



*Republic of Mozambique*



*The United Republic of Tanzania*

# DEVELOPMENT OF THE RUVUMA RIVER BASIN MONOGRAPH AND JOINT INTEGRATED WATER RESOURCES MANAGEMENT STRATEGY



## JOINT INTEGRATED WATER RESOURCES MANAGEMENT STRATEGY

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## PREFACE

The Ruvuma River Basin is shared between the two countries of Mozambique and Tanzania. The Development of the Ruvuma River Basin Monograph and Joint IWRM Strategy constitutes part of the Shared Watercourses Support Project (SWCSP) for the Ruvuma, Buzi and Save river basins. The SWCSP has been prepared by the Southern African Development Community (SADC) Secretariat and the African Development Bank (AfDB), in consultation with the Governments of Mozambique, Tanzania and Zimbabwe, within the framework of the SADC Revised Protocol on Shared Watercourses (2000), the Regional Water Policy (2005), and the Regional Strategic Action Plan on Integrated Water Resources Development and Management (2005). The SWCSP was approved by the AfDB for funding and implementation in May 2006.

The overall long term goal of the joint effort between Mozambique and Tanzania on the Ruvuma River Basin is to ensure the development of integrated water resources management and related physical infrastructure development that contributes to regional integration and poverty reduction.

Project implementing agencies are ARA-Norte in Pemba, Mozambique and Ruvuma Basin Water Office in Mtwara, Tanzania supported by the national Ministries responsible for water. As a transboundary project, the SWCSP including the Ruvuma component is managed by the SADC on behalf of the Governments of Mozambique and Tanzania.

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**List of Abbreviations**

|            |   |
|------------|---|
| AfDB       | African Development Bank                        |
| ARA- Norte | Northern Regional Water Administration          |
| ASM        | Artisanal Small Scale Mining                    |
| BWBs       | Basin Water Boards                              |
| BWOs       | Basin Water Offices                             |
| CBMP       | Community Based Management Project              |
| CBO        | Community Based Organisation                    |
| CDM        | Clean Development Mechanism                     |
| CER        | Carbon Emission Reduction                       |
| DMD        | Disaster Management Department                  |
| DNA        | National Water Directorate in Mozambique        |
| DNHA       | National Directorate of Agricultural Hydraulics |
| DSS        | Decision Support System                         |
| DWA        | Department of Water Resources                   |
| DWR        | Department of Water Resources                   |
| EF         | Environmental Flow                              |
| EFR        | Environmental Flow Requirements                 |
| EIA        | Environmental Impact Assessment                 |
| EKIS       | Enhanced Knowledge Information System           |
| EMP        | Environmental Management Plan                   |
| GDP        | Gross Domestic Product                          |
| GIS        | Geographic Information System                   |
| GWh        | Giga watt hour                                  |
| Ha         | hectare   |
| HP         | Hydropower Plant                                |
| INGC       | National Disaster Management Institute          |
| IWRM       | Integrated Water Resources Management           |
| JIWRM      | Joint Integrated Water Resources Management     |
| JWC        | Joint Water Commission                          |
| LGRP       | Local Government Reform Programme               |
| M&E        | Monitoring and Evaluation                       |
| MADER      | Ministry of Agriculture and Rural Development   |
| MAFC       | Ministry of Agriculture, Food and Cooperatives  |
| MAP        | Mean Annual Precipitation                       |

|          |   |
|----------|---|
| MAR      | Mean Annual Runoff                                    |
| MDG      | Millennium Development Goal                           |
| MEM      | Ministry of Energy and Minerals                       |
| MICOA    | Ministry of Coordination of Environmental Action      |
| Mm3      | Million cubic metres                                  |
| MoPH     | Ministry of Public Works and Housing                  |
| MoW/Maji | Ministry of Water, Tanzania                           |
| MUSD     | Millions of United States Dollars                     |
| Mz       | Mozambique  |
| NAWAPO   | National Water Policy                                 |
| NBS      | National Bureau of Statistics                         |
| NEMC     | National Environmental Management Council             |
| NGO      | Non-Governmental Organisation                         |
| NWRMS    | National Water Resources Management Strategy          |
| NWSDS    | National Water Sector Development Strategy            |
| O&M      | Operation & Maintenance                               |
| PEDSA    | Strategic Plan for Development of Agricultural Sector |
| PIDG     | Private Infrastructure Development Group              |
| PPP      | Public Private Partnership                            |
| PRONASAR | National Rural Water Supply and Sanitation Program    |
| PRSP     | Poverty Reduction Strategy                            |
| PSC      | Project Steering Committee                            |
| RBC      | Ruvuma Basin Committee                                |
| RBWB     | Ruvuma Water Board                                    |
| RBWO     | Ruvuma Water Board Office                             |
| RWP      | SADC Regional Water Policy                            |
| SADC     | Southern Africa Development Community                 |
| SAP      | Strategic Action Project                              |
| SWCIs    | Shared Watercourses Institutions                      |
| SWCSP    | Shared Watercourse Support Project                    |
| TANESCO  | Tanzania Electric Supply Company                      |
| TAs      | Technical Advisors                                    |
| ToR      | Terms of Reference                                    |
| TWM      | Transboundary Water Management                        |
| Tz       | Tanzania  |

|       |   |
|-------|---|
| UN    | United Nations                              |
| USD   | United States Dollars                       |
| UWSSA | Urban Water Supply and Sewerage Authorities |
| WDM   | Water Demand Management                     |
| WRYM  | Water Resources Yield Model                 |
| WSDP  | Water Sector Development Program            |
| WUA   | Water User Associations                     |
| VPO   | Vice-President's Office                     |
| WWF   | World Wildlife Foundation                   |



## EXECUTIVE SUMMARY

The development and management of the transboundary Ruvuma River Basin requires cooperation, under a framework that promotes interdependence and joint management. The Monograph, the Development Scenario Report and the Joint Integrated Water Resources Management (JIWRM) Strategy comprise background and detailed guiding documents for the responsible river basin authorities for further advancing the management of the joint water resources.

The purpose of the Ruvuma River Basin Monograph phase was to present the 2010 baseline data on the current state of the available water resources, socio-economic characteristics, environmental conditions, and current water demand.

The purpose of the scenario phase was to analyse development options and alternative strategic actions to meet future water demand and management requirements. Water has many uses and socio-economic development over time impacts on the water resource. In an era of climate change and uncertain global development dynamics, water planning is more complex than ever.

Water strategies and plans should be robust and lay the foundation for optimal, equitable and sustainable use of the water resource and hence they have to be tested against multi-discipline criteria and different development scenarios.

The national water law and policies of Mozambique and Tanzania together with international water agreements determine the overall governance framework within which the Ruvuma River Basin is to be managed and developed. It should be noted though, that there is no exact formula for IWRM decision making. The IWRM process is instead based on showing the impacts of each action so that informative decisions can be made. Some aspects are ruled by legislation (e.g. EIA, water allocation priorities); others are guided by policy objectives (e.g. access to water). The key steps involved in the strategy formulation analysis are review of sector plans and long term objectives, integrated analysis of development and management options, river systems analysis/water balance modelling and multi-criteria analysis.

The Strategy formulation process has provided substantial information about the range of institutional, social, economic, environmental and technical challenges and opportunities confronting both people and institutions within the Ruvuma Basin related to water.

For the JIWRM of the Ruvuma River Basin, four groups of water management challenges were identified:

- Sustainable use and assurance of water supply to key water users sectors
- Water quality and aquatic ecosystem health
- Water related vulnerability, notably floods and droughts
- Water governance and IWRM implementation, with special focus on the Transboundary Water Management (TWM) dimension

It should be emphasised, though, that the main challenge is that the Ruvuma Basin, currently being in almost pristine condition, may be negatively impacted by nearby mining and industrial developments. The wildlife and eco-tourism potential in the Ruvuma Basin could be a tremendous asset if considered and managed properly. However, it is close to areas where large mining and industrial developments are expected and this will have an environmental influence on the Basin.

The review points to the numerous avenues through which such challenges are being, and can be, addressed. It also underscores the integrated dimension of IWRM and the need to view the

activities proposed under the 'Ruvuma River Basin Joint IWRM Strategy' in relation to other complementary initiatives e.g. in the transport, agriculture and energy sectors. Specifically, a coordinated set of storage and regulating infrastructure to meet water demand have been studied – and priority investments have been identified as a result from the multi-criteria analysis. Additionally, the review indicates that a set of coordinated institutional actions are needed to enhance water management and governance in the basin. Such supporting action projects are important to meet the future water challenges and to achieve the IWRM objectives, stated in international as well as national policies and legislation. As a result a number of priority strategies have been formulated to address identified challenges and to contribute to sustainable development.

To meet the future water management challenges, an array of measures have been defined under the form of a Joint IWRM Strategy Framework comprising strategic action projects (SAPs) to be implemented at short, medium or long term time frames. The analysis of the water resource development scenarios and the macro-economy of the basin have guided the selection of strategic action projects. A major part of the identified strategic actions are not related to augmenting the water supply by investing in water infrastructure projects. Infrastructure investment projects are important but must be supported by strategic management related action projects such as water demand management, disaster management, inter-ministerial coordination and enhanced monitoring, studies and knowledge management. The measures and recommendations are built on the scientific studies and stakeholder feedback.

The priority management and institutional issues and actions that have been singled out are those important to fulfil the mandates under SADC shared Protocol and JWC Agreement. In planning the strategic framework, the aim has been to reach a balance of strengthening the basic framework for transboundary cooperation as well as working on national issues in water resources management. The rationale for a balanced approach is that it is important to focus on the national level IWRM as a way to strengthen TWM.

The strategic actions which have been defined and planned are deemed to contribute to a desirable state for the Ruvuma River Basin of socio-economic development, reduced vulnerability, sustainable use of water and regional integration.

Together, these measures form the joint IWRM strategy and Implementation Plan up to 2030.

The Ruvuma JIWRM Strategy Implementation Plan (Table 0-1) summarises the implementation plan with an indication of the time horizon for implementation (short, medium and long-term) and main implementing agencies. The implementation plan defines proposed lead organizations and key supporting actors that should be actively engaged in these activities. This proposed plan is meant to guide and ensure implementation of the strategic directions and describe how, when, by whom, and to what cost the different components of the strategy can be implemented. However, the plan is subject to changes upon final negotiations among the involved actors.

The plan will be subject to comprehensive reviews on regular basis i.e. every five years, in order to take into account progress and experiences of each five year period. Development of shorter term “operational plans” is moreover recommended to be developed every five years period.

Table 0-1: Ruvuma JIWRM Strategy Implementation Plan

| Challenge            | Strategic Area                               | Action  | Time Frame  |              |               | Lead Institutions                        | Main Partner Institutions  | Cost    |         |         |
|----------------------|--|---|-------------|--------------|---------------|--|--|---------|---------|---------|
|                      |  |   | Short Term  | Medium Term  | Long Term     |  |  | Total   | Mz      | Tz      |
|                      |  |   | (0-2 years) | (3-10 years) | (10-20 years) |  |  | kUSD    |         |         |
| Meeting Water Demand | Coordinated Water Infrastructure Development | <b>Component 1.1: National Infrastructure</b>                                   |             |              |               |  |  |         |         |         |
|                      |  | SAP 1.1.1: Small and medium dam strategy and feasibility study, Basin wide      | x           | X            |               | DNA /ARA-Norte in Mz; DWR/RBWO in Tz     | Provincial ministries in Mz; Government ministries in Tz; Private sector | 120 000 | 60 000  | 60 000  |
|                      |  | SAP 1.1.2: Construction and supervision of selected dams, Basin wide            |             | X            | x             | DNA /ARA-Norte in Mz; MoW/DWR/RBWO in Tz | Provincial ministries in Mz; Government ministries in Tz; Private sector | 250 000 | 125 000 | 125 000 |
|                      |  | SAP 1.1.3 Rural water supply and sanitation, Mozambique                         | x           | X            |               | MoPH/DPOPH                               | DNA/ARA-Norte, private sector, NGOs, CBOs                                | 500     | 500     |         |
|                      |  | SAP 1.1.4: Lichinga urban water supply and sanitation, Mozambique               | x           | X            |               | MoPH/DNA/ARA-Norte                       | Municipalities, FIPAG ,Provincial ministries and private sector in Mz    | 11 000  | 11 000  |         |
|                      |  | SAP 1.1.5: Rural water supply and sanitation, Tanzania                          | x           | X            |               | URWSSA                                   | DWR/RBWO, private sector, NGOs, WUAs                                     | 500     |         | 500     |
|                      |  | SAP 1.1.6: Songea urban water supply and sanitation, Tanzania                   | x           | X            |               | MoW/URWSSA and RBWB/RBWO                 | Municipalities, Government ministries, private sector                    | 2 400   |         | 2 400   |
|                      |  | SAP 1.1.7: Ruvuma-Mtwara interbasin water transfer, Tanzania                    |             | X            |               | MoW/DWR and RBWB/RBWO                    | Municipalities, Government ministries, private sector                    | 500     |         | 500     |
|                      |  | SAP 1.1.8: Development of extensions and planned irrigation schemes, Mozambique |             | X            |               | DNHA                                     | DNA/ARA-Norte, Private sector  | 18 000  | 18 000  |         |
|                      |  | SAP 1.1.9: Development of potential irrigable areas, Mozambique                 |             |              | x             | DNHA                                     | DNA/ARA-Norte, Private sector  | 90 000  | 90 000  |         |

