with the existing and the potential future situation.

Through the scenario planning feasible options need to be determined, in conjunction with the stakeholders, including improvements in water conservation and management, small scale irrigation methods and dams, forest rehabilitation, provision of market infrastructure, and the relative costs of capital and recurrent costs, operating and maintenance needs, and benefits. Provisional themes for describing strategic planning and implementation options in the catchment include:

- The need for increased water storage, the proposed locations of dams, the requirements for development and mitigation of negative impacts and ensuring safety and sustainability.
- The likely areas for future development in the energy and mining sector and requirements for resources allocation, pollution control and mitigation measures to protect natural resources.

- Resource requirements for agriculture, fisheries and forestry and recommendations for mitigating potential negative impacts of these on other resources users and the ecosystems.
- Opportunities for the development of water infrastructure in support of transport and navigation.
- The requirements for flood and drought management including institutional measures (e.g. insurance, demarcation of flood lines and early warning systems), soft measures (e.g. catchment management, maintenance of wetlands and riparian buffers), and hard measures (e.g. increased storage capacity, berms and flood control levies).
- The prioritisation of areas for interventions in catchment management and land use planning and outlining the necessary steps and support required for this process as well as the mutual benefits that can be obtained for other sectors including water storage and carbon sequestration.
- Priority areas for wetland management and outline appropriate steps in the rehabilitation and management of wetlands in support of sustainable water resources and rural livelihoods.
- Interpretation of national guidelines for riparian area management and the benefits in terms of water resources management, flood mitigation and pollution control and recommendations for different management processes in different areas based on the current situation and pressures.
- Identification of protected areas and areas of critical biodiversity and an assessment of the potential impacts of alternative development scenarios and water resource infrastructure and recommendations for mitigation measures or management options to improve sustainability.
- Identification of the importance and requirements for environmental flows and recommendations for how to quantify these in the individual catchments and the requirements for implementation through for example changes to water related infrastructure design and operating rules.
- Future requirements for water supply and sanitation and the necessary physical infrastructure development, institutional arrangements, operations and maintenance.
- Highlighting of key water quality and pollution management concerns in each catchment and recommendations for ways to improve the situation through for example improved monitoring and enforcement, provision of basic sanitation services, upgrades to treatment plants, changes in agricultural practices and the use of riparian buffers and natural and artificial wetlands.
- Sedimentation concerns with respect to water quality impacts, reduced storage capacity in dams, and in particular the impacts on Lake Malawi, and describe potential development, institutional and land use changes that could improve or manage the situation.
- Potential climate change impacts and appropriate adaptation measures.

In developing these sector specific development plans it is important to recognise that there are many cross-cutting issues and mutually supportive or alternatively contradictory impacts. These need to be pointed out and incorporated as part of the analysis of alternative development scenarios and the overall CMP.

The strategic implementation plan describes the potential timing of development options in order to identify priority actions and to facilitate financing and the long term planning required for some interventions such as the design and construction of a dam or a water supply system or irrigation scheme. The implementation plan for a catchment wide management plan can include broader strategic activities, as well as site specific localised activities including rehabilitation activities, infrastructure development, etc. The CMP and Sub-catchment Plans should be integrated with the Area Development Plans.

Output

Catchment wide and sub-catchment management implementation plan.

5.3.4.3 Micro-Catchment Plan

Micro-Catchment Plans are Sub-Sets of the Catchment and Sub-Catchment Plans. The Catchment and Sub-Catchment Plans delineate the wider land use zones. Overlaid on topographic maps, it identifies areas that should remain under forest cover; steep areas not suitable for farming; stream/river sources and banks that to be placed under protection; cultivable areas to be subject of conservation agriculture, irrigation farming and aquaculture and other land use types.

The Micro-Catchment Plans represent broad integrated land use plans that will be agreed upon by Group Village Heads/Village Heads and key village representatives (Indunas). Technical input of various sectors present in the area must be sought. If not available, arrangements should be made to bring in such expertise.

The objective of Micro-Catchment Plans is to “stratify the area under each Group Village Head into agreeable land use categories” that will be mapped, zoned and accepted to be maintained through legally binding arrangements in conformity with the Land Bill (2013).

Such land use planning must provide goods required by villagers for their daily livelihoods (timber, fuel – wood and charcoal, food crops, etc.). The planning must also provide for regulating services – climate control, water quality control, disaster control and where feasible wildlife habitat regulation. Cultural aspects of land use must be accorded its rightful pace in the integrated land use planning. Envisaged land use categories/zones include the following:

- Agricultural land (where soil and water conservation land husbandry practices will be instituted – contour bunding, box ridging, agroforestry, conservation agriculture, fish farming);
- Permanent forest-cover areas (land which would be identified and agreed upon by villagers as marginally suitable/not suitable for crop production). Participatory Forest management plans to be prepared for conservation and sustainable utilization of such forest land;
- Riverine/stream conservation strips (which may be developed through engineering works to support irrigation farming and fish farming);
- Grazing land (marginal areas that can be developed to provide grazing for livestock); and
- Wetlands – management of wetlands as sources of water and associated biodiversity conservation activities.

Consideration will also be made to set aside adequate land for current and future needs of infrastructure development including school blocks, health units, community centres roads and bridges and other social facilities. It is not for the CMP to invest in such construction, however, such plans need to be integrated with the local District Councils as input into their planning and programming of development activities.

For the micro-catchment plans to be sustainable, they will need to be integrated into the overall District Development Planning system. This will allow local communities to develop by-laws which enforce the micro-catchment management and land use plans. Further, the priorities of each land use plan must be integrated into the Village Action Plan (VAPs), which will be costed to become a Village Investment Plan (VIPs). Development of VAPs and VIPs is a strategic activity to ensure that such priorities are integrated into the District Development Plan (DDPs) and the District Investment Plan, which directly increases sustainability as such plans access funds from the District Development Fund and other financing mechanisms such as the Local Development Fund (LDF) and the Constituency Development Fund (CDF).

Output

Micro-catchment implementation plan.

5.3.4.4 Village-Level Action Plans

The preparation of Village-Level Action Plans follows the basic approach adopted in the preparation of Micro-Catchment Plans. However, the emphasis needs to be placed on the enforcement of the adoption good land husbandry practices at household level.

The aim is to sustainably increase crop yield on limited land available for smallholder agriculture. This will enhance food security thereby mitigating the need for villagers to extend into marginal land for cultivation.

Further, the aim is to reduce the dependency on charcoal, thereby reducing the deforestation in Malawi. The measures include:

- Permaculture principles;
- Homestead tree planting;
- Agroforestry practices – alley cropping; intercropping, hedges and wind breaks,
- Conservation agriculture – which will embrace soil and water conservation measures.
- Afforestation with beneficial trees.
- Alternative energy sources
- Alternative income generation

The preparation of Village-Level Action Plans should be a participatory process that will be subject to monitoring and periodic reviews so that a robust system of Village-Level Planning is instituted.

Output

Village-level catchment management implementation plans for each village clustered under a Group Village, including activity details for small structures.

5.3.5 Implementation Plan

The implementation plan is the ultimate deliverable from the CMP process. The Implementation plan is the roadmap that contains all the actions and activities, projects and programmes that have been identified in order to achieve the strategic objectives and the catchment-specific vision. The Implementation can be compiled according to each scale of catchment or its components, i.e. from Village action plan to micro-catchment, to sub-catchment to catchment/Water Resource area.

Working with the prioritised list of actions and activities further details are captured. Usually a table format is the simplest to work with. The implementation plan must be a realistic plan that includes a clear definition of roles and responsibilities, a sound financing strategy, provision for capacity-building, and systems to monitor progress and make adjustments as needed. For each action, identify who is responsible for the action; identify potential source of funding for the activity. Also think about the scale of the activities, are they relevant in a particular village/field or community, a particular area, or are they applicable to the catchment as a whole. Identify what indicator could be used to monitor progress of achieving the activity.

5.3.5.1 Elements of the Implementation Plan

The Implementation Plan is presented in Table format, according to the strategic theme that support the catchment vision. Each strategy under the strategic themes is then expanded as follows:

- a) Targets - what are the specific activity/ies aiming to achieve;
- b) Activities (implementation actions);
- c) Indicators (Monitoring and Evaluation), to measure outcomes of Activities,
- d) Timeframes: Short (6 months), Medium (1-2 years) or Long (3-5 years) for implementation of Activities;
- e) Responsibility, at Catchment /WRA scale, micro-catchment scale, village scale and Other Stakeholders for implementation of the Plan;
- f) Costing / Funding Source, per Activity.