|                              |  |  |   |   |   |   |   |         |        |         |
|------------------------------|--|--|---|---|---|---|---|---------|--------|---------|
|                              |  | SAP 1.1.10 Extension of existing irrigation schemes, Tanzania  |   | X |   | MAFC                                      | DWR/RBWO, Private sector  | 96 000  |        | 96 000  |
|                              |  | SAP 1.1.11: Development of planned irrigation schemes, Tanzania                                      |   | X | x | MAFC                                      | DWR/RBWO, Private sector  | 80 000  |        | 80 000  |
|                              |  | SAP 1.1.12: Development of potential irrigable areas, Tanzania                                       |   |   | x | MAFC                                      | DWR/RBWO, Private sector  | 19 000  |        | 19 000  |
|                              |  | SAP 1.1.13: Upgrading of existing irrigation schemes, Basin wide                                     |   | X |   | DNHA in Mz; MAFC in Tz                    | DNA /ARA-Norte in Mz; DWR/RBWO in Tz; private sector                | 92 000  | 22 000 | 70 000  |
|                              |  | SAP 1.1.14: Pre-feasibility and feasibility studies of selected hydro-power projects, Basin wide     |   | X |   | EdM in Mz; TANESCO in Tz                  | DNA /ARA-Norte in Mz; DWR/RBWO in Tz                                | 800     | 400    | 400     |
|                              |  | SAP 1.1.15: Construction of selected prioritised HP schemes, Basin Wide                              |   | X | x | JWC, Ministries of Energy                 | DNA /ARA-Norte in Mz; DWR/RBWO in Tz; private sector                | 240 700 | 40 100 | 200 600 |
|                              |  | <b>Component 1.2: Joint Water Infrastructure</b>   |   |   |   |   |   |         |        |         |
|                              |  | SAP 1.2.1: Pre-feasibility of the Joint Ruvuma multipurpose project                                  |   |   | x | JWC; DNA /ARA-Norte in Mz; DWR/RBWO in Tz | DNHA, EDM, in Mz; MAFC, MAFC, MEM/TANESCO in Tz                     | 800     | 400    | 400     |
|                              |  | <b>Component 1.3: Mobilisation of investment funding</b>   |   |   |   |   |   |         |        |         |
|                              |  | SAP 1.3.1: Development of funding mechanisms and piloting, Basin wide                                |   | x |   | JWC; DNA /ARA-Norte in Mz; DWR/RBWO in Tz | Private sector  | 500     | 250    | 250     |
| Maintain WQ and River Health | Cross-Sectoral Environmental Interventions | <b>Component 2.1: River protection projects - Addressing key causes of environmental degradation</b> |   |   |   |   |   |         |        |         |
|                              |  | SAP 2.1.1: Pollution control from informal mining areas  | x | x |   | DNA /ARA-Norte in Mz; DWR/RBWO in Tz      | Ministry of mines and MICOA in Mz; Ministry of mines and NEMC in Tz | 800     | 400    | 400     |
|                              |  | SAP 2.1.2: Erosion control   |   | x |   | DNA /ARA-Norte in Mz; DWR/RBWO in Tz      | MICOA, MoM, MADER in Mz; NEMC, MNRLHS                               | 400     | 200    | 200     |



|                            |   |   |   |   |  |  |  |       |     |     |
|----------------------------|---|---|---|---|--|--|--|-------|-----|-----|
|                            |   | SAP 2.1.3: Water source protection  | x | x |  | DNA /ARA-Norte in Mz; DWR/RBWO in Tz       | MoPH/DPOPH,MICOA in Mozambique; URWSSA, MHHS in Tz.      | 100   | 50  | 50  |
|                            |   | <b>Component 2.2 Water quality management</b>   |   |   |  |  |  |       |     |     |
|                            |   | 2.2.1: Establishment of environmental water (quantity and quality) requirements           | x |   |  | DNA /ARA-Norte in Mz; DWR/RBWO in Tz       | MICOA in Mz. VPO-Environment/ NEMC in Tz                 | 300   | 150 | 150 |
|                            |   | 2.2.2: Ecological status monitoring   |   | x |  | DNA /ARA-Norte in Mz; DWR/RBWO in Tz       | MICOA in Mz. VPO-Environment /NEMC in Tz                 | 300   | 150 | 150 |
|                            |   | 2.2.3: Establishment of water quality management plans                                    | x | x |  | DNA /ARA-Norte in Mz; DWR/RBWO in Tz       | DNA and MICOA in Mz. VPO-Environment /NEMC in Tz         | 300   | 150 | 150 |
| Reduce Vulnerability       | Climate Change and Disaster Management        | <b>Component 3.1: Climate change adaptation</b>   |   |   |  |  |  |       |     |     |
|                            |   | SAP 3.1.1. Climate change modelling and development of climate change adaptation strategy |   | x |  | JWC; DNA /ARA-Norte in Mz; DWR/RBWO in Tz  | Provincial ministries in Mz; Government ministries in Tz | 400   | 200 | 200 |
|                            |   | <b>Component 3.2 Disaster management</b>  |   |   |  |  |  |       |     |     |
|                            |   | SAP 3.2.1: Development of disaster management plans and response system                   |   | x |  | JWC; DNA /ARA-Norte in Mz; DWR/RBWO in Tz  | INGC in Mz; VPO-DMD, in Tz                               | 1 300 | 650 | 650 |
| Efficient Water Governance | Institutional Consolidation and Strengthening | <b>Component 4.1: Institutional Management Framework</b>                                  |   |   |  |  |  |       |     |     |
|                            |   | SAP 4.1.1: Operationalisation of JWC  | x | x |  | JWC; MOPH/DNA in Mz; MoW/DWR in Tz         |  | 1 200 | 600 | 600 |
|                            |   | SAP 4.1.2: Institutional consolidation of the ARA Norte                                   | x |   |  | MOPH/ DNA /ARA-Norte                       |  | 800   | 800 |     |
|                            |   | SAP 4.1.3: Institutional consolidation of the RBWO  | x |   |  | MoW/DWR/RBWO                               |  | 800   |     | 800 |
|                            |   | SAP 4.1.4: Legal review   | x |   |  | JWC; MOPH/DNA in Mz; MoW/DWR in Tz         | Ministries of Environment, Energy, Mines, Agriculture    | 100   | 50  | 50  |
|                            |   | <b>Component 4.2: Water Management</b>  |   |   |  |  |  |       |     |     |
|                            |   | SAP 4.2.1: Water use registry, permit system and control                                  | x | x |  | DNA /ARA-Norte in Mz; DWR/RBWB/ RBWO in Tz | Ministries of Environment, Energy, Mines, Agriculture    | 300   | 150 | 150 |

|                             |  |   |   |   |  |  |           |         |         |
|-----------------------------|--|---|---|---|--|--|-----------|---------|---------|
|                             | SAP 4.2.2: Water pollution permit system and control                                 | x | x |   | DNA /ARA-Norte in Mz; DWR/RBWB/ RBWO in Tz     | MICOA in Mz; NEMC in Tz                                  | 300       | 150     | 150     |
|                             | SAP 4.2.3: Enhanced Knowledge and Information System – Phase II                      |   | x | x | JWC; MOPH/DNA/ ARA-Norte in Mz; MoW/ DWR in Tz | DNA /ARA-Norte in Mz; DWR/RBWO in Tz                     | 1 500     | 900     | 600     |
|                             | SAP 4.2.4: Sub-basin plans   |   | x |   | DNA /ARA-Norte, Mz; DWR/RBWO, Tz               | Provincial ministries, Mz; Government ministries, Tz     | 300       | 150     | 150     |
|                             | SAP 4.2.5: Groundwater Management Strategy   |   | x |   | DNA /ARA-Norte in Mz; DWR/RBWO, Tz             |  | 500       | 250     | 250     |
|                             | Component 4.3:Promotion of Stakeholder Participation and Cross-Sectoral Coordination |   |   |   |  |  |           |         |         |
|                             | SAP 4.3.1: Support to Ruvuma Basin Committee (RBC)                                   | x |   |   | DNA /ARA-Norte                                 | RBC  | 200       | 200     |         |
|                             | SAP 4.3.2: Support to Ruvuma Basin Water Board (RBWB)                                | x |   |   | MoW/DWR  | RBWB, RBWO   | 100       |         | 100     |
|                             | SAP 4.3.3: Ruvuma Catchment Committee (RCC) and Water Users Associations (WUAs)      | x |   |   | DWR/RBWO                                       | RCC and WUAs   | 200       |         | 200     |
|                             | SAP 4.3.4: Support to inter-ministerial coordination                                 | x |   |   | DNA /ARA-Norte in Mz; DWR/RBWO in Tz           | Provincial ministries in Mz; Government ministries in Tz | 100       | 50      | 50      |
|                             | SAP 4.3.5: Ruvuma River Awareness Kit  |   | x |   | JWC  | DNA /ARA-Norte in Mz; DWR/RBWO in Tz                     | 100       | 50      | 50      |
|                             | SAP 4.3.6: Community Basin Management Projects (Phase II)                            | x | x |   | DNA /ARA-Norte in Mz; DWR/RBWO in Tz           | RBC in Mz; RBWB, RCC in Tz                               | 10 000    | 5 000   | 5 000   |
| Total Ruvuma JIWRM Strategy |  |   |   |   |  |  | 1 043 100 | 377 950 | 665 150 |

# 1 RUVUMA STRATEGY FORMULATION - PURPOSE AND PROCESS

## 1.1 Introduction

This document presents a Joint Integrated Water Resources Management (JIWRM) Strategy and Implementation Plan for the Ruvuma River Basin shared between Mozambique, Tanzania and Malawi. This JIWRM Strategy Report presents future water management issues and needs in the Ruvuma River Basin and strategies and actions to address them, both in terms of infrastructure development, environmental protection, and institutional efficiency. It builds on the insights of stakeholders and scientific sector studies of current and future water availability, water utilization and water quality issues as well as multi-criteria analyses of strategic options to address future water demands and management needs. The JIWRM implementation plan prioritises Strategic Action Projects (SAPs) in short, medium and long-term actions and defines the roles and responsibilities for their implementation.

The Ruvuma JIWRM Strategy report structure is presented in Figure 1-1.

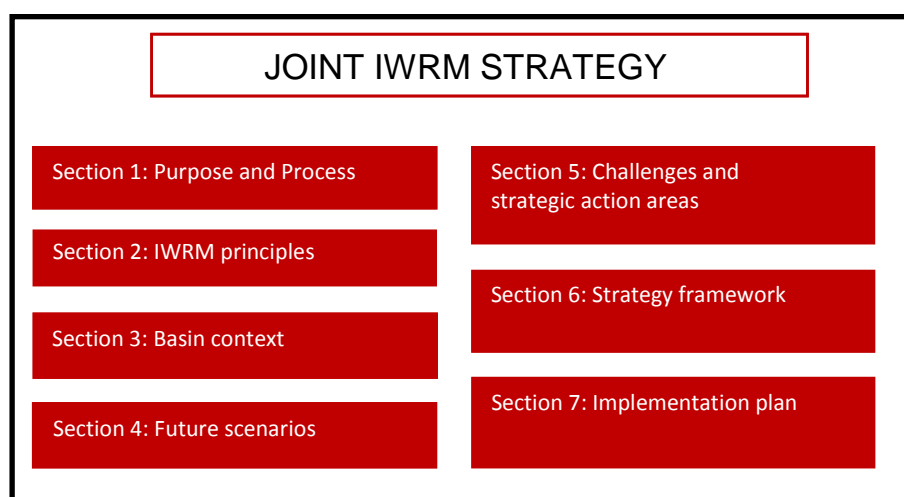


Figure 1-1: Components of the Joint IWRM Strategy of the Ruvuma River Basin

## 1.2 Purpose

The initiative for the Ruvuma JIWRM Strategy formulation process has been a joint undertaking by Mozambique and Tanzania<sup>1</sup>.

The river basin is an almost unparalleled case in South-Eastern Africa because it is one of the few shared rivers that is basically hydrologically pristine with no significant water storage and / or river regulating infrastructure. The Ruvuma River Basin is rich in both aquatic and terrestrial biodiversity and a large part of the basin is ecologically untouched, especially in Mozambique. This low rate of development has historical and geographical explanations. The future development of the Ruvuma River Basin will be determined by a number of key driving forces, notably macro-economic but also “physic-biological” phenomena such as population growth and climate change. Recent developments have resulted in an increasing interest in exploring the natural resources of the

<sup>1</sup> <2% of the basin is located in in Malawi

Ruvuma River Basin, especially in Tanzania and this has a bearing on the management of the shared Ruvuma River.