This is illustrated in an example in Table 7.

Note, that the activities identified are not limited to jurisdiction of the catchment. Some activities identified may require legislative or national policy adjustment.

Table 7: Example of an Implementation Plan

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: To increase the resilience of the Catchment and its people to natural and human pressures through sound land and environmental management practices.								
Strategy 5.6: Climate change adaptation and preparedness								
Target	Activities	Indicators (M&E)	Time frame	Responsibility				Costing & Funding Sources
				Catchment Scale	Sub-catchment Scale	Micro Scale	Other Stakeholders	
a) <i>Flood management</i>	<ul style="list-style-type: none"> Determine flood lines for populated areas - rural, urban and industrial areas. Provide floodplain development protocols (i.e. suitability of land uses in floodplains). Review role of infrastructure in flood management and the expected role of currently proposed infrastructure. Develop flood management plan for each watershed. 	<ul style="list-style-type: none"> Flood lines defined. Floodplain development protocol developed, implemented and regulated. Flood management plans (flood mitigation and adaptation strategy) developed. Catchment flood management councils/committees established. 	Short/Medium	<ul style="list-style-type: none"> CMC to facilitate the identification of flood prone areas in the catchment. To facilitate the development of strategies and guidelines for flood management at catchment scale. 	<ul style="list-style-type: none"> Districts to map out flood prone areas at sub-catchment level. To develop sub-catchment flood management strategies and guidelines. 	<ul style="list-style-type: none"> Districts, to map out micro flood prone areas. To develop and implement flood management strategies at micro levels. 	<ul style="list-style-type: none"> NGO, Private Sector, water users. Donors, academic institutions, etc., to support the identification and development of flood management strategies through information provision, research and funding. 	<ul style="list-style-type: none"> Annual Budget Donor funding Private Sector Service Fees
b) <i>Drought management</i>	<ul style="list-style-type: none"> Develop Sub-catchment Drought 	<ul style="list-style-type: none"> Sub-catchment requirements for UN Convention to 	Short	<ul style="list-style-type: none"> CMC to coordinate the development of 	Districts to develop and implement sub-catchment drought management plans	<ul style="list-style-type: none"> Districts, etc. to develop and implement 	<ul style="list-style-type: none"> NGO, Private Sector, water users. Donors, etc., to 	<ul style="list-style-type: none"> Annual Budget Donor funding Private Sector

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: To increase the resilience of the Catchment and its people to natural and human pressures through sound land and environmental management practices.								
Strategy 5.6: Climate change adaptation and preparedness								
Target	Activities	Indicators (M&E)	Time frame	Responsibility				Costing & Funding Sources
				Catchment Scale	Sub-catchment Scale	Micro Scale	Other Stakeholders	
plans	Management Plans. • Develop Catchment-wide drought management Plan.	combat desertification are met.		Catchment-wide drought preparedness plans.	in line with the catchment wide plan	micro drought management plans in line with sub-catchment and catchment wide plans.	support micro, sub-catchment and catchment wide drought management plans including provision of information.	• Service Fees

5.4 Step 4: Implementation

The responsible parties identified in the implementation plan are tasked with implementing the activities identified. This may require including the activities into the business plans of government organisations, work plans of district and local institutions, or mobilising communities, villages and farmers. The Catchment Management Committee is tasked with monitoring the implementation of catchment management plan; similarly the AWU or VNRMC is tasked with monitoring implementation at the small catchment component levels.

Activities include:

- i) Technical designs
- ii) Investment IEE
- iii) Procurement
- iv) Capacity building and training

5.4.1 Technical designs

After completion of the preparatory activities for a certain sub project, the preliminary design followed by the detailed design of a structure or the improvement of a small scale irrigation scheme, small dam or district-level infrastructure or market infrastructure can be made. This will again be a participatory process. Followed by the preparation of documentation like specifications, bill of quantities and bidding documents.

5.4.2 Environmental Assessment

The rapid environmental assessment focuses on investments proposed as part of the intervention targeting process. The assessment needs to be undertaken with due regard to the requirements for Environmental Impact Assessment in Malawi, as set by the Environmental Management Act of 1996, and the 1997 Malawi EIA Guidelines. The objective conducting an environmental assessment is to ensure that any potential adverse environmental impacts are identified early and proposed mitigation measures are proposed, thus enhancing sustainability of the proposed investments. All activities must comply with the Environmental Impact Assessment legislation and requirements, where applicable.

5.4.3 Procurement facilitation

In the catchment, the facilitation of procurement will focus on the necessary inputs to implement the catchment, micro-catchment and village plans.

5.4.4 Capacity building and training

Ongoing capacity building and training are important to ensure the successful implementation of the catchment plans, and to ensure that there is knowledge transfer through the generations and succession of implementers. Capacity building and training should not be limited to the various technical topics in the implementation plan, but should also include the operational, institutional and administrative activities of developing, implementing, monitoring and revising the catchment management plans.

5.5 Step 5: Monitor and Revise

Monitoring and evaluation (M&E) is essential to ensure that implementation is on track, to measure short and long term impacts and to evaluate the impacts in order to modify the plan or its implementation (as necessary). M&E will be guided by the specific result-based indicators described in the Implementation Plan. For the projects/programmes, this will include M&E of progress in terms of implementation programmes and actual against planned expenditure, among others. More detailed step-wise M&E indicators should be identified for each projects/programme so that progress can be adequately tracked and evaluated.

The reporting system, to be implemented by the CMC, would have to be designed in such a way that progress is tracked for the individual activities of the CMP. Problems encountered and the measures taken to address the problems should be reported on a quarterly and annual basis. In addition, systematic periodic evaluation and objective assessment of the progress made towards the achievement of the overall goal of the CMP should be done.

Activities include:

- i) Monitoring and evaluation system
- ii) Monitoring framework
- iii) Targets and indicators
- iv) Evaluation sheet
- v) Evaluation and Feedback
- vi) Manage data
- vii) Reporting
- viii) Communicating
- ix) Update, adapt revise plan

5.5.1 Monitoring and Evaluation System

Key components of the monitoring and evaluation (M&E) system should be the selection of the indicators and ensuring feedback of the results into the decision-making and implementation processes. In simple terms, M&E is necessary to ensure that implementation takes place with the intended results and impacts. A proper M&E system, whose results are shared among stakeholders, also fosters accountability and transparency, and is likely to generate broad-based support for the plan implementation. It is essential that there is full consistency between the goals, objectives, strategies, activities and the chosen indicators.

M&E systems can be costly³⁰ and often require significant human, data and financial resources. It is therefore necessary to develop an efficient, effective and sustainable system, which can be implemented within existing or planned for resources and line functions. The data and their

³⁰ The costs of no M & E may be considerably higher when plan implementation is ineffective and inefficient.

interpretation should be rigorous and robust; it is important to measure what is valued, not value what is being measured. Interpreting and acting on the data is as important as the data collection itself.

It is extremely important that the Strategies and Plans are monitored and evaluated on a regular basis. How often, and when, monitoring is carried out will be dictated by what is being measured – environmental improvements will have different timescales to budget expenditure. Stakeholders need to know whether progress is being made and what the achievements have been at any given moment. M&E will also provide everyone with indications of where delays or diversions are being experienced, so these can be addressed. Monitoring also provides an evidence base to show funders that you are using their money effectively, to identify where more funding is required to tackle new issues, or try new actions where stubborn problems remain. Formal monitoring results are often shared with wider stakeholders and funders, whilst informal monitoring will be restricted to those managing the process.

Importantly, the Strategies and Plans are “living documents” and should not stay static, as circumstances are not static. M&E allows for timely adjustments and/or updates. Ideally the Catchment Management and Implementation Plan should be reviewed and updated every five years. Use the results of monitoring to identify what has or has not, or can and cannot be achieved when revising the plan.

5.5.2 Monitoring Framework

The M&E should focus on the implementation issues (are activities implemented according to planning) and the results (e.g. is water used more efficiently?).

M&E can aid the successful implementation of the Catchment Management Plan; ensure that targets and goals set out in the CMP are achieved and problems regarding implementation are detected early and addressed. Monitoring of the CMP and achievements will be done on the basis of the Implementation Plan and identified progress indicators.

Monitoring and evaluation will be guided by the specific result-based indicators described in the Implementation Plan. For the projects, this will include M&E of progress in terms of implementation programmes and actual against planned expenditure, among others. For individual projects/programmes, more detailed step-wise M&E indicators should be identified for each projects/programme so that progress can be adequately tracked and evaluated.

The reporting system, to be implemented by the CMC, would have to be designed in such a way that progress is tracked for the individual activities of the CMP, problems encountered and the measures taken to address the problems are reported on a quarterly and annual basis. In addition, systematic periodic evaluation and objective assessment of the progress made towards the achievement of the CMP overall goal will be done.

5.5.3 Targets and Indicators

The evaluation is based on the monitoring results and possible additional data collected. It provides feedback into the decision making process, and may lead to adjustments in the plan and its implementation. Good targets and indicators, stakeholder participation in monitoring process, as well as good feedback mechanisms are essential for effective M&E.

An indicator is a “pointer” that helps you to measure progress towards achieving results. There are two types of indicators: quantitative indicators (measurable) and qualitative indicators (statement).

An indicator, quantitative or qualitative, provides a simple and reliable means to measure or reflect the changes connected to catchment management interventions. An indicator helps to isolate a result or change. Indicators are not important on their own but they are important at pointing or signalling the change that is a result of planned interventions derived from the implementation plan. The indicator is not the change but the indicator signals the change. Indicators should be used for establishing a

baseline for an intervention within the catchment area. The baseline values are used to track progress of a catchment intervention or lack thereof and to monitor whether it achieves the objectives set out.

A good indicator should have the following characteristics:

Specific – the indicator should be giving specific information regarding a change or changes that have occurred;

Measurable – the indicators should be measurable;

Attainable – the indicator should not be for showing off but there should be possibility of attaining it;

Realistic – the indicator should be reliable in a sense that it should give you information required every time you call upon it; and

Time bound – the indicator should be sensitive to time.

When selecting an indicator it is important to look at the following:

- a) **Validity:** Does the indicator allow you to be precise in measuring the results (quantity, quality, time-bound) that conforms to the needs and priorities set out in the CMP.
- b) **Reliability:** Do the indicators measure trends over time (for example: the absenteeism rate of children in primary school may vary according to the time of the year, in relation with the calendar of agricultural activities)? To be reliable, the information must normally be collected at the same time period.
- c) **Representivity:** Do the indicators provide disaggregated information by sex, age group, etc.)?
- d) **Simplicity:** Is the information available and will it be feasible to collect and analyse it?
- e) **Affordability:** Can we afford to collect and analyse this information?

5.5.4 Monitoring & Evaluation sheet

The format of an M&E Sheet would be fairly similar to the implementation table, i.e. the columns of targets, activities, the indicators, and a scoring column and notes/progress column, and a date column, and who was responsible for the monitoring assessment. This is then used as a scorecard, and can be kept as records to follow progress. It would be useful to arrange the activities into time-order as well i.e. short, medium and long, so it is easy to follow what should be done immediately.

A scoring matrix would be needed, so that the same rating can be used in the future and not be subjective. Possible scoring types could include:

- Measurement against set targets, e.g. expressed as % or numbers achieved
- Fixed measurement e.g. hectares or number of schemes
- Qualitative / subjective evaluation, which could e.g. be on a scale from 1 to 5

An M&E example from the implementation plan is shown in Table 8 below.

Table 8: Monitoring and Evaluation example

Strategic Option 4: Livelihoods and Socio-economic development					
Strategic Objective: To develop and manage water resources to serve social and economic development in the catchment.					
Strategy 4.1: Water demand of intensified, modernised agricultural and aquaculture developments					
Target	Indicators (M&E)	Timeframe	Responsibility		
			Catchment Scale	Micro-catchment Scale	Village Scale
c) <i>Irrigation and drainage</i>	<ul style="list-style-type: none"> Irrigation development plan (Catchment master plan) in place Area under irrigation in ha Efficiency of water use New irrigation projects implemented 	Quarterly data and annual evaluation	CMC – evaluation, assessment and feedback	Data management and evaluation	Provide information

An example associated M&E sheet is shown in Table 9.

Table 9: Monitoring and Evaluation example sheet

Strategic Option 4: Livelihoods and Socio-economic development						
Strategic Objective: To develop and manage water resources to serve social and economic development in the catchment.						
Strategy 4.1: Water demand of intensified, modernised agricultural and aquaculture developments						
Target	Activities	Indicators (M&E)	Scoring	Notes/ progress	Date	Assessed by
c) <i>Irrigation and drainage</i>	Develop the catchment's irrigation master plan in which lands best suited to irrigation are defined and a long term irrigation development plan put forward for discussion with stakeholders. Opportunity to be linked to needs.	Irrigation development plan (Catchment master plan) in place	Yes/no	Note progress on development of irrigation master plan.	Capture date	Institution responsible for monitoring assessment
c) <i>Irrigation and drainage</i>	Existing irrigation schemes evaluated and indicated improvements implemented.	Area under type of irrigation in ha (or alt. number of improvements)	X hectares	Notes on improvements for existing irrigation schemes	Capture date	Institution responsible for monitoring assessment
c) <i>Irrigation and drainage</i>	Plan for the expansion of irrigation within the limitations of	Studies completed	No of studies	Notes on irrigation	Capture date	Institution responsible for monitoring

Strategic Option 4: Livelihoods and Socio-economic development						
Strategic Objective: To develop and manage water resources to serve social and economic development in the catchment.						
Strategy 4.1: Water demand of intensified, modernised agricultural and aquaculture developments						
Target	Activities	Indicators (M&E)	Scoring	Notes/ progress	Date	Assessed by
drainage	catchment water access.			expansion		assessment
c) Irrigation and drainage	Seek optimal use of irrigation water through crop selection, improved irrigation methods and WC/WDM	Efficiency of water use	Scale from 1 to 5	Notes on efficiency improvements achieved	Capture date	Institution responsible for monitoring assessment
c) Irrigation and drainage	Implement planned irrigation projects - as per the proposed development programme (construction of dams and introduction of more diversion. Refer to the list of proposed implementation projects.	New irrigation projects implemented (alt. status of implementation)	No of projects	Notes on schemes & associated progress	Capture date	Institution responsible for monitoring assessment

There are many data collection methods and their choice will depend mostly on their simplicity and cost. The data collection methods can also be classified into quantitative and qualitative methods.

For quantitative methods, the structured questionnaire is the most used and this will collect data on frequencies, numbers and quantities.

For qualitative data collection a number of methods are used and these include:

- ❖ Participatory Rural Appraisal (PRA),
- ❖ Participatory Learning and Action (PLA),
- ❖ Self-assessment,
- ❖ Testimonials,
- ❖ Focus groups,
- ❖ Participant observation,
- ❖ Case studies,
- ❖ Individual and group interviews,
- ❖ Documentary content analysis, etc.

Surveys are usually used to collect both qualitative and quantitative data.

5.5.5 Evaluation and Feedback

The monitoring results need to be annually evaluated. Data analysis or interpretation means making sense of the data that you have collected – it is a collection of methods used to derive useful information from collections of data. Data analysis is used in any field that collects data and wants to have useful information. In the context of catchment management monitoring and evaluation, data analysis is supposed to be an integral part of the operations to decipher meaning and isolate results that are being generated by the programme.

The findings should be discussed in the CMC and the implementing institutions need to ensure that implementation remains on schedule and yield good results. The findings of the evaluation need to be incorporated in to Malawi's development planning cycle (mid-term review and national and district

development plans) and in the plans of major stakeholders. Evaluation may lead to modification of the CMP or its implementation.

5.5.6 **Managing data**

As reporting on indicators will be carried out by different institutions, it is important to ensure the data collected are managed and stored in an accessible format and place. Information Management, as discussed in Step 2, should also accommodate the information collected in terms of M&E.

5.5.7 **Reporting**

Reporting takes two forms. The first relates to reporting on progress on the Implementation Plan as a whole. This should be undertaken by a task team that meets every 6 months. The second relates to the reporting on the achievement of the specific actions and targets. It is important to report on progress of the activities and targets using the indicators. The timeframe for carrying out assessments must be realistic, i.e. it must provide time for projects to be implemented and take effect. A standard reporting timeframe is 2-3 years, depending on the targets and the longevity of the Implementation Plan. It is important to note that the institutions that were tasked specific activities are responsible for reporting on the activity specific indicators. This may result in several institutions reporting on the same target.

5.5.8 **Communicating**

It is important to ensure the effective communication of progress against the targets, to all stakeholders involved, as well as the general public is carried out in order to build trust in the Catchment Management Plan. Communication can take the form of newspaper articles, updated progress chart on a webpage or regular newsletter.