The development and management of this shared watercourse therefore requires cooperation under a solid framework that promotes interdependence and joint management. The national water law and policies of Mozambique and Tanzania together with international water agreements determine the governance framework within which the Ruvuma River Basin is to be managed and developed. The development of the Joint IWRM Strategy is a prerequisite for further advancing water resources management in the Ruvuma River Basin, because it affects the existing policy and legal frameworks. This Strategy is the key instrument to develop and manage water resources in an integrated and sustainable manner and it is the primary mechanism for managing water across the sectoral and national borders in the Ruvuma River Basin.

### 1.3 The Nexus Approach

By speaking of a water, energy and food security nexus we emphasise that these three sectors are inextricably linked and that most actions in one sector will have impacts in one or both of the other sectors. A nexus perspective aims at increasing our understanding of the interdependencies between the sectors and how they further influence other sectors of concern such as biodiversity and climate. A nexus approach integrates management and governance across sectors in order to improve water, energy and food security.

The challenge of thinking in a water, energy and food security nexus perspective for the Ruvuma River Basin has been a central approach in the JIWRM Strategy formulation process.

This strategy builds on the analyses of these choices i.e. potential Nexus scenarios. The rationale is that the planning of water allocation and water infrastructure development and other water management measures looks different in each Nexus Scenario option. Another central approach has been to study infrastructure options suitable for multi-purpose use e.g. energy production, irrigation and flood control.

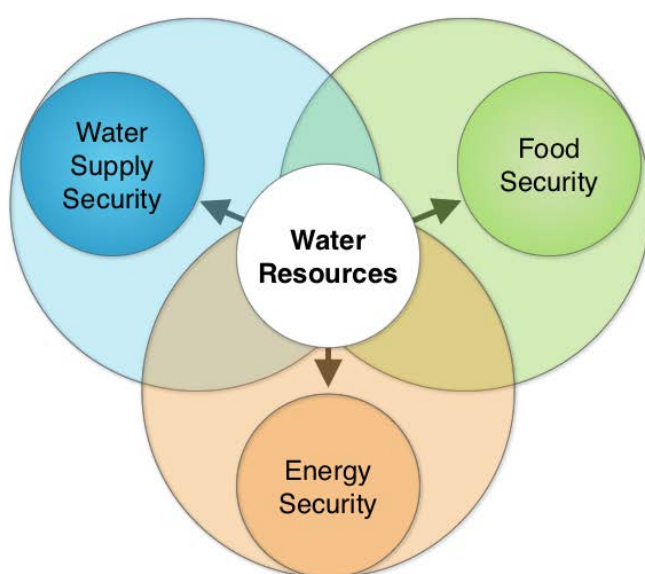


Figure 1-2: The NEXUS Approach

## 1.4 Process

The development of the Ruvuma JIWRM Strategy was undertaken by a consultancy comprised of Sweco International and its associates: BRL (France), Consultec (Mozambique), Austral COWI (Mozambique) and COWI Tanzania.

The formulation process consisted of three phases:

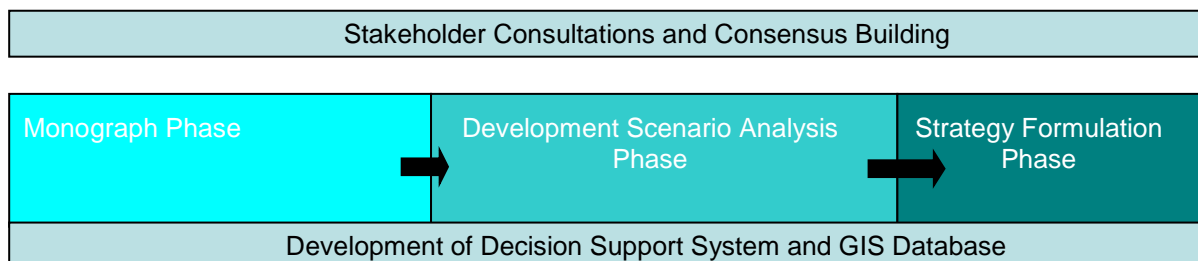


Figure 1-3: Joint IWRM Planning Process and Phasing

The principles and practices followed throughout the planning phases were purposefully designed to institute an integrated (inter-sectoral) and participatory approach to the processes of managing and utilising the water resources. In order to ensure trust and support for the Strategy and Implementation Plan, it was important that the JIWRM Strategy be based on scientific evidence, clear evaluation criteria and consensus. To this end, the assessment and analytic phases aimed at an accurate identification and analysis of the water resources and demand, on the one hand, and the environmental and social issues within the catchment, on the other. These are generally seen as vital to the sustainable use of an essential resource and to the mitigation of possible adverse impacts.

### The Monograph Phase

The objectives of the Monograph phase are to i) create baseline data and information on the current water resources, water demand, socio-economic and environmental conditions in the Ruvuma Basin, ii) through a comprehensive analysis of the baseline data give directive focus for the Development Scenarios and iii) define base-line indicators for monitoring impacts, processes and progress.

The principle objective of the Ruvuma Monograph Report (Figure 1.3) was to present an introduction to the Ruvuma River Basin and to provide an overview of the key characteristics including a set of illustrative thematic maps of important features of the basin. The Ruvuma River Basin Monograph was thus intended to set the stage for future activities that will contribute to the overall development goals. Consequently, it presents baseline data on the current state of the water resources, socio-economic characteristics, environmental conditions, water demand, legal and institutional settings in the Ruvuma River Basin. The report further identifies priority water management issues and provides the preliminary directive focus for the subsequent project phases.

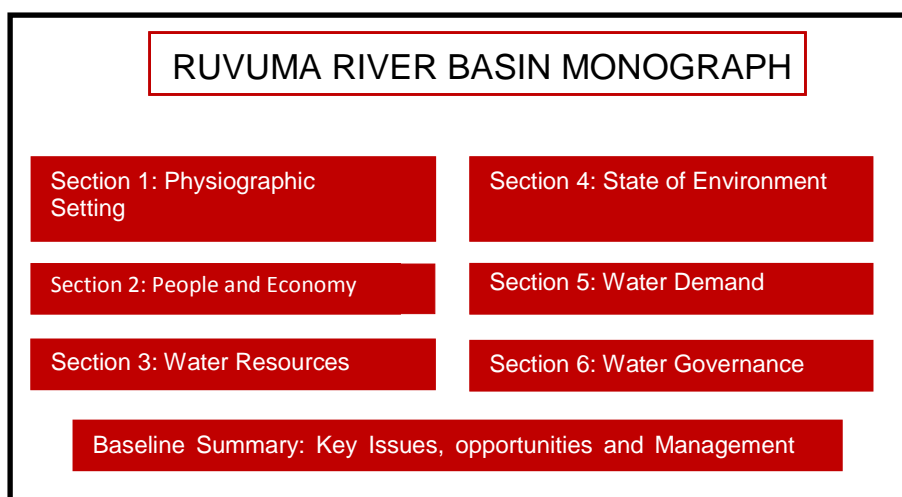


Figure 1-4 : Components of the Ruvuma River Basin Monograph

### Development Scenario Phase

The second phase of the JIWRM Strategy formulation project was to prepare and come to a consensus on the Development Scenario to be ranked as the most optimal for meeting the future water management needs up to 2030 and beyond.

The preparation of the JIWRM Strategy provided the opportunity to discuss a number of critical issues about the Ruvuma River Basin. There are several important options that have a large bearing on the development of water resources: i) should the hydropower potential in the basin be fully developed? ii) should the agricultural potential be fully developed for food security? iii) should only limited development of these sectors be allowed for the benefit of wildlife and environmental conservation? Alternative road maps for achieving the overall goal may be defined. The overall goal must be a healthy prosperous economy and well secured well protected vital eco-systems. In the light of this, there are several important alternatives that need to be analysed from a Water, Energy and Food Security Nexus perspective.

For the JIWRM of the Ruvuma River Basin, four water management challenges were identified:

- Sustainable use and assurance of water supply to key water user sectors
- Water quality and aquatic ecosystem health
- Water related vulnerability, notably floods and droughts
- Good water governance and IWRM implementation, with special focus on the Transboundary Water Management (TWM) dimension

Both structural and non-structural measures are required to deal with these management challenges.

With regards to the structural measures, the objective of the Development Scenario Phase was to review water allocation and water infrastructure options required to meet the water demand in a sustainable manner, the rationale being the need of the water sector capable of responding to specific socio-economic development drivers and associated water needs and impacts. Considering the transboundary context, this requires effective integrated planning as well as appropriate water resource development and allocation criteria.

As part of the strategy formulation process, specific scientific studies assessed the available water resources and the current and future water demand, including the environmental needs (environmental flow). Water balance modelling was then employed to simulate the water system for

each of the different development scenarios. This task included multi-criteria screening of proposed infrastructure development projects. The objective of the multi-criteria analysis was to assess and rank the proposed development scenarios from technical, socio-economic, environmental, financial and economic aspects.

The key steps in the water infrastructure planning process can be summarised as follows:

- Defining of the role of water in the Ruvuma basin's economy
- Determining the water resources availability and quality
- Determining water demand for key water use sectors
- Defining environmental flow requirements for all major rivers
- Identifying priority large scale investment needs comprising single and multi-purpose investments (including flood control), inter-basin water transfers and conjunctive use operations for surface and groundwater
- Undertaking water balances analysis for various infrastructure development options
- Performing multi-criteria screening including economics, social and environmental analyses of the various options
- Establishing financing needs
- Recommending phased developments and the preparations of preliminary designs and pre-feasibility studies

With regards to the second step, ensuring the sustainable management of the resource through effective protection and conservation, and proficient governance, is of paramount importance in the Ruvuma River Basin. The existing and proposed conservation areas cover almost half of the area. With regards to the need of ensuring good water quality and of sustaining ecosystem health, the environmental and social issues identified in the monograph phase were analysed in order to find potential mitigation and adaptation measures, including potential joint actions and investments.

The key steps of the planning process for the environmental measures can be summarised as follows:

- Mapping national parks and protected areas
- Mapping terrestrial and aquatic biodiversity
- Identifying threats
- Identifying sensitive areas and areas of specific importance
- Identifying roles and responsibilities regarding conservation and protection of water
- Analysing responsive actions required from the water management perspective
- Prioritising and preparing phased strategic action projects

Thirdly, an assessment was undertaken to determine the magnitude and scale of water vulnerability in the basin and potential actions to address this challenge.

The integrated analysis revealed that it is possible to improve the living conditions for the population while at the same time recognising the environmental needs of the Ruvuma River Basin. However this requires enhanced operational capacity of the basin water authorities, which are currently not carrying out mandated and minimum IWRM/TWM functions. Practical implementation of IWRM is a challenge. Thus strategic institutional action projects were identified and prioritised in order to fill gaps identified in the institutional assessment during the monograph phase.

As a result of the analysis of the strategic action projects, an action plan has been proposed for the future development of the basin. This action plan integrates the structural projects analysed and proposed in the development scenarios as well as non-structural projects.

The main output of the second phase is the Ruvuma River Basin Development Scenarios and Ranking Report.

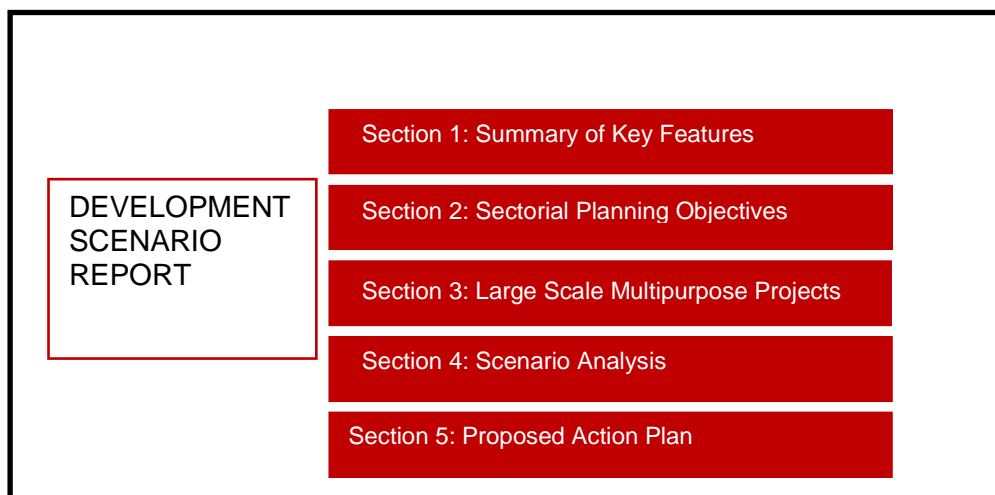


Figure 1-5: Components of the Development Scenario Report

### Strategy Formulation Phase

The end-product, the JIWRM Strategy, comprises a set of Strategic Action Projects (SAPs). The SAPs address identified management challenges. The JIWRM consists of short, medium and long-term interventions to support integrated water resources management to meet socio-economic development including poverty eradication and environmental integrity.