When reporting, the message should be clear and unambiguous for specific audiences e.g. VDC, ADC, DDC or donor. The results should be clear and make sense to the target audience. There should be an agreed frequency for reporting. The information should be timely, and any delays should be explained for credibility. Keep it simple and focused.

Presentation and format determines how well the information is actually received by the targeted audience. The results should be presented in such a way that the target audience will relate to them and understand the results. It is recommended to write a report in a predetermined format. Within the format the information or results should be presented in a compelling manner, for example by using pictures graphs, tables and summaries.

6 Participatory approaches for catchment management planning

This chapter outlines various approaches for participatory planning in the catchment context. The CMP team or project team should select the approach that most suits their needs or type of information they require. The following participatory techniques are outlined in this chapter:

1. Village meetings
2. Participatory Rural Appraisal (PRA)
3. Visual mapping
4. Transect walk
5. Semi-structured interviews
6. One-to-one interview
7. Action research
8. Group work
9. Rapid (Relaxed) Appraisal of Agriculture Knowledge Systems (RAAKS)

These techniques can be used in conjunction with each other.

There are a couple of basic rules to adhere to in all the approaches:

- Respect stakeholders, learn with them and learn from them.
- Be patient and courteous – don't undermine, intimidate, exclude or label people.
- Try not to interrupt speakers.
- Find ways to help people to express and analyse their knowledge.
- Resist the temptation to impose your ideas and values.
- Be aware of your body language during the meeting. Be respectful.
- Be approachable.
- Be interested.
- Turn your mobile phone off. Don't text or take calls during the participatory approach, unless it is a dire emergency.
- Follow protocol, where applicable, both cultural and political.
- If you record, photograph or film any of the participation sessions, be sure to ask permission from the participants first.

6.1 Village meetings

Village meetings bring different groups of people together to discuss the project, gain information and get feedback. The way you conduct the first village meeting is critical as it sets the tone for your future relationship with the people in the area. At the first meeting give a full account of:

- Who you are
- Where you are from
- What organisation you are working for
- Who is funding the project
- Why you are there
- What you plan to do
- What you expect of the stakeholders
- What they can expect from you
- The expected time period of the project
- An outline of other projects.

Do not raise unrealistic expectations by agreeing to things that the project may not be able to achieve or deliver. Rather make clear from the beginning the limits of what the project can achieve. Agree on a

course of action only if you are quite certain that it can go forward. If you are not sure about a suggestion, keep the possibility open. Be attentive. Listen, listening in itself encourages people to come up with practical ideas that may have seemed impossible before.

At the end of a village meeting, express appreciation for the stakeholder's time. Highlight the important features of the meeting. Arrange times and venues for activities that were agreed upon in the meeting. Be cautious not to create false expectations or bad attitudes. Catchment management is important for everyone. It is not for practitioners to "pay" stakeholders to carry out good catchment practices. Be cautious about creating this expectation.

This method is appropriate for Village and Micro-catchment planning.

6.2 Participatory Rural Appraisal (PRA)

This method involves local people carrying out their own appraisal, analysis and actions. It uses group exercises and interactive visual tools to facilitate information sharing and analysis. PRA encourages shared learning and gives people the freedom to try and fail, or succeed. It views mistakes as learning opportunities and chances for constructive criticism. In this way the people own the decisions and are committed to the work.

The practise of PRA means:

- **Reverse the conventional direction learning:** Gain social, physical and technical knowledge from and with people face-to-face. Facilitate analysis by letting people use maps, diagrams, explanation, planning, monitoring and evaluation.
- **Understand the power of the practitioner's role:** Denying your power as a practitioner simply confuses people – it works better to discuss with stakeholders how you can use your power effectively.
- **Work as a team:** A balanced team represents environmental, socio-economic and cultural perspectives. The team should include local stakeholders who know the area, as well as people with the required skills and knowledge.
- **Share knowledge:** Share knowledge and experience willingly and openly, allowing for self-critical appraisal and learning from others. Local people should share knowledge amongst themselves and with outsiders. Practitioners should share their findings with each other and with the local people.
- **Use non-authoritarian approaches:** Listen rather than lecture, be relaxed and unhurried, probe and explore instead of rushing to the next topic, don't dominate or control, learn about the community's concerns and priorities. Enable the people to do their own research and analysis and state their own priorities.
- **Make trade-offs:** Balance the costs of different ways of learning against usefulness of the information. Make trade-offs between quantity, relevance, accuracy and timeliness of different approaches to learning.
- **Triangulate:** Use a range of methods, investigators and disciplines to crosscheck information. PRA recommends that you draw on at least three sources of information to make the necessary recommendations and decisions.
- **Seek diversity:** Deliberately look for contradictions and differences rather than simply working with averages.

PRA can be carried out all scales of catchment planning. However, at the broader catchment scale, it is recommended to carry out several PRA workshops throughout the catchment, rather than attempt to cover the whole catchment in one PRA.

6.3 Visual mapping

Visual mapping is the collective act of drawing a map. It builds rapport among the people making the drawing, and generates lively discussions about the environmental, economic and social aspects in

the catchment. The map can later be used to plan, implement and evaluate IWRM activities. Two common maps used in IWRM are:

- Social maps, which show a village, including households, gardens, beehives, schools, roads, streams and rivers.
- Resource maps, which show land-use patterns, trees, rivers, ponds, and soil types, problem areas.

Mapping helps participating stakeholders describe locations, land tenure patterns and the condition of the land. It gives people a clearer spatial understanding of the upstream and downstream effects of IWRM.

First plan a rough layout of the map. Participants need to agree on the type of map (social map, resource map, or a combination), the categories of information to include, the physical area that will be mapped, the format (size and shape of the paper), and the orientation (where to position north and south). Where paper isn't available, drawing in the sand, or on the side of a building is also fine.

Stakeholders then use coloured pens (markers) to show different features and how they experience the catchment and river (not simply just a drawing of the river and its physical features). The practitioner and project team should not interfere in this part of the exercise. When the drawing is complete, the practitioner can hold a semi-structured interview. People may then decide to add new information, such as number of schoolchildren, beehives, crop yields and size of pastures.

Questions to stimulate a resource map:

- What crops are planted?
- What farming systems are applied?
- How is the farm managed?
- What is the yield of the farm?
- Where does the farm get its water from?

This technique can be carried at for all the various scales of catchment planning. At the broader scale, the participants can be grouped, and several visual maps for the different parts of the catchment created.

The visual map can also be used in developing a vision. First let the participants create a map of their "catchment" showing the present day. Then add/delete from the map what they would like for their future.

Information in the map can be verified with a transect walk.

6.4 Transect walk

In a transect walk, stakeholders identify and discuss different aspects of the catchment as they walk through part of the catchment. They walk along a chosen route, talking among themselves and with the practitioner about things that they notice, and things that impact on water resources: such as soil conditions, erosion, land use patterns, location of- /state of water collection points, irrigation, landslides and gullies, ground cover, etc. Group discussions around overgrazing, deforestation, soil conditions, pasture conditions, farming systems applied, are useful topics for discussion and understanding the level of awareness of catchment issues.

Make sure not to walk too fast on a transect walk. Be observant and ask questions, "Why?", "what do you think?" Encourage participants to ask their own questions and share their knowledge about the use of local resources.

- Wear suitable shoes (hat, suncream, water, may also be appropriate)
- Plan the route with the stakeholders (identify what needs to be seen).
- Take notes, photos. Mark on the route map points of interest and discussion.
- If the walk focuses on a specific aspect, make sure the participants have the necessary background knowledge.

Transect walk is appropriate for village scale and micro-scale catchment planning. A transect walk may also be carried out where specific issues have been identified in the broader catchment planning process, as means to gather more information about the issue.

6.5 Semi-structured interviews

A semi-structured (conversational) interview is one with a loose structure that responds to the person or group being interviewed. Many participatory techniques, such as mapping, transect walks, etc. use this tool to gain more insight into relevant issues or topics. For example, after a group of stakeholders has drawn a visual map, you can use a semi-structured interview to enable them to share their knowledge, experiences, perceptions and understanding of the map.

A semi-structured interview allows a free flow of conversation so that participating stakeholders can introduce whatever topics they feel are important. One-to-one interviews are better when the issues being discussed are specific or sensitive, but a semi-structures group interview also works when a topic is applicable to many people. Be aware of one or two strong participants hi-jacking the conversation. Be sure to enable everyone to participate and contribute their own views in the discussion.