The Strategy proposes and promotes action projects and water infrastructure investments that are technically robust, socially acceptable and economically sound. The key characteristics of JIWRM Strategy are:

- the JIWRM Strategy was prepared within the framework of SADC Revised Protocol on Shared Watercourse Systems (2000) and follows the principles given in the national water policies and legal frameworks in Tanzania and Mozambique
- the JIWRM Strategy takes into account the physiographic, socio-economic and water management context within the river basin
- the JIWRM Strategy contains plans for water allocation, takes national water use priorities into consideration as well as the needs and expectations of existing and potential water uses
- the JIWRM Strategy defines the need for catchment and environmental protection, including erosion prevention
- the IWRM Strategy is phased and progressive and consists of separate components over time

The Joint IWRM strategy comprises detailed guiding documents for the responsible basin water authorities. Nevertheless, the strategy and especially its implementation plan is a dynamic document that should be regularly reviewed and up-dated.



In addition, a simple and rudimentary Decision Support System (DSS), that includes hydrological and water balance models set up for the Ruvuma River Basin and a GIS database, has been developed as a basis for future monitoring, basin planning, and management.

The formulation of the Joint IWRM Strategy of the Ruvuma River Basin has been undertaken over the period of March 2010 – May 2013.

### **Stakeholder Participation and Consultation Process**

Not only is a scientific approach important to build trust and ensure a consensus, equally important is the participatory approach. The success of the strategy will depend on the motivation and commitment of many actors, especially those living and operating in the basin itself. The Project stakeholders have been identified and grouped in two major stakeholder groups i) key project stakeholders and ii) stakeholders at large (the general public).

The key project stakeholders have been formally and regularly consulted throughout the strategy formulation project. As they represent a broader group of stakeholders, this group had a special responsibility to give advice and feed-back.

Additional stakeholders were reached through the project web-site. The purpose was to create awareness and support among the people at large residing and operating in the Basin and as such are important water managers, and likewise instrumental to the success of strategy implementation.

The consultative and participation process involved seven sets of activities:

- Consultations in the field
- Definition of key stakeholder groups and lines of communication
- Participation of Technical Advisors (TAs) in information collection and verification, and facilitating national level consultations.
- Milestone stakeholder workshops for stakeholder information and feed-back
- Expert and Steering meetings
- Coordination with parallel projects
- Project website

Consultations in the field and definition of key stakeholder groups were mainly carried out by the Consultant during the Monograph Phase. The TAs from the riparian states were assigned to facilitate national level consultations to ensure feedback on conclusions and recommendations from the key stakeholders groups at each milestone of the formulation process. This process also ensured the verification of input data and drawn conclusions. The TAs were employed by SADC and were based full time at the implementing agencies.

Four international consultative workshops were held at key stages in the formulation process alongside with Project Steering Committee meetings.

The JIWRM Strategy formulation process took place under the overall direction of the Project Steering Committee, with representative from the head of water ministries and SADC, tasked with overseeing, commenting and approving the Consultant's technical work.

Both Mozambique and Tanzania have established stakeholder institutions with a fair representation of the identified basin stakeholders and these were involved throughout the process and have been key participants at the formal stakeholder workshops attended by the PSC.

The project website [www.ruvumariver.org](http://www.ruvumariver.org) was established to support dissemination of information to stakeholders of the Ruvuma River Basin during the JIWRM Strategy formulation process.



## 2 IWRM PRINCIPLES

### 2.1 IWRM and Good Governance

Water's many different uses require integrated planning and development. Integrated Water Resources Management (IWRM) is generally regarded as a pre-requisite for achieving national goals related to poverty alleviation, economic growth, disaster resilience and climate change adaptation. Good governance is regarded a precondition for the practical implementation of IWRM.

*IWRM* has been defined as a comprehensive, participatory planning and implementation tool for managing and developing water resources in a way that balances social and economic needs, and



that ensures the protection of ecosystems for future generations. Operationally, IWRM means applying comprehensive knowledge from multi-disciplinary scientific studies of the basin as well as the insights from diverse stakeholders to plan and implement sound and balanced solutions. In practice, this means to balance sometimes competing needs for environmental sustainability, economic growth, and social development and to communicate the inter-dependence between the three objective areas.

*Water governance*, can be defined as the range of political, social, economic, and administrative systems that are in place to regulate the development and management of water resources and provision of water services at different levels of society. Values, power, politics, and corruption are common positive and negative driving forces in water governance and consequently the fundamental requirements for good water governance are strong political will, responsibility and accountability, and inclusiveness, participation and responsiveness.

*Transboundary Water Management (TWM)* brings additional complexity since it is not governed by the same strong legal framework as the national water management dimension.

Figure 2-1 : Cashew nut.

### 2.2 IWRM Policies and Principles

The overall long term goal of the joint effort between Mozambique and Tanzania on the Ruvuma River Basin is to ensure development of integrated water resources management and related physical infrastructure development that contributes to regional integration and poverty reduction.

Water is a key factor of production in agriculture, industry and other types of economic activities and there are a number of direct and indirect linkages between IWRM and achieving national economic development goals. The IWRM Strategy is supportive of the national development objectives of Mozambique and Tanzania and follows the principles stated in the regional and national water policies summarised in the following chapters.

## 2.2.1 Common Principles for SADC countries

SADC Regional Water Policy (RWP) of 2007 declares the common intentions of the SADC member states to apply the Dublin Principles and the IWRM best practices, including related management tools e.g.:

- stakeholder participation
- integrated planning
- water demand management (WDM)
- conflict resolution
- gender mainstreaming.

The aim of the RWP is to harmonise water governance and promote IWRM implementation. The RWP has nine thematic areas which address the management issues and challenges pertaining to the water resources of the SADC region and aim at optimising the development opportunities. For each thematic area the RWP provides specific policy statements which are fairly measurable which will facilitate progress monitoring.

The main policy areas and aims are:

- *Regional Cooperation in Water Resources Management*: aiming at water for regional integration and socio-economic development, cooperation in water resources management of shared watercourses, inter-sectoral and international cooperation, and harmonisation of national policies and legislation
- *Water for Development and Poverty Reduction*: aiming at meeting water demand for basic human needs and for industrial development including water for food and energy security
- *Water for Environmental Sustainability*: aiming at improving protection of the environment, water quality management, and control of alien invasive species in watercourses
- *Security from Water-related Disasters*: aiming at human protection from water related disasters and covering disaster prediction, and management and mitigation
- *Water Resources Information and Management*: aiming at enhanced and transparent data and information acquisition and management and information sharing
- *Water Resources Development and Management*: aiming at a river basin approach, integrated planning, dams and dam management, water demand management, and alternative sources of water
- *Regional Water Resources Institutional Framework*: aiming at the development and consolidation of institutional arrangements at regional and national levels and for Shared Watercourse Institutions purposefully designed for IWRM implementation
- *Stakeholder Participation and Capacity Building*: aiming at enhanced participation and awareness creation, capacity building and training, gender mainstreaming and research, technology development and transfer
- *Financing integrated water resources management in the region*: aiming at sound financial strategies, financial sustainability, cost reduction and public-private-partnership

The RWP provides guidance for the reform and harmonisation of national policies, strategies and legislation which would also facilitate joint management.

International water agreements and conventions guide the planning, utilisation and management of common water resources. The international legal framework for the management of the Ruvuma watercourse constitutes, mainly:

- The Revised Protocol on Shared Watercourses in the SADC, 2000
- The Joint Water Commission (JWC) Agreement between Mozambique and Tanzania, 2006

And additionally:

- The UN Convention on the Law of the Non-Navigational Uses of International Watercourses, 1997
- The Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention)
- The Convention on Biological Diversity
- The UN Framework Convention on Climate Change and Kyoto Protocol
- The Stockholm Convention on Persistent Organic Pollutants

Application of the principles outlined in the above legal documents is of paramount importance for the use and protection of watercourses as well as the larger issue of beneficial cooperation between the two countries.

Mozambique and Tanzania are not signatory parties of the UN Watercourse Convention. However they are signatory parties of The SADC Revised Protocol on Shared Watercourse Systems and have transposed it to national law. The Protocol recognises the principles of UN Watercourses Convention and includes specific provisions for equitable and reasonable utilisation”, the “obligation to prevent significant harm” (Article 3 (10) (a)) and “notification of planned measures”. The Protocol was signed in 2000 and came into force in 2003 and stands as a regional legal framework to which all national laws and policies must conform.

The Protocol supports and directs the establishment of shared watercourse institutions (Article 5) and Agreements (Article 6). It also offers a detailed explanation of the meaning of equitable and reasonable use (Article 3 (8)). In this respect, the Protocol supports the IWRM approach with an emphasis on sustainable development. With development as a focus it recognises the specific context of Southern Africa with a high degree of under-development and lack of water infrastructure. This is also transpired in its definition of “Management” whereby “Management of a shared watercourse” is defined as (i) planning the sustainable development of a shared watercourse and providing for the implementation of any plans adopted, and (ii) otherwise promoting the rational, equitable and optimal utilisation, protection, and control of the watercourse.

In accordance with the Revised Protocol on Shared Watercourses, the Governments of Mozambique and Tanzania signed in 2006 an Agreement for the establishment and operation of a Joint Water Commission (JWC) for the management of the Ruvuma River Basin. Both Mozambique and Tanzania have ratified the Agreement and transposed it to national law.

By signing and ratifying the JWC Agreement, Mozambique and Tanzania have committed themselves to the following principles with regard to the shared Ruvuma basin:

- Principle of sustainable development
- Principle of sustainable utilization
- Principle of prevention of harm
- Principle of precaution

- Principle of inter-generational equity
- Principle of co-operation
- Principle of equitable and reasonable utilisation



*Figure 2-2 : The Ruvuma River.*

## 2.2.2 Key Principles of Mozambique

The National Water Policy (2007) directs water resources management in Mozambique. The policy formulation was motivated by the recognition that insufficient resources and attention had previously been directed to the integrated water resources management issues. Specific challenges which needed more attention were identified with regard to the effective improvement of hydrological networks, the development of new hydraulic infrastructures (not the least for socio-economic development), integrated and participatory water resources management and planning, and finally the consolidation of the ARAs. Thus, the Policy elaborates on these areas and provides clear policy statements on these issues.

In summary, the goals of the revised Water Policy comprise:

- Satisfaction of basic needs of human water consumption
- Improvement of sanitation
- Water efficiently used for economic development
- Water for environmental conservation
- Reduction of vulnerability to floods and droughts
- Promotion of regional peace and integration
- Assurance of water resources for the development of Mozambique

Reducing vulnerability is one key IWRM objective. Mozambique ranks third amongst the African countries most exposed to risks from multiple weather-related hazards, and major floods, cyclones and droughts have a significant impact on the country's economy. The correlation between rainfall and overall GDP is strong which points to a vulnerable society. With each major shock, as much as 58% of the population and more than 37 % of GDP are at risk from two or more hazards.

The present institutional and legal set-up in Mozambique is essentially defined by the Water Law, Nr. 16/91, complemented by other legal documents providing for the creation of the various ARAs, for the legal framework for urban and rural water supply and sanitation, for the water tariff policy (1995) and, the Regulation of Licenses and Concessions of Water (2007).



The fundamental principles stated in the Water Law are:

- Unity and coherence in the management of river basins
- Institutional coordination and public participation in the decision-making process
- Compatibility of the water policies with the policies for regional planning and environmental conservation
- De-centralization in water resources management, particularly at the operational level

Regarding water use and exploitation, waters are classified into waters of common use and waters of private use. Waters of common use are those consumed by a family, for domestic purposes, cattle and small scale irrigation, with no use for mechanisation. Common uses of water are free and do not require any licence or concession nor is any payment of tariffs involved. Waters of private use need an authorization that can be given by law, licence or concession, under the following general principles and constraints:

- Water supply for domestic use has priority over all the other private uses
- No private uses will be allowed if they conflict with the water requirements for environmental conservation
- To satisfy different requirements, conflicts, resulting from water scarcity, will be solved as a function of the socio-economic value of each use
- The users of water for irrigation must make intensive use of that water, taking adequate and economically justifiable measures to reduce water losses

A specific policy for the tariff system, the Water Tariff Policy, was adopted. The principles that guide the water tariff policy are: User pays, Polluter pays, Equity, Environmental protection, Efficient use of water, Sustainability, and De-centralisation and participatory management. Further actions are needed to reinforce the water tariff system and increase the willingness to pay. For instance, it has been difficult to adjust the tariff for irrigation although progress has been seen.

The main objective of the National Water Resources Management (NWRM) Strategy (2007-2017) is to implement effectively the National Water Policy and to reach its various development goals for sustainable and integrated water resources management and development.

### **2.2.3 Key Principles of Tanzania**

In Tanzania, the water management is guided by the National Water Policy (NAWAPO) of 2002 and the National Water Sector Development Strategy 2005-2015 (NWSDS) of 2006.

The NAWAPO incorporates the principles of the Government's Development Vision, Poverty Reduction Strategy Paper (RRSP) and Local Government Reform Programme (LGRP) and introduces elements of decentralisation and devolution. Tanzania policy framework is characterised by its strong promotion of devolution of powers as the instrument for ensuring sustainability in water resources management and water supply. This principle is central to NAWAPO which provides for effective institutionalised linkages between the key actors explicitly central government, local government, the private sector, NGOs, CBOs, and the communities (WSDP, 2006).