Semi-structured interviews can be carried out all scales of catchment planning. With larger groups of stakeholders, break into smaller groups to facilitate more discussion and inputs from the participants. A small group (± 10 people or less) is more personalised than a large group (30 people and more). Consider the type of information you would to gain from the conservation, and arrange your groups accordingly. For example, if you want to raise women's role in water management, then have a group of only women, don't group the women with the men.

6.6 One-to-one Interview

Gently guide and balance the interview to ensure that the person remains focused on the task. Don't be rude or forceful. Use a mental (or written) list of questions to make sure you achieve the aims of the interview, but always remain open to exploring new or unexpected issues that the interview raises. Start with open-ended questions, then look into specific issues. Use both visual and verbal methods to probe. A useful strategy is to apply the 'but-why?' method to get to the deeper causes. Accurately record and date the information from the interviews. You can synthesis your own notes, but keep an accurate reflection of the interview. Give copies of the interview reports to the stakeholders. If you record the interview, be sure to ask permission from the interviewee first.

6.7 Group work

Divide the stakeholders into smaller groups to explore specific issues. Features which can change over time include:

- Extent of land cultivated
- Extent of pastures
- Extent of erosion
- Extent of forests
- Availability of water
- Number of cattle, sheep, goats, pigs, chickens, horses, donkeys
- Farming practices used (rotation, mono-cropping), etc.

Small group techniques are useful in workshops with a large number of participants. They give quiet, less dominant members a chance to express their views. There are many different small group methods, including problem census and brainstorming.

Practitioners need to clearly explain the purpose of a group exercise to all participants. Once in their small groups participants discuss the task and carry out the exercise. Then the whole (plenary) group comes back together to reflect on each small group's findings and explore the issue further.

This technique is appropriate for broad scale planning. Where detailed more specific information is required, then the small scale approaches such as village meetings, visual mapping and PRA can be used in conjunction with group work.

6.8 Action Research

Action Research is a method of getting diverse social groups to work together in ways that consciously build their relationship. By working towards a common purpose, the groups begin to understand the social, economic, historical and political forces that influence them and others, and that they have on each other (upstream – downstream).

The Action Research process is a series of structured interactions. First, the problem is defined. Then the action is planned. Then the action is carried out. Finally the action is observed and reflected upon. The problem is then redefined (or next problem identified), further action is planned, and another cycle of action research takes place. Action Research can be described as a spiral of events in which action and relationships evolve as the cycle goes forward.

Action Research is a process of learning by doing, and learning with others. It helps participants learn about their practices, languages, modes of work and power relationships. They examine how their skills and values shape their identity and the socio-political structures around them, and how social structures may be limiting their growth. All parties gain a broad perspective on new possibilities to make decisions about the structures and interventions they need. The method is a good way to challenge unjust and unproductive systems of working. It helps people look critically at how oppressive and destructive situations are created and maintained. It helps upstream and downstream participants understand each other's contexts.

This technique is appropriate for catchment-wide planning.

6.9 Rapid (Relaxed) Appraisal of Agriculture Knowledge Systems (RAAKS) (taking over projects)

RAAKS is an action-orientated method for stakeholder analysis and problem solving. It is a way of systematically monitoring and improving stakeholder performance. The method enables stakeholders to gain an overview rather than see the project from one perspective. RAAKS uses systems thinking, multiple perspectives, action orientation, and participatory and joint learning.

There are 3 phases in the RAAKS cycle, which can be repeated continuously:

- Define the problem situation and identify all relevant stakeholders, whether these are individuals, groups, or organisational networks;
- Analyse constraints and opportunities;
- Plan actions to improve performance.

Typical questions when RAAKS is applied:

- Which individuals, groups or organisations are stakeholders? Which has an interest or influence on the work in the catchment?
- What are the objectives of the different groups? What actions do they pursue?
- What external factors influence what happens in the catchment?
- What linkages exist between stakeholders? What is the content and quality of those linkages?
- To which other relevant networks do stakeholders belong?
- What constraints and opportunities do you see in the joint work of stakeholders in the catchment?

This technique is appropriate for catchment scale and sub-catchment planning.

7 MODELLING

7.1 Establishment of Analytical Tools and Simulation Models

Water resources decision-making is increasingly becoming a multi-stakeholder negotiation process, which can be well served by analytical tools and simulation models. In such a process, the decision for selecting among a set of possible development and management options has to take into account the priorities and preferences of a range of stakeholders and decision-makers (in a multi-jurisdiction context). In the policy and strategy domain, these tools and models provide the prerequisite shared knowledge base to support the joint identification of development strategies. In the planning and management domain, the tools and models enable the evaluation of impacts and benefits of alternative water resources development and catchment management plans in order to inform scenario development and analysis.

In line with the above, simulation, optimisation, and multi-criteria analytical tools are required. The following sub-tasks are envisaged for the establishment and application of these analytical tools and simulation models:

- Formulation of an integrated modelling framework as a decision support system (DSS)
- Selection of the most appropriate catchment component models (e.g. aquifer models as opposed to rainfall-runoff or hydrodynamic channel flow models)
- Configuration of individual baseline catchment or component models
- Validation of individual catchment or component models
- Simulation of alternative development scenarios

7.2 Formulation of an Integrated Modelling Framework as a Decision Support System (DSS)

The design of the DSS must be focused on the need to support the analysis of alternative development scenarios or components of the scenarios in line with the catchment vision. This requires the identification and assessment of the most appropriate analytical tool or model to address each of the requirements of the scenarios. The latter process informs the formulation of an integrated framework of tools and simulation models, i.e. the DSS, to quantify potential impacts and benefits of alternative development scenarios. The core of these models is usually a water resources simulation model, but other components of an integrated modelling framework could include, but are not limited to, the components listed in Table 10 below.

Table 10: Potential model components

Model Components	Summary
Rainfall/Runoff model	Converts rainfall into catchment run-off at a given time interval.
Land use change model	Evaluate impacts of land use change in terms of catchment runoff, natural capital and resource development, and carbon sequestration.
Irrigation and crop model	Determine the potential for agricultural development including suitable crops and potential yields as well as irrigation demand requirements.
Erosion and sedimentation models	Potential impacts of land use change and management development options on erosion and sediment production.
Water quality model	Impacts of alternative development options on water quality
Groundwater model	Models the potential for groundwater development and impacts.

Model Components	Summary
Hydropower model	Determine hydropower potential under alternative development, operational, and climate change scenarios.
Ecosystem model	Model potential impacts of alternative catchment management processes on natural ecosystems including nutrient dynamics of soils, water resources impacts, soil productivity and carbon budgets.
Economic (Cost/Benefit) model	Evaluate the potential impact of alternative development options in terms of job creation, income and contribution to economic growth in order to do a simple cost/benefit of alternative development scenarios.

Choosing the appropriate scale (spatial and temporal) and the level of complexity of the individual component models is critical. This will be informed partly by the requirements of the DSS, but will also be influenced by the availability of data for calibration and validation of the individual models so as to avoid over precision. The final selection of scale should be made early in the CMP development in consultation with the stakeholders.

Spatially, it is likely that each catchment will be divided into five to ten sub-catchments that will be defined by the major rivers and the location of streamflow gauges and potential development options.

Temporally, the time step and simulation period will also be informed by the availability of data and the requirements of the DSS. For example monthly simulations are suitable for water resources assessments and can be run over longer time periods of up to 100 years (depending on the availability of historical data), while water quality, sedimentation and flooding models require shorter time steps (daily or sub-daily) to investigate impacts of pollution or flooding.

7.3 Selection of the most appropriate simulation models

The selection of the most relevant and appropriate models should be guided by a sound understanding of the purpose of the modelling, the type, reliability and precision of required model output, spatial and temporal requirements for model configuration, the availability of relevant and reliable input data which are required to configure the model and the availability and quality of observed data to be employed in model calibration and validation. Table 11 provides examples of readily available models and analytical tools appropriate to support integrated catchment management.