NAWAPO adopts the main IWRM principles i.e. to manage water resources in an integrated and comprehensive manner and to ensure equitable, efficient and sustainable utilization of the country's water resources. It also incorporates other important principles of water resources management including separation of operational viz-a-viz policy and regulatory functions, involvement of

stakeholders at policy and operational levels (with decision making powers), reinforcement of economic incentives (charges for water use and pollution discharge) and coordination across water-using sectors.

The management of water resources is thus explicitly guided by the following principles:

- Separation of service delivery and water resources management
- Management responsibility is devolved to river basins, catchments, and water user groups
- Planning is an inter-sectoral process involving all stakeholders
- The value of water is recognised through charges for water use and pollution discharge
- Environmental water allocations are needed to ensure river health
- Trans-boundary waters are managed through a cooperative approach
- Human consumption is the highest priority water use

To give effect to the new water policy of 2002, the Water Resources Management Act No 11 of 2009 and the Water Supply and Sanitation Act No 12 of 2009 were enacted by the National Assembly, were gazetted and came into force on August 1<sup>st</sup>, 2009.

The major principles of water resources management in Tanzania were introduced by the old Water Utilisation Act. For instance, that all water in Tanzania is vested to the government. It also granted legal rights to water use and it established the nine Basin Water Boards (BWBs) and implementing Basin Water Offices (BWOs) to be responsible for water management and development planning.

The new Water Management Act of 2009:

- Reinforces the powers of the BWBs overseeing the work of the BWOs and the new central oversight structure
- Authorises water abstraction charges, discharge permits and water quality standards
- Empowers the Minister to establish and set aside a “reserve” before water allocation decisions are made
- Promotes trans-boundary water resources management and collection of data
- Provides for cross-sectoral collaboration
- supports the establishment of water user groups

Consequently, this legislation provides the necessary authority for the required institutional reorganisation, autonomous financing of BWBs/BWOs, and stakeholder participation in decision-making as called for in the NAWAPO.

The implementation of the water sector reform is supported by the on-going sector wide Water Sector Development Programme, WSDP (2006) and its three sub-sector programmes, explicitly: National Water Supply and Sanitation Programme, Urban Water Supply and Sewerage Programme and the Water resources Management programme. The WSDP is supported by grants and loans from international finance institutions. The WSDP comprises planned interventions as far as the year 2025.



## 2.3 Summary Governance Framework

The tables below give an overview of the enabling framework for the joint management of the Ruvuma Basin and show the links between regional and national policies, laws and institutions at different management levels. As can be seen from the tables, the basic components required for a solid water governance framework are in place. However, there are needs for consolidation and strengthening of the key pillars, legislation and institutions.

Table 2-1 : Policy and Legal Framework.

| Description                                   | Regional   | Mozambique  | Tanzania  |
|---|--|---|---|
| <b>Legal and Policy Framework</b>             |  |   |   |
| <b>Water Policy</b>                           | SADC: The Regional Water Policy (2005)   | Revised National Water Policy (2007)<br><br>Water Tariff Policy (1998)  | National Water Policy (2002)  |
| <b>National Water Law</b>                     |  | The Water Law (1991) <i>(a Draft Water Law Mozambique was prepared in 2005 but it was not put forward for public discussion and approval since then)</i><br><br>Regulation of Licenses and Concessions of Water (2007).<br><br>Governmental decrees creating the delegated management framework for urban water supply (1998) | Water Resources Management Act (2009)<br><br>Water Supply and Sanitation Act (2009) |
| <b>International Water Law and Agreements</b> | SADC: The Revised Protocol on Shared Watercourse Systems (2000)<br><br><i>(The Revised Protocol incorporates the principles of the UN Convention on the Law of the Non-Navigational Uses of International Watercourses (1997) and the Dublin Principles)</i> | Bi-lateral Agreement for the establishment and operation of a joint Water Commission (2006)   |   |
| <b>IWRM Strategy</b>                          | SADC: The Regional Water Strategy (2007)   | National Water Resources Management Strategy 2005-2017 (2007)   | National Water Sector Development Strategy 2005-2015 (2006)                         |

Water sector planning is moreover governed by the policy and legal framework of other sectors, e.g. irrigation, energy, environmental and social development related sectors (poverty, gender, HIV/AIDS). Guiding documents of these key parallel policy areas are also in place.

Water institutions must be in place for policy formulation, implementation cross-sectoral decision making, coordination and outreach and at different levels. The current institutional set-up at the international, national, and basin levels for the management of the Ruvuma's water resources is illustrated in Table 2-2.

*Table 2-2 : Institutional Framework.*

| <b>Description</b>  | <b>Regional</b>   | <b>Mozambique</b>  | <b>Tanzania</b>  |
|---|---|--|--|
| <b>Council of Ministers for Water</b>   | SADC Council of Ministries for Water  | National Water Council                                   | National Water Board   |
| <b>Ministry /Department of Water</b><br><i>Responsible to oversee implementation of the SADC The Revised Protocol on Shared Watercourse Systems</i> | The SADC Water Division, within the SADC Directorate of Infrastructure & Services | Ministry of Public Works and Housing                     | Ministry of Water  |
|   |   | National Directorate of Water                            | Department for Water Resources Management                      |
|   |   | International Rivers Office                              | Transboundary Water Resources Management Section               |
| <b>River Basin Institutions</b>   | Ruvuma Joint Water Commission   | ARA-Norte  | Ruvuma River and Southern Coast Basin Water Office             |
| <b>Stakeholder Institutions</b>   |   | ARA-Norte Management Board<br><i>(to be established)</i> | Basin Water Board <i>(reformed and re-established 2010)</i>    |
|   |   | Ruvuma Basin Committee                                   | Ruvuma River Catchment Committee<br><i>(to be established)</i> |
|   |   |  | Water User Associations WUAs                                   |

### 3 RUVUMA BASIN CONTEXT

#### 3.1 Biophysical Setting

The Ruvuma River Basin is shared between Mozambique, Tanzania and Malawi. The main Ruvuma River flows along the border between Mozambique and Tanzania. The total catchment area is approximately 155,000 km<sup>2</sup>. Mozambican territory covers 100,000 km<sup>2</sup> (~65%), while Tanzania covers 52,000 km<sup>2</sup> (~34%). The remaining part in Malawi covers 2,500 km<sup>2</sup> (<2%).

In Tanzania, the basin partially covers three regions, 4% of which lies in Lindi, 75% in Ruvuma and 21% in Mtwara. In Mozambique, it covers two provinces with 85% in Niassa Province and 15% in Cabo Delgado Province.

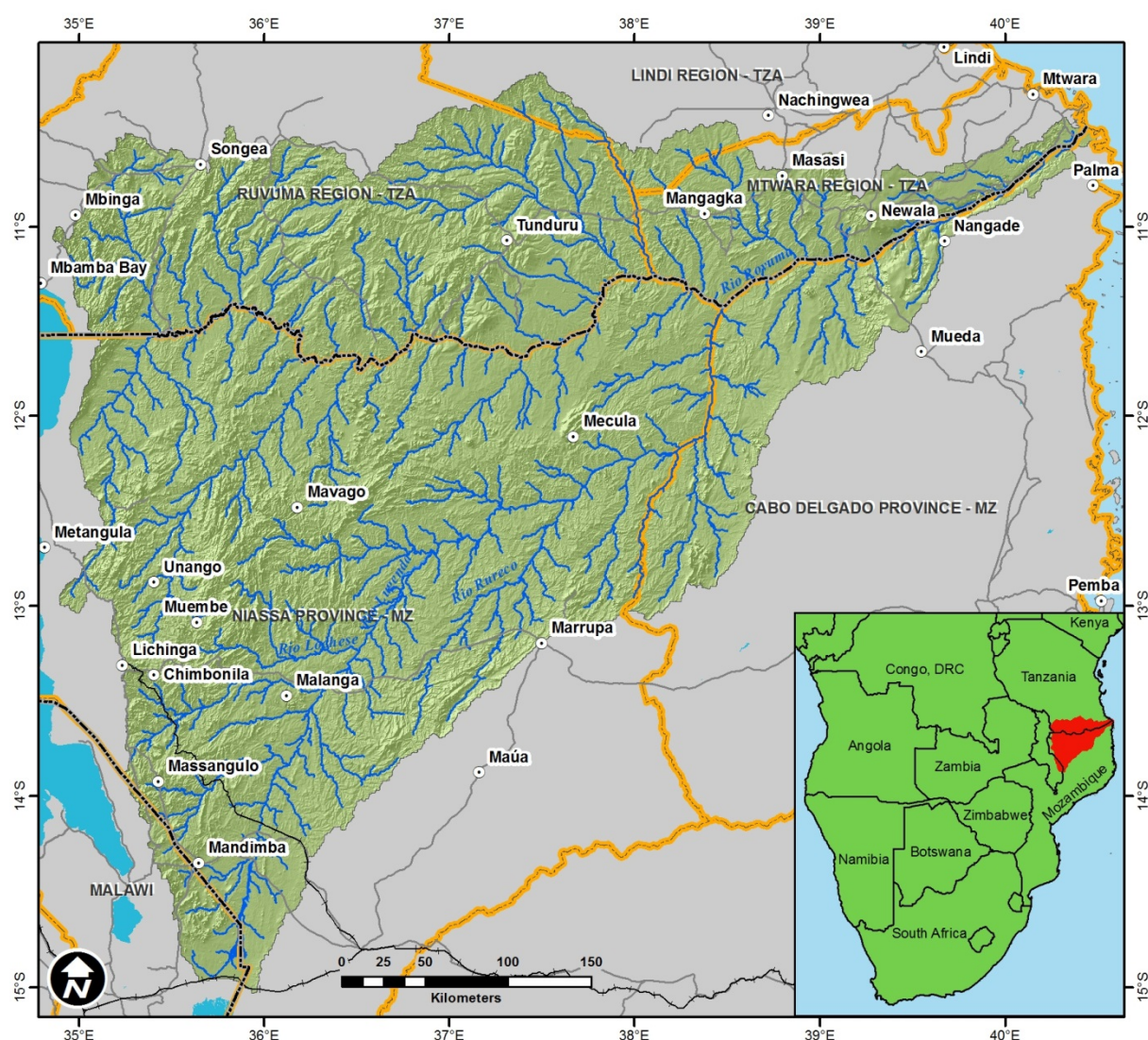


Figure 3-1 : Ruvuma River Basin – international and provincial/regional borders

The western part of the basin is the only area with mountains and high altitude. Further east, towards the Indian Ocean, the basin is characterised by a plain topography even if no widespread floodplains can be seen as in many other rivers in Mozambique.

Two general climatic zones can be distinguished in the Ruvuma basin, the coastal belt where tropical conditions characterised by high temperatures and high humidity prevail, and the upstream semi-temperate highlands characterised by wetter conditions.

The annual average temperature in the basin is fairly stable but there is a direct correlation between altitude and lower temperature. The annual average temperature in the Ruvuma River Basin ranges from 15°C to 26.6°C.

In general, considering the large area, rainfall does not vary much across the basin. A few peaks at the catchment divide have values up to 1,700 mm/year but otherwise rainfall seems to be between 850-1,250 mm/year. Rainfall generally decreases from the mountainous areas in the west towards the central parts of the basin, before increasing slightly again in the coastal area.

The upper part of the river basin, Upper Ruvuma, is dominated by dense forests and woodlands with some patches of cultivation evident in the northern sections of the sub-catchment. As one moves in a south-easterly direction, the land-cover transitions into a mosaic of shrubland and woodlands. Most of the cultivation in this catchment occurs in the Tanzania portion of the river basin. Mangroves can be found at the mouth of the Ruvuma River with some coastal forests located further inland, south of the Ruvuma River.

The Ruvuma River Basin is an unexploited area with only 3% of the area classified as urban and 10% classified as cultivation whilst woodlands and shrubland cover 35% respectively 44% of the area.

## **3.2 People and Economy**

### **3.2.1 Demography, Livelihoods and Vulnerability**

#### **Demography**

In general, settlements in the Ruvuma River Basin consist of scattered rural village communities, a few small towns, market centres, commercial farms and estates. These are generally concentrated in river valleys, flood plains, along main roads and in the vicinity of towns and administrative centres. There are very few settlements in the middle of the basin, which is almost pristine and is the location for the large Niassa Nature Reserve. The Ruvuma River Basin is generally very scarcely populated and the largest administrative and commercial centres in the basin are Lichinga in Mozambique and Songea in Tanzania. Within the basin in Tanzania, 90% of the population live in rural areas and 10% in urban areas. Similarly, in Mozambique, 67% live in rural areas and 33% in urban areas. Even in urban areas, population has access only to basic or even poor quality services and facilities.

There are many ethnic groups in the basin of which some are present on both sides of the border. Informal trade, informal economic activities and social relations motivate short and long term migration between both countries.

The population is made up mostly of subsistence farmers and fishermen, dependent on the Ruvuma River and its effluents for their livelihoods.

In Mozambique, following the peace agreement in 1992, the population has gradually moved back to their original towns and villages. In addition, the initial restoration of the local economy and new development initiatives has attracted additional people especially to the Niassa Province, which can be seen from the variation in the census results of 1997 and 2007.

The estimated basin population for 2010 was approximately 2.4 million with 1.5 million in Tanzania and 0.9 M in Mozambique. The population projection figures furthermore show that by 2030, the Ruvuma Basin could have in the order of 4.5 million inhabitants, of which 2.4 million in Tanzania and 2.1 million in Mozambique.



The estimated density of the population in 2030 and its distribution between rural and urban areas is shown in Figure 3-2.

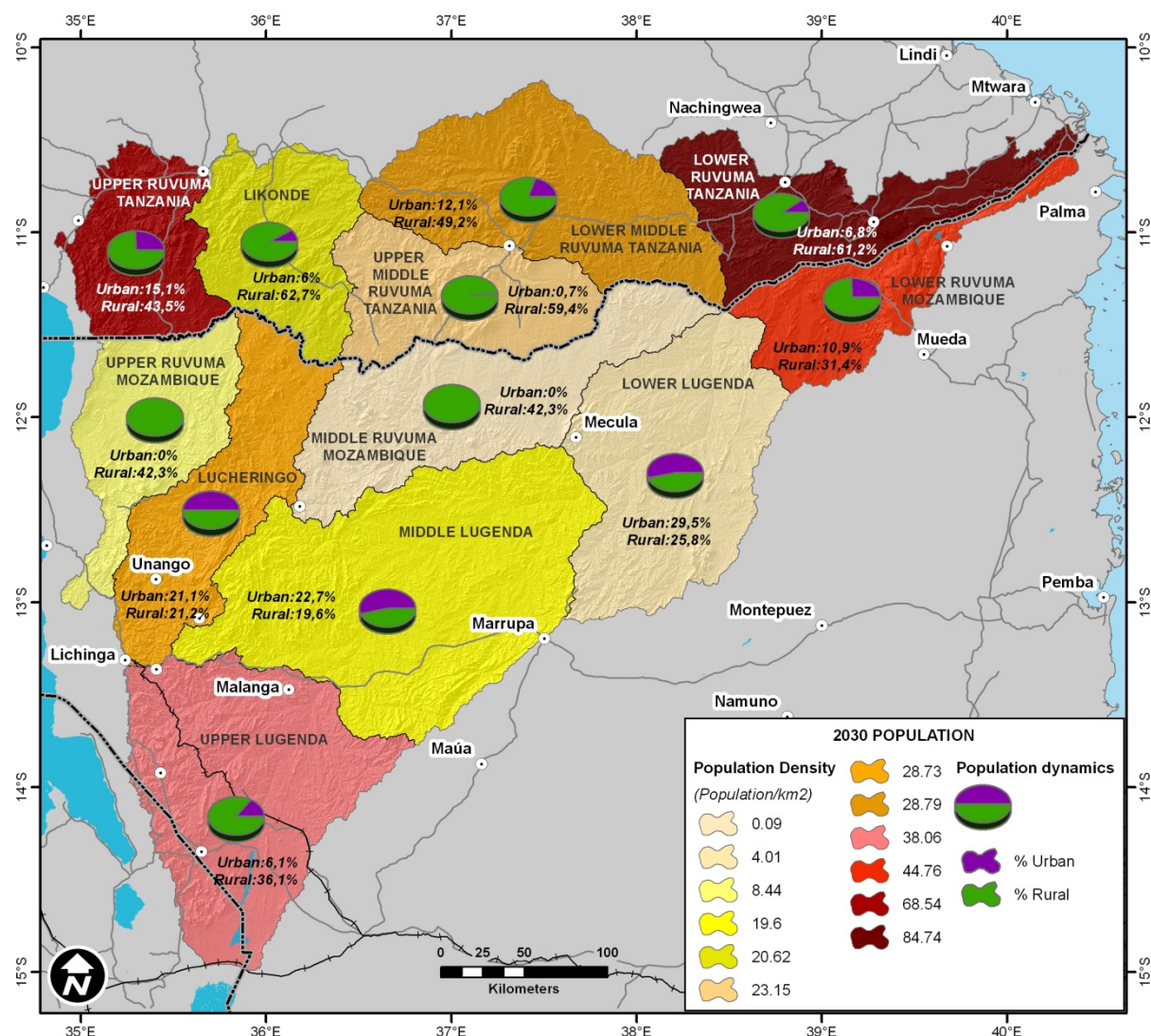


Figure 3-2: 2030 population density and distribution

## Social Indicators

Even though water resources are plentiful, access to safe drinking water is poor due to the lack of water supply infrastructure. There are very few piped water supply systems. The rural population is basically served by boreholes or dug wells. Access to appropriate sanitation is also poor. Over 90% rely on on-site solutions (septic tanks in the town centres and latrines for the peri-urban and rural areas) in the Ruvuma and Mtwara Regions. Only the Songea urban district has a sewerage system in place.

Regarding the health situation, the population is mainly affected by waterborne diseases, malaria, and malnutrition. HIV/AIDS prevalence in the Ruvuma River Basin is slightly less than 10% with Tanzania having a slightly lower prevalence compared to Mozambique.

The health sector in the region is faced with a variety of basic problems, which is contrary to the development of a healthy and productive population. Poor communications, poor water supply, poverty, poor rural health services and malnutrition are only some of the factors contributing to poor health

Agriculture is the main sources of income for the economically active population (90% in Niassa and Cabo Delgado provinces, Mozambique and 87% in Mtwara and Ruvuma regions, Tanzania). The main problem for the rural population is, basically, the lack of access to credit and affordable inputs for production, limiting their capacity to subsistence and cash crop agriculture.

Poverty Incidences for Niassa and Cabo Delgado provinces are 70% and 57% respectively (NBS Mozambique). In Tanzania the poverty incidence is 41% in the Rovuma region and 38% in the Mtwara region (NBS Tanzania). Despite abundant water and other natural resources, poverty in the Ruvuma River Basin continues to be a major setback to sustainable development.

### **Vulnerability and Water Dependency**

Vulnerability within the Ruvuma River Basin is related to water-related disasters such as floods, droughts, deforestation, food insecurity, waterborne pollution and associated public health hazards. Vulnerability is both of an acute and a chronic nature.

The Ruvuma River Basin experiences food surplus. However at the household level, the situation is different. Vulnerability in the basin is more of a chronic nature than a short-term and acute one. Acute (transitory) vulnerability is mainly associated with disaster prone areas. Vulnerability in the basin to floods and drought is classified as moderate rather than severe.

Most of the top 10 diseases and cause of deaths are water-and sanitation related in the Ruvuma River Basin. There is a general lack of improved sanitation facilities and lack of knowledge of the relationship between water, hygiene and excreta disposal. The problem of water related diseases are however not limited to sanitation. It is equally relevant in irrigation, seen in the increase in the prevalence of bilharzias and malaria. Another example is the artisanal extraction of gold using mercury in the extraction process, for example, in Northern Niassa in Mozambique. The use of agrochemicals is not yet a main issue due to little commercial farming in the area.

With the clearance of the forest for wood, firewood or the use of land for agriculture, erosion becomes a potential problem. Deforestation is considered the main source of losing productive water sources. To make soil and water conservation work properly and effectively, the protection of water sources needs a joint approach of all villages surrounding areas of water sources.



### **3.2.2 Economic Sectors and Water Dependency**

The agricultural sector is the main contributor to the basin economy.

Governments in both countries have started to focus on the development of the area and to attract local and international private investors. Regional/Provincial zoning plans are being developed to identify the major areas for private investments. The Ruvuma River Basin is rich in natural resources and sparsely populated, which makes the area very competitive in attracting local and foreign investments in the areas of conservation, ecotourism, commercial agriculture, forestry and mineral exploitation. However, the lack of good basic infrastructure augments the costs of products for regional and international markets. Development of the irrigation sector is hampered by the fact there are no large dams exist in the river basin and transport, energy and communication are

underdeveloped. Low education and skill development of the economically active population is also a disadvantage.

Private investments, especially local middle sized agriculture and agro processing firms, international safari game lodges and international commercial forestry companies have just recently started to focus on the area. Other sectors include wildlife hunting, ecotourism and artisanal exploitation of gold.

Off-shore findings of natural gas reserves are expected to drive economic development in the area around the Ruvuma River Basin.



### 3.3 Water Resources Situation

#### 3.3.1 Water Resources Availability

In Mozambique, two major tributaries feed the Ruvuma River: The Lucheringo and the Lugenda Rivers. The Lugenda River comprises a major part of the Ruvuma River Basin, covering 39% of the total area. The major tributary on the Tanzanian side is the Muhuwesi.

The most probable estimate of surface water resources in the River basin points to a total of 27,500 Mm<sup>3</sup>/year at the river mouth. It is important to note that the estimation of surface water resources for the Ruvuma River Basin is associated with an uncertainty of  $\pm 20\%$ , the reason being the very scarce input data both in terms of the length of how long records have been kept and their spatial coverage.

The distribution of generated surface water resources between the countries follows more or less the superficies. The reason for this distribution between Mozambique and Tanzania is that water resources in terms of specific runoff per area vary mostly from east to west, rather than along a north-south axis. The Table 3-1 summarizes the data.

Table 3-1 : Distribution of runoff between countries

| Country    | Area (Km <sup>2</sup> ) | MAR (Mm <sup>3</sup> /a) | Percentage |
|------------|-------------------------|--------------------------|------------|
| Tanzania   | 52 100                  | 9 265                    | 34%        |
| Mozambique | 100 000                 | 17 727                   | 64%        |
| Malawi     | 2 500                   | 533                      | 2%         |

The total amount of groundwater recharge in the basin is approximately 9,300 Mm<sup>3</sup>/year (5.7% of MAP). However, with granite/gneiss constituting 67% of the basin area and noting that



granite/gneiss typically denotes a low-yielding aquifer, the actual groundwater potential of the basin is generally low.

The Ruvuma River Basin groundwater potential, as a function of recharge and aquifer storability, is approximately 5,320 Mm<sup>3</sup>/year. The calculated groundwater potential is a theoretical value that does not represent economic utilizable or feasible volumes that can be abstracted annually. Taking into account the groundwater recharge and hydro-lithology, the aquifers within the highest groundwater exploitation potential occur in the unconsolidated, intergranular deposits in the western portion of the basin on the Tanzanian side. Groundwater from these aquifers could support domestic and commercial supplies and they most likely play an ecosystem support role as well. It must be noted that in the remaining areas groundwater is present but only feasible to develop for domestic purposes. Borehole yields are typically low and careful borehole siting methodologies are needed. On the coast, groundwater is relatively easily accessible but may be too saline for use, or prone to sea water intrusion during pumping.

In summary, groundwater in the Ruvuma River Basin is not a resource that can be widely utilized for economic activities. Approximately 8 % of the area has a high groundwater potential which would be beneficial for productive sectors, notably industry and irrigation.

### **3.3.2 Floods, Drought and Climate Change**

Flood magnitudes have been assessed through regional flood analysis. The flood magnitudes at the river mouth vary from a mean annual flood of about 1,800 m<sup>3</sup>/s to some 25,000 m<sup>3</sup>/s for a 10,000-years flood.

Floods are not a major problem in the Ruvuma River Basin for to the simple reason that no large settlement areas are located within the main inundation areas. However, the problem increases with the influx of people and economic activities. In any case, flood discharge estimates are required for a variety of purposes including the design and appraisal of reservoirs and hydropower and irrigation schemes.

Estimated results of streamflow drought corresponding to various threshold levels indicate that severe and extreme streamflow droughts did not occur during the period 1960 to 1990. However, moderate droughts occurred in six of the years between 1982 and 1990.

A national scale climate change analysis for Tanzania and Mozambique presented contradictory results. It is thus very difficult to make any quantitative estimates as to the effect of climate change on the Ruvuma River Basin, based on the previous studies or trend analyses. Both the future projections of rainfall as well as the trends in historical records show contradictory results and it is thus not even possible to predict whether rainfall will decrease or increase. Because of increased temperatures, most scenarios seem to point to the fact that increased evaporation will be a probability. Increased evaporation may create increased local rainfall and cloud formation. It is, therefore, not easy to make outright predictions as to the net effect on water resources.

The indicative data suggests a rainfall change of less than 10% up to the year 2100. In a 20-year or even 50-year perspective, the changes are even less. This should be compared to with the large uncertainties in the estimation of water resources, due to the scarcity and poor quality of available hydrometeorological data. The results arrived at was  $\pm 20\%$ .



### 3.4 Environmental Issues

#### Terrestrial Biodiversity and Protected Areas

The Ruvuma River Basin is dominated by the Eastern Miombo Woodlands Eco region and is home to a rich variety of fauna.

With regards to conservation areas, the Ruvuma River Basin has almost 20 forest reserves. The Ruvuma basin also has wildlife conservation areas which include game reserves and wildlife management areas in both Tanzania and Mozambique. The main feature in this context is the Niassa Game Reserve which covers some 28% of the basin area.