Table 11: Examples of readily available models and analytical tools appropriate to support Integrated Catchment Management

Model	Summary Description	Primary Functionality								Reference
		Rainfall-Runoff	Channel Flow, Flooding & Sediment	Aquifer Dynamics	Infrastructure Operations	System Optimisation	Water Quality	Environmental Flows or Land Management Impacts	Multi-Criteria	
SWAT	SWAT is a catchment-scale, continuous daily simulation model, designed to predict the impact of land management on water, sediment, and agricultural chemical yields in ungauged catchments. Major model components include weather, hydrology, soil temperature and properties, plant growth, nutrients, pesticides, bacteria and pathogens, and land management. An ideal model for consideration of rainfall-runoff, land use change, sediment, erosion and water quality simulations.									http://swat.tamu.edu/software/swat-model
WEAP	WEAP provides a flexible and user-friendly framework for planning and policy analysis. It places demand-side issues such as water use patterns, equipment efficiencies, re-use strategies, costs, and water allocation schemes on an equal footing with supply-side topics such as streamflow, groundwater, reservoirs and water transfers. WEAP is simulates both the natural (e.g. evapo-transpirative demands, runoff and baseflow) and engineered components (e.g., reservoirs, groundwater pumping and hydropower) of water resource systems.									www.weap21.org
Mike Basin	This is a comprehensive river system model that operates at any time-step and simulates both the natural (e.g. evapo-transpirative demands, runoff and baseflow) and engineered components (e.g., reservoirs, groundwater pumping) of water resource									www.mikebydhi.com

Model	Summary Description	Primary Functionality								Reference
		Rainfall-Runoff	Channel Flow, Flooding & Sediment	Aquifer Dynamics	Infrastructure Operations	System Optimisation	Water Quality	Environmental Flows or Land Management Impacts	Multi-Criteria	
	systems. It has an advanced GUI and is geared for water resources system optimisation.									
HEC-HMS	This is a user-friendly short time-step model designed for flood hydrograph generation and routing through river and reservoir systems.									www.hec.usace.army.mil
HEC-RAS	This is a hydrodynamic channel flow model with a user-friendly GIS-based GUI that allows analysis of flood water levels and lateral extent of inundation and sediment transport under flood conditions. The water level impacts of hydraulic structures in river channels can also be simulated.									www.hec.usace.army.mil
MIKE11	This is a hydrodynamic channel flow model with a user-friendly GIS-based GUI that allows analysis of flood water levels and lateral extent of inundation and sediment transport under flood conditions. The water level impacts of hydraulic structures in river channels can also be simulated.									www.mikebydhi.com
Qual-2K	This is a hydrodynamic channel flow model designed for steady-state analysis of water quality dynamics in river systems. The model simulates both conservative and non-conservative water quality mechanisms and constituents and is particularly useful for assessing nutrient and sediment dynamics and related algal blooms and the latter's impacts on dissolved oxygen.									www.epa.gov/OST/QUAL2E_WINDOW_S
DRIFT	This is a multi-component DSS for assessment of environmental water requirements in rivers, wetlands and									www.southernwaters.co.za

Model	Summary Description	Primary Functionality								Reference
		Rainfall -Runoff	Channel Flow, Flooding & Sediment	Aquifer Dynamics	Infrastructure Operations	System Optimisation	Water Quality	Environmental Flows or Land Management Impacts	Multi-Criteria	
	estuaries. It integrates information on streamflows, channel hydraulics, all relevant aquatic and riparian ecosystems and the level of development of the catchment in a multi-criteria framework.									
eWater Toolkit	The Toolkit is a source of software tools and information related to the daily modelling and integrated management of catchments and water resources, including water quality tools. It provides a web-based distribution point for hydrological, ecological and catchment management models, databases and other resources. It is particularly useful to support environmental flow requirement processes.									www.toolkit.net.au
CENTURY	This is a set of ecosystem models with which the potential impacts of alternative development and land use scenarios can be modelled. The influence of each scenario on forage production, the supply of fuel wood, and the amount of carbon sequestered above- and below-ground can be assessed. The effect of predicated changes in climate on each of these services can also be modelled. These outputs can then be used to assess the effect of each scenario on food production, livelihoods and soil fertility based on published datasets and available literature.									www.nrel.colostate.edu/projects/century

7.4 Configuration of individual catchment models

Having selected the most appropriate simulation models, these will need to be configured for each catchment. This requires information on the catchment characteristics, the current status of land use and water related infrastructure, historical rainfall and stream flow information, and estimates of past, present and future water use requirements (information gathered in the Assessment phase). The individual models should be configured separately, but ensuring the ease of integration and transfer of results between models where required.

7.5 Validation of individual catchment models

The models should be validated against historical information on streamflow and water demands to ensure that the models give a reasonable, if not perfect, representation of the water situation in each catchment. The availability of data for calibration and validation of the various models is likely to be limited in some of the catchments and provides a potential risk and challenge to the development of simulation models. The models will have to be developed in the potential absence of reliable data and this needs to be considered when determining the required complexity of the models and interpreting the results.

7.6 Development of Visualisation and Reporting Tools

Appropriate visualisation and reporting tools will need to be developed for the comparison of alternative development scenarios and options. These can either be based on existing software systems, such as WEAP, Mike Basins, or simpler, more customised Excel based visualisation and reporting tools. The type of tools developed will be based on the outcomes of the visioning and scenario development stakeholder engagement that will identify what decisions need support and the appropriate indicators required to support these decisions. The visualisation tools must provide a clear and concise output from the analysis and ideally be able to compare alternative options in a workshop environment.

Most available water resources planning tools provide a similar variety of options for the presentation of both data input and results, as well as comparison of alternative development scenarios. These are now typically presented either in the form of maps or charts or summary tables. They are widely used and have the advantage that WEAP is generally available free of charge to developing country institutions. Another advantage of many of the inbuilt visualisation and comparison tools is that it can be used in a workshop environment to give immediate results to show the impacts of alternative development scenarios coming out of discussions.

The scenario comparison tools built into existing water resources models such as WEAP are often of a very technical nature and not easily interpretable by the stakeholders. It is often necessary therefore to translate these outputs into likely impacts on a selection of key indicators (see previous phase).

The impact of alternative development scenarios will then be quantified using the integrated modelling framework (centred around the water supply model) and can be displayed in a consequence table. This provides a clear way of visualising the comparison between scenarios.

7.7 Integrating Climate modelling into the Hydrological analysis

Climate models are mathematically driven dynamic tools used to simulate atmospheric conditions, either globally (GCM) or over a focused region (RCM), for the purpose of examining the change from the current climate while being influenced by anthropogenic climate change factors. This is done by using the current atmospheric, land use and ocean conditions as the initialisation points of the models. The simulation will follow one of four climate change scenarios based on global economic and industrial development. These are the Relative Concentration Pathways (RCPs) and represent the

range of scenarios from industry focused on increased fossil fuel usage and indifferent world governments to the uptake of green sustainable technologies and very proactive governments.

Climate models iterate the atmosphere over progressing states in time as forced by the RCP and are therefore able to present climatic conditions years in the future. Among the output of the models are variables of seasonality, temperatures, rainfall, soil moisture, evapotranspiration. Further analysis such as heatwave character, drought likelihood, rainfall intensity and distribution can be done on these outputs. Climate models simulate the atmosphere at varying spatial resolutions from 5 degree to 0.1 degree squares according to latitude and longitude, relative to the objectives of the project. Increasing the spatial resolution however significantly increases the computing time required to create the climate scenarios and as such the standard practice is to present climate data at a scale of 2.5 degree squares. Further resolution can be gleaned in the post-simulation of the GCM through downscaling the output to give regional climate character. This method uses detailed topography, land use and local meteorological readings as additional simulation parameters to provide more localised context to the climate scenarios. The downscaled data provides the base rainfall information for the hydrological modelling and allows for more on-the-ground climate interventions to be put in place.

Further information on GCMs, model downscaling, Malawian climate and weather capacity and the implementation of downscaling methodologies into hydrological modelling can be found in the following publications.

- World Bank : Shire Integrated Flood Risk Management Project.
- World Bank : Support to the Department of Climate Change and Meteorological Services Malawi

8 Establishing Catchment Management Committees (CMC) /AWU

To be completed in 2015, when more information available.

8.1

9 Financing Catchment Management Plans

9.1 Introduction

Although there are examples of mechanisms in other countries to engage the non-profit and private sectors in watershed management, the public-good nature of watershed environmental services justifies the use of public sector funding, whether from the national *fiscus* or from development partners. At the basin level, core funding for watershed infrastructure development, maintenance and management would usually be provided by a national government with local cost-recovery mechanisms providing complementary finances. At the village level, communities may not have the luxury of time for government to help address critical aspects of their location and environment. In such cases there is a very pressing need for affected communities to raise their own funds.

Generally there would be two elements to financing a management catchment plan at village level. The first would be a need to raise finance to develop the plan itself; and then, once agreed and approved by all relevant stakeholders, finance would be needed to implement prioritised elements of the overall plan.

One can liken catchment management planning and implementation to planning and developing a business. The plan itself is a route map to the issues that a given community of stakeholders wishes to address with a list of actions, preferably prioritised with defined timelines and detailed resource needs and associated costs. Such business plans would normally be taken to a bank to motivate a loan. However, it is highly unlikely that commercial banks would provide the funds for village catchment management activities in Malawi, as most elements would be not be of the quick, profit generating type. Besides this, the cost of borrowing money, whether short or long term, is prohibitively expensive for most rural communities at this time. Notwithstanding this, there are many development partners in the region who are prepared to offer special grants to communities wishing to improve the environmental health of their landscapes and mitigated environmental degeneration in a sustainable manner.

9.2 Typical approach to applying for and managing a community grant

The following describes a typical approach to applying for and managing a community grant, whether from a specific development agency or financing facility. The underlying concept of a grant is its ability to provide value addition, or to complement actions already being, or about to be, undertaken by communities. Given the shortage of funds available for direct use by rural communities in Malawi, grants are usually competitive, and thus much effort and research should go into developing community ideas into workable and manageable action plans.

Invariably, rural communities would not have sufficient savings and access or cash to develop a village catchment plan. Thus, donors may well assist this process by launching a grant for the development of a community or village catchment plan. A second grant phase would then see elements of the plan set out in a formal application for implementation, again in a competitive format. In some cases there would be a single grant split into two phases, with implementation of the second phase being dependent on a robust plan being tabled and approved by the contracting authority.

Communities are also not fully equipped and skilled to prepare catchment plans and therefore they need to partner with a professional group to assist in this. Such partners would be civil society groups, non-governmental organisations and even private sector companies. The partners apply for the grant on behalf of a community and also manage the funds for them. The partners are therefore the grantee and the community members the end beneficiaries.

In most grant schemes there is an element of community participation by way of the provision of physical resources (such as trees), or own money, bricks and in some cases of 'sweat equity'. Each

type of contribution would be specified in the grant contract. It should be noted that community contributions can also be other grants raised from local, district community grants which are available in Malawi.

During the evaluation process, the contracting authority follows pre-set criteria to determine the robustness of an application and to rank it against other applications. A typical grant application scorecard is given in Table 12 below:

Table 12: Grant application evaluation grid

Section	Maximum Score
1. Financial and operational capacity	20
1.1 Do the applicants and, if applicable, affiliated entity(ies) have sufficient experience of project management?	5
1.2 Do the applicants and, if applicable, affiliated entity(ies) have sufficient technical expertise? (especially knowledge of the issues to be addressed.)	5
1.3 Do the applicants and, if applicable, affiliated entity(ies) have sufficient management capacity? (including staff, equipment and ability to handle the budget for the action)?	5
1.4 Does the applicant have stable and sufficient sources of finance?	5
2. Relevance of the action	30
<i>Score transferred from the Concept Note evaluation</i>	
3. Effectiveness and feasibility of the action	20
3.1 Are the activities proposed appropriate, practical, and consistent with the objectives and expected results?	5
3.2 Is the action plan clear and feasible?	5
3.3 Does the proposal contain objectively verifiable indicators for the outcome of the action? Is any evaluation planned?	5
3.4 Is the co-applicant(s)'s and affiliated entity(ies)'s level of involvement and participation in the action satisfactory?	5
4. Sustainability of the action	15
4.1 Is the action likely to have a tangible impact on its target groups?	5
4.2 Is the proposal likely to have multiplier effects? (Including scope for replication, extension and information sharing.)	5
4.3 Are the expected results of the proposed action sustainable? - financially (<i>how will the activities be financed after the funding ends?</i>) - institutionally (<i>will structures allowing the activities to continue be in place at the end of the action? Will there be local 'ownership' of the results of the action?</i>) - at policy level (where applicable) (<i>what will be the structural impact of the action — e.g. will it lead to improved legislation, codes of conduct, methods, etc?</i>) - environmentally (if applicable) (<i>will the action have a negative/positive environmental impact?</i>)	5
5. Budget and cost-effectiveness of the action	15
5.1 Are the activities appropriately reflected in the budget?	5
5.2 Is the ratio between the estimated costs and the expected results satisfactory?	10
Maximum total score	100

Scoring: The evaluation grid is divided into sections and subsections. Each subsection will be given a score between 1 and 5 as follows: 1 = very poor; 2 = poor; 3 = adequate; 4 = good; 5 = very good.

9.3 Financial management of grants

Financial management of grants can be complicated and stressful for grantees, especially those not used to keeping essential paper trails and to filing regular tax returns. In order not to financially compromise the grantee once a project has closed, there are a few guiding principles which are usually laid down by funding agencies. Once a grant is awarded a first payment is quickly released to

the grantee to start the actions specified in the grant contract. Once a certain proportion of this first payment has been spent the grantee would then apply for a second payment which is usually made following a financial audit by a professional accountant, and paid for out of the grant budget. Before completing the project, the contracting authority usually withholds 10% of the grant as a retention against any ineligible expenditures.

According to the type of grant contract signed, during the implementation or operational phase the grantee would usually be requested to provide regular progress reports, both narrative and financial, with comparisons made between planned and actual outcomes. The contracting authority would normally undertake spot monitoring visits to the project to assist address technical and managerial challenges and to make sure that the grantee was following appropriate financial management systems and guidelines. Then once the grant is in its closure phase, a strict audit is usually made of the work undertaken by the community and the grantee, along with a professional financial audit which would verify assets and all expenditures against a formal financial management system and paper trail as required by the financing agency. Ineligible actions and expenditures would be left for the grantee to repay out of the portion of the grant held in retention.

9.4 Existing Grants in Malawi

- CIDA's Canada Fund for African Climate Resilience Partners supports projects that focus on reducing the effects of climate change and improving local adaptation to the impacts of weather related challenges in Africa.
- Pilot Program for Climate Resilience (PPCR) (AfDB)
- Rockefeller Foundation Climate Change Resilience Initiative
- AfDBs Africa Climate Change Fund
- NEPAD Climate Change Fund
- DfID's Climate Resilience Infrastructure Development Fund (especially for scoping, pre-feasibility studies and detailed design etc. especially for projects with a transboundary emphasis – this closes in 2018.
 - The project HQ is based in Pretoria run by WYG International and Adan Smith Institute.
- African Water Facility (AfDB)
- EU Global Climate Change Alliance – EUR 8.0 million allocation to Malawi – grants provided to implement community lead projects in four pilot districts (Nano, Zomba, Phalombe and Blantyre). Grant applications under evaluation, M&E component being implemented (evaluation of grant applications and follow-up during implementation, component to capacitate Department of Irrigation personnel and district development committees and associated non-state actor organisations.
- Millennium Challenge Account
- More EU funds are likely to be made available for this type of activity in the next five year programme cycle in the European Development Fund (EDF XI) which is currently in the planning phase.

Obtaining the funds is a complicated process and is usually channelled through government agencies. In Malawi the obvious route is from the District and Area Development committees through to say DoI, then up through to Treasury (Ministry of Finance). So the catchment planning process is vital to getting actions clearly demarcated and prioritised. There is a National Irrigation Development Fund (NIDF) to be established soon and this would be a good conduit for donors to see transparency and

accountability brought to bear. The NIDF would have a secretariat to make the final applications to regional climate resilience and associated funds.

10 Alternative source of income to help protect catchment areas

10.1 Introduction

Malawi faces a nexus of development challenges with regard to poverty in many protected areas and in particular the Shire River Basin catchment areas. The high population growth rate predominantly in rural areas (85%), low agricultural productivity due to small acreage (1.9 acre/household) and poor farming technology, high food insecurity, limited employment opportunities (<10% on salary income), low electricity connection (9%) and other factors have worsened the poverty levels with national poverty rate at 50.7% with southern region at 63%. These extreme conditions of well-being have placed enormous pressure on natural resources especially forestry, land and water since they provide safety net for the poor.

The old adage that says “your chicken is not safe if your neighbour is hungry” applies to the community catchment management programme under Shire River Basin Programme. A holistic and complimentary programmes are therefore required to ensure that catchment areas are protected and management well while the community around them are provided with alternative sources of income to support their livelihoods.

Experience from a number of programmes on natural resources management have provided the inspiration in supporting that natural resources from the catchment area can provide sustainable livelihoods to the communities around and beyond. There are a number of ways to enhance sustainable, secure, and equitable access to natural resources for rural communities and address issues of deforestation, land degradation that are caused by human activities.