In addition there are two national parks partially located in the basin: the proposed Ruvuma National Park in Mozambique and the Mnazi Bay Ruvuma Estuary Marine Park in Tanzania. The protected areas are linked by a number of ecological corridors that cover a major part of the Ruvuma River Basin. As an additional step in keeping to keep wildlife in the national parks and to avoid the often common conflict between wildlife and people, a number of wildlife management areas and hunting blocks have been demarcated and interventions have been embarked upon to involve the communities and make them benefit from improved natural resources and wildlife management.

The existing and proposed conservation areas cover almost half of the area of the Ruvuma River Basin, and this must be considered in the water sector planning.

#### Aquatic Biodiversity and Ecological Status

The Ruvuma River Basin is a part of the large eco-region named Coastal East Africa.

The Ruvuma Estuary is listed as a major mangrove area, the mangrove forests considered to be among the best in both Tanzania and Mozambique (Gawler & Muhando 2004), covering an area of approximately 95 km<sup>2</sup> (Ferreira *et al.* 2009). Highly productive nurseries for both fish and prawns, the east African mangroves significantly enhance the biodiversity of the surrounding marine environment while providing vital habitat for migratory birds, marine turtles, dugongs and porpoises (WWF Eastern African Marine Eco region 2004, Ferreira *et al.* 2009).

The aquatic habitats in the Ruvuma River Basin host a variety of species with several endemic species. About 30 % of the nearly 100 fish species are, for example, endemic to the region. The swamps and floodplains characteristic for the region also provide a good habitat for several bird species.

The rivers and estuary were assessed on a scale developed in South Africa, which rates river conditions from A (= natural) to F (no longer functioning). Sites visited in 2010 ranged from A to D, but were mostly in good condition (B/C or higher), particularly in the lower parts of the basin. The aquatic ecosystems of the Ruvuma River Basin thus are largely still in good condition because the hydrology of the basin is largely natural and the basin has a high proportion of natural vegetation cover. In the upper parts of the basin, in relation to their size, rivers are heavily used by people and this has local impacts. Where mining is carried out, these impacts are severe. However, the deteriorating condition of the catchment woodlands due to clearing and burning is probably the greatest concern in many areas.

#### Water Quality

The surface water quality measurements suggest that the water chemistry is generally good in the Ruvuma River Basin, in as much as it falls within existing water quality guidelines.

The main concerns in terms of water quality are the very high turbidity in certain rivers. The probability of elevated levels of the pH due to the extensive use of rivers for washing, and the

possibility of high levels of heavy metal toxins as a result of mining activities. Levels of nutrients are also likely to be elevated as a result of human settlements throughout the basin.

In general, groundwater quality appears acceptable for domestic consumption although salinity has been reported locally. However, this is a generalisation and there may be specific elements that have a particularly high concentration, for example fluoride, iron or manganese. The population in the Ruvuma River Basin largely uses groundwater as a source of drinking water. Thus groundwater protection measures are important as well as the complete analysis of groundwater (including microbiological content) of domestic supply boreholes on a regular basis. The threat of sea water intrusion in coastal areas is always a pertinent issue. In order to prevent the intrusion of saline water into the aquifer systems, groundwater abstraction rates must not be too high.



### 3.5 Water Utilisation and Demand

The knowledge of present and future water demand in Tanzania and Mozambique is one of the cornerstones of the JIWRM Strategy. Water demand is estimated per country, per sub basin as well as per water use sector.

The key water use sectors in Ruvuma River Basin are urban and rural drinking water, small scale irrigation and water for sustaining ecosystem services. Water utilisation in the basin is characterised by the general low development of the area. No large dams exist. Current water demand for the hydropower, industry, afforestation and navigation is negligible in the basin, at present.

In both countries, the largest user of water is the agricultural sector. However, a major difference can be noted between the type of areas irrigated in Mozambique and Tanzania in the Ruvuma River Basin. The following two trends stand out:

- In Mozambique, irrigation is mainly undertaken by private farms while community-based and small-scale irrigation projects are nearly non-existent
- In Tanzania, irrigation is mainly small-scale and community-based

Hydro-power in the region is not well developed. It should be noted, however, that the potential for developing hydropower is great and the water impacts of this sector could therefore increase substantially were the potential be fully developed.

The Ruvuma River Basin is rich in biodiversity and is characterised by a large number of important eco-systems. Consequently, non-consumptive environmental demand is significant. Two different theoretical methodologies have been applied to estimate water flow requirements for the eco-systems, the Desktop Model and the minimum release concept. According to the desktop model, between 23-67% (differs between sub-basins) of the natural Mean Annual Run-off (MAR) would have to be allocated to sustain the current ecosystem classes. Using the minimum release concept, whereby the median of the annual low flows is used as a basis for determining the minimum releases, between 6 and 22% (depending on sub-basin) of the natural MAR would need to be allocated for the benefit of the ecosystems.

Navigation is not an important issue on the Ruvuma River and no structural projects are planned in this sector.

Present water demand in Tanzania is substantially higher than in Mozambique. The future water demand is a function of the potential for increased demand for various sectors which in turn is dependent on which development –nexus decided upon and the economic growth likely in the region of the Ruvuma River Basin. The JIWRM Strategy is based on the analysis of potential increase in water demand up to the year 2030 for different Nexus-scenarios. Future water demand is based on projected development scenarios ranging from probable to high demand scenarios for that period.

The future development of the Ruvuma River Basin will be determined by a number of key driving forces, notably the macro-economic outlook and planning objectives of each water user sector.

The following clusters of driving forces have been identified:

- Demographic (population growth, migration pressures, urbanization)
- Economic (economic development rate, rate of water works investment)
- Technological (water use efficiency)
- Social (poverty, inequity, health, education)
- Governance (policies, power structure, level of conflict, globalization)
- Environmental (water-related diseases, soil salinization, water pollution, ecosystem health)
- Climatic (possible future changes in temperature, evapo-transpiration/evaporation, precipitation, river flows and frequency of droughts and floods)

To understand future water management and development needs an analysis of key water user sectors is required. Hereby the predicted expected future development needs of each sector can be determined. Demand management instruments and water allocation measures must also be applied. In estimating the water demand and in determining the development options, these driving forces were taken into consideration and their relevance for the Ruvuma River Basin, established.

Considering the various sectors of consumptive use – urban water supply, rural water supply, irrigation, livestock, industrial and mining – and the estimates of water demand, it is clear that irrigation is by far the most important water user now and in the future, with rural water supply as a distant second. The significant increase in water demand up to the year 2030 is mainly due to development of the agricultural sector in Tanzania.

Moreover, the water demand analysis shows that, similar the current situation, the estimated future water demand will be considerably larger in Tanzania than in Mozambique.

Still, water demand is low compared to the available water resources. The figures confirm the general view that water resources are presently in abundance in the Ruvuma River Basin. It should be noted, however, that the flow required for environment and eco-system services, were it applied, would be the largest user of water in the Ruvuma River Basin.

While the development of some sectors will depend on new storage and regulating infrastructure, for other sectors, the direct impact on the water resources will be minimal or even non-existent. It should be noted that the infrastructure projects with direct impact on the water resources of the Ruvuma basin are not numerous, compared with other transboundary basins in the region.

The main projects, identified to date, with significant needs for water resources development and management are related to the irrigation, hydropower and environmental management sectors.



## 4 FUTURE SCENARIOS

### 4.1 Scenario Description

Sector studies undertaken within the framework of the strategy formulation process, have made possible the identification of development, which could have a direct or indirect impact on the joint water management of the Ruvuma basin.

The development of some of these sectors such as irrigation and hydropower requires creating new infrastructure for storing and regulating the available water resources. In the water and sanitation sector, the increasing population, with its water demand and its aim for a better standard of living (hygiene and public health) would also create the need for new structural developments.

Other sectors, like the environmental safeguard or the development of tourism would not require a particular hydraulic infrastructure, yet they must respect certain norms in terms of minimum water flow and water quality in the water courses.

A sectoral review of potential development projects and opportunities has been undertaken. The review resulted in an estimated water demand for each sector and the need for new hydraulic infrastructure.

The development of irrigation in the Mozambican part concerns essentially private farms, while in Tanzania numerous extension projects and the construction of new public irrigated schemes have been identified.

A similar observation can be made about the hydropower projects, an important number of them being in the pre-feasibility or feasibility stage in the Tanzanian part, while few projects have been identified on the Mozambican side. Within the framework of the strategy formulation process, a preliminary study concerning a transboundary hydropower production was carried out. It could benefit both countries by interconnecting the national networks.

In terms of environmental protection and the development of protected areas, both countries appear to have taken into account the fantastic resources that the basin has in terms of ecosystems and wildlife. Beyond heritage protection, safeguarding of the natural environment could open up interesting tourism opportunities. Many projects are underway in both parts of the basin. Tanzanian and Mozambican authorities work together in this domain, most notably in the Selous Niassa Wildlife Corridor.

The analysis revealed that irrigated agriculture, hydropower, water supply needs and environmental protection were the principal sectors in which the development and its consequences must be analysed in detail through a hydrological model. Thus, four scenarios were simulated via the WRYM (Water Resources Yield Model), to analyse the environmental, social and economic impacts created by the basin's development on the water resources. One of the scenarios corresponds to the current situation (scenario 0). The other three scenarios take into account the various levels of development of the water supply and the different hydro agricultural and hydropower developments. They also consider the need to guarantee a minimum environmental water flow in the river, as well as at the water abstraction points identified.

As a basis for scenario construction a number of aspects have been considered. Primary uses were given the highest priority, both countries envisaging full coverage with regards to water supply and sanitation for the rural and urban populations. In the Ruvuma basin, there is great potential for the development and cooperation in the sectors of hydropower and irrigation including the provision of large multipurpose transboundary infrastructure. There is also great potential for cooperation on wildlife management, environmental protection and tourism. Lastly, maintaining the environmental

flows is considered a main component of the scenario screening process. In order to evaluate potential development in terms of water balance, environmental and social impacts, and economic considerations, an array of scenarios have been defined. In total, 4 scenarios have been studied:

**Scenario 0:** This scenario represents the current situation and can be considered the reference base-line scenario. It is used to set the parameters of the model. The environmental flow requirements have not been assessed in this scenario.

**Scenario 1:** This scenario represents a high development scenario in the water supply and irrigation sectors. No hydropower infrastructure has been included in this scenario.

**Scenario 2:** This scenario represents a high development scenario in terms of water supply, irrigation, and hydropower including a transboundary multipurpose project.

**Scenario 3:** This scenario represents a high development scenario in terms of water supply, and an improved situation in terms of irrigation and hydropower. No large-scale transboundary multipurpose projects are included in this scenario.

### Operating rules

Priority of water supply to the various water users are as follows:

1. Domestic
2. Ecological requirements
3. Irrigation
4. Hydropower

Environmental flow requirements have been discussed together with the two countries, and within the scope of the strategy formulation process, a minimum flow average of 15% was agreed upon.

## 4.2 Scenario Analysis

Firstly, these scenarios are compared in terms of areas equipped for irrigation and operational irrigated areas, energy produced, water abstraction, supplementary water storage capacity needed and investment costs. *Table 4-1* below summarises this information.

Secondly, the multi-criteria analysis assessed the water demand, water balance, the environmental and social impacts and, costs and benefits as well as macro-economic considerations in each scenario.