10.2 Existing Knowledge and Practice

From the onset it should be realized that catchment areas/watersheds are areas that the rural communities have long relied on with regard to economy and culture. Most catchment areas (e.g. of Lilongwe and Diamphe rivers) are spiritual sites whose access is restricted/controlled by the spiritual leaders. Common catchment areas are associated with initiation activities or as graveyards or a place of mystical events. Since the management of catchment areas or watersheds is a derivative of community based natural resource management (CBNRM) it is established on rural development philosophy. It is simple and attractive one that communities defined by their tight special boundaries of influence/control and responsibilities, and by their clear and integrated social structure and common interests will manage their natural resources in a more reasonable and efficient, equitable and sustainable manner. In fact the natural resources around the catchment area are regarded by the community members as “Pool of Common” resources. In Malawi a “Pool of Common” resources are rivers, open woodland or grassland for livestock grazing, wood supply for building materials and burial services, medicines, crop residues after harvest, wild game meat (shared amount the hunters), fish in rivers, aquifers, irrigation channels, livestock water supply points etc.

Therefore the notion that rural communities should and can satisfactorily manage their natural resources according to their local custom, practice, knowledge and technologies has a long history and a solid foundation.

10.3 Policy Reform and Current Practice

Unfortunately the recent past policies took away most of the rights and responsibilities of the rural community in looking after the “Pool of Common” resources. The government of Malawi is now pursuing progressive legislation by giving back to the community the responsibilities of taking care of the natural resources particularly forest resources (National Forest Policy 1997 and Forest Act 1997)

and fish (Fisheries Conservation and Management of 1997). It is important to note that these policy reforms in natural resources management have had to compete with or challenge many years of institutional and structural destruction at the local level and the rural communities who had grown tired and wary of government in meddling with natural social phenomenon and practices.

Although the government has put in place new policy frameworks in managing natural resources which reinforced by a number of programmes including the Shire River Basin, these are challenged by counterproductive human activities such as theft, illegal tree cutting in the reserves, uncontrolled charcoal burning, overexploitation and bush fires. These human activities are largely driven by extreme poverty and sheer despair conserving the limited potential of the farm-based income sources.

10.4 Alternative Rural Livelihoods

The Shire River Basin programme therefore focuses on improving the well being of the community living around catchment areas in Malawi. A number of interventions have been developed with a view to increasing the options for generating income and food security. These interventions are either natural resources-based income generating activities or tree planting for conservation purposes.

This programme overall outcome would be increased sources of income which would improve the well-being of the communities adjacent to catchment areas/watershed within the Shire River Basin and other areas in Malawi.

10.4.1 Rationale of Rural Enterprise Development

Rural enterprise development is part of the long established approach in tackling poverty and is premised on diversification and innovation of the rural economy by increasing its market orientation and fostering value addition to the rural products. The transformation of agricultural and natural resources products will lead to additional non-farm employment, increased incomes and reduced pressure on natural resources.

Most studies in Malawi have confirmed the important role rural enterprise sector play. For instance, it is asserted that:

- MSE contribute income to about 25 percent of the Malawian households;
- MSEs employ about 38 percent of the total Malawian labour force.
- The off-farm enterprises employ about 22 percent of the total labour force.
- In the whole sector, women account for 42 percent of the total employment;
- The MSEs contribute about 15.6 percent to the GDP; and
- Over 80 percent of the MSE are located in the rural areas.

Rural Enterprise Development will therefore complement other initiatives within the Shire River Basin by promoting off-farm and on-forest enterprises by rural households and “entrepreneurs” (charcoal, firewood, and quarry sellers) which ultimately leads to the creation of new jobs, improved livelihoods and general well-being of the community. The intervention promotes an alternative growth paradigm within the Shire River Basin catchment area.

10.4.2 The Approach

One of the key components of the intervention is the governance structure. The programme will promote self-organisation of the target group and expression of group interest by the identified participants. To ensure ownership and inclusiveness of the initiatives and cooperation of the “entrepreneurs” the following steps should be followed:

The enterprise development intervention will be managed through the established Catchment Management Committees and will operate as a sub-committee with specific responsibilities and duties.

a) Sensitization: The intention is to convince the community the need to support the “poor” whose means of livelihoods is destroying catchment areas. It is important to consider how, where and when to undertake awareness raising of the initiatives. Awareness creation is one form of change-oriented communication as you seek support from a number of stakeholders with varied beliefs, values and perceptions. The purpose of sensitization is to create a behavioural change by affecting attitudes, knowledge of those who receive the message.

b) Identification of Potential Entrepreneurs and on and off forest/farm enterprises: Stakeholder identification and analysis are critical in participatory planning process and constitute one area that deserves more time. The activity provides early information regarding individuals, groups and institutions that will affect the success of an initiative with a community. The analysis should not only include people but practices, policies, environment, beliefs related to on-forest and off-forest/farm enterprises. There are primary and secondary stakeholders. Primary stakeholders for the programme are the charcoal burners, wood loggers, fishermen, wood sellers and hunters. Secondary stakeholders are NGOs, government institutions and private sector.

When undertaking stakeholder analysis, it is advisable to conduct further analyses such as relationships analysis, power relations analysis, and conflict analysis these tools help the project team the cause and effects of natural resources conflicts and inequity in its use and then find solutions.

c) Mobilization: When working with the rural community it is advisable to use Community Mobilization Cycle. This involves “knowing the community, provide information and create interest, Analysis of needs, Selection of leaders by the community, identification of partners, Planning, Projects Implementation, Monitoring and Evaluation.

d) Market linkages: The marketing aspect of the programme is a critical area. There is tendency for people to produce what the available resources can easily produce not what the market demands. Market surveys should therefore be conducted before support is provided to an entrepreneur identified by the Catchment Management Committee.

e) Financial Support: A significant proportion of the initial capital – both fixed and working-for small enterprises are obtained from personal accumulated from other activities such as farming or selling off of assets. The access to finance will be a key component that supports the success of the rural enterprise development initiatives. The mode of operation for the credit products are handled under “Community Savings and Credit Clubs”.

10.5 Likely Enterprises to be promoted

a) Agro-forestry enterprises: A number of on –farm tree enterprises are one of the means of crop diversification and are key coping mechanisms for those members in the community that are vulnerable to shocks and food insecurity. The following trees have proved to be more profitable if planted for business purposes in Malawi and these are: *Jatropha curcas*, *Moringa*, *Acacia polyacantha* and *Azadirachta*. These leaves, flowers, branch cutting and fruits are used for many purposes. Other interventions include planting of trees for commercial purposes and agriculture. This initiative shall be promoted in collaboration with afforestation interventions within the catchment management approach.

b) Forest Based Enterprises: The most common forest based enterprises are bee keeping and processing, mushroom harvesting, fruit picking, flying ants (ngumbi), medicinal activities, fishing etc. The community will be trained in the philosophy of co-management of the natural resources which emphasizes partnership of the community with the government through the planning, implementation and monitoring process of the natural resources. In this case, the government will strengthen the capacity of community institutions in planning as well as co-managing state forests in partnership with the department of forestry.

c) Off-farm enterprises: There are a number of off farm enterprise and these may in Chitetezo mbaulas which are fuel efficient stoves, which reduce the amount of firewood required to cook.

Fireless cookers are insulated cooking containers made from local materials. Training on the proper use and benefits of both technologies are provided to the communities, and some have also been trained in the construction of these stoves. The project team can train communities in the caring and maintenance of poultry for eggs or meat. The manure can be used as farm inputs which should help improve crop production.

Value chain

Marketing of products made at local level has always been problematic in Malawi. However, organizations like the Farmers' Union of Malawi (FUM) and the National Association of Smallholder Farmers in Malawi (NASFAM) have stepped in to promote such products through proper branding, packaging and advertising. The two organisations also provide support in market research.

Required support in the entire value chain should be identified such as input support, irrigation, processing / storage facilities, credit facilities, market information, infrastructure, extension services, business / management training, etc. Cost estimates will be made where relevant.

- Compile information regarding market opportunities for targeted smallholder farmers including contact information of potential buyers, quality standard requirements and price information.
- Develop and implement training programs to enable marketing groups improve business management practices.
- Provide technical support to implementing partners to enhance systems for collective marketing of commodities and purchasing of inputs among marketing groups.
- Build capacity of farmer marketing groups to link effectively to private sector service providers.
- Facilitate interventions to improve productivity of targeted commodities.