Table 4-1 : Syntheses of the scenarios

| Scenario number  |  | 0                         |                           | 1                                |                           | 2  |                           | 3                                |                           |
|--|--|---------------------------|---------------------------|----------------------------------|---------------------------|--|---------------------------|----------------------------------|---------------------------|
| Hydropower dam   |  | Current Situation         |                           | Current situation                |                           | Full development   |                           | Improved situation               |                           |
| joint project  |  | Current Situation         |                           | Current situation                |                           | Alternative B : two reservoirs and two run-off river schemes |                           | Current situation                |                           |
| Irrigation   |  | Current Situation         |                           | Full demand                      |                           | Full demand  |                           | Improved situation               |                           |
| Water supply (Urban, Rural, livestock, Industrial)         |  | Current Situation         |                           | Full demand                      |                           | Full demand  |                           | Full development                 |                           |
| E-Flow for all basin                                       |  | No                        |                           | Yes                              |                           | Yes  |                           | Yes                              |                           |
| Other projects   |  | Yes                       |                           | Yes                              |                           | Yes  |                           | Yes                              |                           |
| Hydroelectricity   |  | Average energy (GWh)      |                           | Average energy (GWh)<br>/ scen.0 |                           | Average energy (GWh)<br>/ scen.0                             |                           | Average energy (GWh)<br>/ scen.0 |                           |
| Average energy (GWh)                                       | All systems  | 2                         |                           | 2                                | 0                         | 1 972  | 1 970                     | 118                              | 116                       |
|  | Mozambique (HP Lichinga, Mbahu)  | 2                         |                           | 2                                | 0                         | 14   | 12                        | 2                                | 0                         |
|  | Tanzania ( Lupilo A, Lower Nakatuta, combined Nakatuta, Lumeme, Sunda Falls, Kwitanda) | 0                         |                           | 0                                | 0                         | 151  | 151                       | 116                              | 116                       |
|  | Transboundary project  | 0                         |                           | 0                                | 0                         | 1 819  | 1 819                     | 0                                | 0                         |
| Irrigation   |  | Area (ha)                 |                           | Area (ha)                        | Additional area / scen. 0 | Area (ha)  | Additional area / scen. 0 | Area (ha)                        | Additional area / scen. 0 |
| Irrigated area (ha)  | Whole basin  | 9 340                     |                           | 59 800                           | 50 500                    | 59 800   | 50 500                    | 47 100                           | 37 800                    |
|  | Mozambique   | 740                       |                           | 13 000                           | 12 300                    | 13 000   | 12 300                    | 2 600                            | 1 900                     |
|  | Tanzania   | 8 600                     |                           | 46 800                           | 38 200                    | 46 800   | 38 200                    | 44 500                           | 35 900                    |
| Water abstractions   |  | in Mm3                    | % MAR at outlet of Ruvuma | in Mm3                           | % MAR at outlet of Ruvuma | in Mm3   | % MAR at outlet of Ruvuma | in Mm3                           | % MAR at outlet of Ruvuma |
| Water abstraction  | Evaporation  | 0                         | 0.00%                     | 0                                | 0.00%                     | 87   | 0.32%                     | 1.0                              | 0.00%                     |
|  | Irrigation   | 24                        | 0.09%                     | 268                              | 0.97%                     | 268  | 0.98%                     | 240                              | 0.88%                     |
|  | Water supply   | 7                         | 0.03%                     | 24                               | 0.09%                     | 24   | 0.09%                     | 24                               | 0.09%                     |
| Storage capacity   |  | Storage capacity required |                           | Volume Mm <sup>3</sup>           | % of the volume           | Volume Mm <sup>3</sup>                                       | % of the volume           | Volume Mm <sup>3</sup>           | % of the volume           |
| Additional regulation reservoirs (million m <sup>3</sup> ) | Whole basin  | -                         |                           | 112                              |                           | 112  |                           | 85                               |                           |
|  | Mozambique   | 0                         |                           | 38                               | 34%                       | 38   | 34%                       | 19                               | 23%                       |
|  | Tanzania   | 0.3                       |                           | 74                               | 66%                       | 74   | 66%                       | 66                               | 77%                       |

The conclusions drawn from the multi-criteria analysis assessing the water balance, the environmental and social impacts and, costs and benefits as well as macro-economic considerations are summarised below.

#### Water demand and balance

For each abstraction point, the hydrological model developed for the basin allowed the strategy formulation process to determine whether or not the surface water resources were sufficient to satisfy a theoretical water demand.

It has also enabled verifying whether or not the minimum social reserve (drinking water and basic needs) and environmental water flow was respected at specific points. Moreover, it enabled calculating the energy effectively produced during the year by the hydropower projects in terms of the available water flow and the retained water volumes. It showed that the hydropower projects would not have a direct impact on the water availability at different water abstraction points.

The analysis undertaken proved that the water demand for Ruvuma development scenarios varies between 0.2 % (for the current situation) and 1.7 % (highest water demand scenario) of the MAR at the Ruvuma estuary.

It can be deduced from the results that the environmental flow will always be guaranteed (from January to December for 30 out of 30 years) for the scenarios where this variable has been considered.

It should be noted that even in the case of the scenario with the highest water demand, the water actually consumed represents a very small part of the rivers' water flow in the Ruvuma estuary. However, an important part of the water is consumed in the tributaries of the Ruvuma River. Knowing that the levels of the water resources are relatively low during the dry season, a seasonal lack of water is observed at certain points of the watershed.

In the Ruvuma basin the existing infrastructure for water storage is non-significant. This is why, in order to avoid water shortages, an increase in water storage infrastructure must follow an increase in water demand. In the light of the analysis of the water storage capacities required, this infrastructure should be able to store between 10 and 200 Mm<sup>3</sup> depending on the scenario. This assessment is based upon the desire to avoid water shortage as identified by the WRYM.

Its results are also based on the assumption that, for the irrigation abstraction points, the capacity of the water storage required must make up for the water deficit 4 out of 5 years whereas for the primary use abstraction points, the capacity of storage required must make up for the water deficit every year (5 out of 5 years).

For scenarios 1 and 3, the shortages can be eliminated resolved by building small and medium size dams to store water during the months when there is a surplus of water flow (compared to the water demand), so that the water can be used during the months when there is a water shortage. Scenario 2 requires large reservoirs.

It must be noted that the results presented in the previous chart were obtained from modelling and simulations. As such, they are purely indicative and must be used with care. For instance, the estimation of surface water resources, a key in-data in the WRYM, is associated with an uncertainty of  $\pm 20\%$ . Indeed, during the modelling an important number of assumptions were made because of the low availability of the information.

#### Environmental and social impacts

The scoring of analysed development scenarios shows that scenario 3 has less of a negative environmental impact compared to the other scenarios. This is because scenario 3 does not



consider the full development of hydropower and irrigation. However, it should be noted that Scenario 3, would require the energy demand to be met from other energy sources than hydropower. The environmental impacts of developing other energy sources such as coal and natural gas would be different.

The scenario that exhibits most negative environmental impacts is scenario 2, which includes the high development scenario for the irrigation and hydropower sectors. This indicates that fully developing both the irrigation and hydropower potential in the basin may cause significant environmental impacts especially to sensitive areas and to the hydrological cycle. It should be noted, that some of the potential hydropower schemes in Tanzania are located in areas that have been identified as sensitive or of importance to conservation.



#### Costs and benefits of each scenario

The estimation of the implementation costs focuses on the main infrastructure, both hydropower and irrigation, proposed in the scenarios.

In terms of investment costs, scenarios 1 and 3, with a medium infrastructure development, represent an investment cost of between 400-500 MUSD and scenario 2, with the highest infrastructure development for irrigation and hydro-electrical production, represents an investment cost of 1,600 MUSD.

Scenario 2 is clearly the scenario with the highest level of investment in both the irrigation and the hydropower sector for both countries. In scenario 3, the investment costs for the Mozambican side of the basin are very low for two main reasons: there are few hydropower infrastructure projects proposed, and most of the irrigation infrastructure development is linked to private farms and therefore not included in the public investment cost.

The investments are expected to lead to multiple macro-economic benefits, supporting the long-term sustainable economic growth in the basin. Irrigation is a key factor for agricultural productivity. The improvement of existing irrigation schemes and the development of new ones would have a positive impact on the livelihoods of those depending on agriculture, by improving productivity.

The high development scenario considers the full development of planned schemes plus the partial development of all irrigable land. This would have an indirect positive impact in terms of creating

more opportunities for employment and trade of agricultural products. In addition, irrigation schemes for intensive agriculture would allow farmers to produce crops without relying on rainfall, ensuring constant production and reducing vulnerability to an unpredictable climate. By ensuring that farmers harvest and trade year around this would be of great advantage especially with reference to export crops.

Small and medium reservoirs associated with irrigation could have a positive impact on the environment when used to manage downstream water flow. In some cases the storage reservoir could be used to release flow during the dry season to keep a minimum environmental flow in the water courses. In most cases, mitigation measures could also be proposed to reduce the negative impacts on the environment and on the population.

The development of hydropower in the Ruvuma Basin would have significant positive impacts in terms of providing a renewable source of energy. The monograph describes this on the Mozambican side of the basin where only 3% of the population have access to electricity while 59% use petrol or gas and 30% use firewood. In the Tanzanian part of the basin, approximately 8 % of the 2010 population had access to diesel generated electricity while the majority of the remaining population depended on firewood.

The water supply and sanitation projects would significantly improve health and the standard of living for the communities within the service delivery area. The development of these water supply and sanitation projects would provide safe drinking water, reduce distance for rural communities to access water and reduce waterborne diseases. Most of the top 10 diseases and causes of death are water- and sanitation related.

#### Macro-economic considerations

Different water planning contexts can be expected depending on which development sectors the countries chose to focus on in a water, energy, and food security nexus perspective. The water supply and sanitation sector has unquestionably the highest priority in strategic planning. However, investments targeting the hydro-power respective irrigated agriculture would be driven politically, based on macro-economic considerations. The major macro-economic and nexus considerations for the analysed scenarios are presented below.

Water infrastructure development would mainly follow the developmental pace of the agriculture and energy sectors. For instance, if scenario 2 is desirable, water planning would be heavily involved since this scenario would require a large scale water infrastructure.

Scenario 1 would aim at strongly orientating the basin towards explicit agricultural development, with the primary objective of contributing to the countries' food security. Indeed, the development of an irrigated and intensive agriculture would create jobs directly but also indirectly through the appearance of agro industry service providers following the increase in agro-production.

The realisation of this scenario would depend on the development of other domains (e.g. development of the roads and communication axis, agro industries, support to the agricultural sector).

Scenario 2 would aim at high (full) development of both hydropower production and irrigated agriculture, with the primary objective of contributing to commercial economic development. Was this scenario being chosen as the directive focus for development, the basin would become a producer of renewable energy (hydropower) and of food crops as well as of cash crops.

This scenario would require major efforts from both governments. This scenario could only be realised if major focus from both countries targets the Ruvuma River Basin in favour of other basins

and development regions in their respective countries. Looking at current policy and planning directions, this seems not to be the case.

Scenario 3 aims at an increased but moderate development of agriculture and hydro-power production, which could open up for more explicit effort to protect the environment and to develop eco-tourism. Scenario 3 includes the hydro-agricultural projects already identified in national planning documents and by the private sector. This scenario would result in limited water infrastructure development but would open also for a more pronounced effort towards the protection of the environment and the development of eco-tourism.

All scenarios would require feasibility studies and the implementation of small and medium sized dams. All scenarios, moreover, would require strategic actions aiming at protecting the environment

Given the results of the water balance model and the multi-criteria assessment, all three potential scenarios are feasible. However, scenario 3 seems to be the most realistic scenario. It only takes into account the hydro agricultural infrastructure projects already identified, the hydropower production projects that are most economically viable, and the water supply needs of the primary uses. It is also the scenario where the social and environmental impacts and costs are most reasonable. And the one the water sector must, as a minimum, be preparing for.



## 5 CHALLENGES AND STRATEGIC ACTION AREAS

### 5.1 Setting and Key Features

The Ruvuma River Basin's key features are:

- The Ruvuma River is almost unparalleled in South-Eastern Africa. It is one of the few shared rivers, that is basically hydrologically pristine. No significant water storage or river regulating infrastructure exist
- The Ruvuma Basin is rich in both aquatic and terrestrial biodiversity. A large part of the basin is environmentally/ecologically untouched and has high degree of biodiversity, especially in Mozambique
- The existing and proposed conservation areas cover almost 50% of the area of the Ruvuma River Basin and careful planning of the infrastructure is required so as not to encroach upon important conservation areas
- Population density is currently low. However annual population growth is estimated to increase substantially within the basin especially on the Mozambican side i.e. more than the national average
- The people living in the Ruvuma River Basin are generally poor, most of them living on subsistence agriculture
- There is at present low level of economic development. Basic infrastructure is improving but still remains at a generally poor level
- The current water demand only accounts for less than 1% of the available water resources. The current use of water for irrigation is at small scale level. The potential area for irrigation is much larger than the area currently under operation
- The current environmental threats to the water course are relatively few in number, small in dimension, and local in extent, e.g. informal gold and gem stone mining (Lupilichi, Tunduru), untreated effluent from settlements (Lichinga, Songea) and erosion due to unsustainable land use practices. Out of those, mining is the worst and destruction of vegetation the most widespread problem
- The identified portfolio of development projects with future water withdrawals is relatively small (mainly small and medium scale irrigation schemes). However, the demand to enlarge the portfolio of multi-purpose water infrastructure projects may rise due to on-going improvements of basic infrastructure (roads, electricity) and general economic development, especially on the Tanzanian side
- There are no immediate driving forces or plans for large-scale water infrastructure development in the Ruvuma River Basin. However, the potential for development in the hydro-electric and irrigation sectors is great
- Water availability is not a limiting factor for economic development and food security. Instead, the limiting factor seems to be the slow pace of investment in basic infrastructure,



notably water supply and sanitation, irrigation, energy and roads. Consequently, there is a great need for local water infrastructure investments

- There exists a water governance framework for transboundary and integrated water resources management, although key institutions are not fully consolidated and suffer from low capacity for practical implementation of mandated functions and law enforcement

The future development of the Ruvuma River Basin will be determined by a number of key driving forces, notably:

- Peace and stability in the region permitting the area to become a focus zone for rehabilitation/construction of basic infrastructure and a cross-boundary investment zone for regional integration initiatives e.g. cross-border power transmission lines and bridges
- Recently discovered coal reserves and off-shore natural gas reserves coupled with the increasing global market prices on minerals and fossil fuels. Recent prospecting off-shore Mtwara in Mnazi Bay has revealed large deposits of natural gas and possibly also oil reserves. The presence of oil and gas companies offers opportunities for the establishment of petrochemical processing and other allied industries in the vicinity of Mtwara. In particular there are plans for the establishment of cement and fertiliser plants that would require large volumes of water for their operation. The same situation occurs in the offshore of northern Cabo Delgado Province, where world scale natural gas reserves have been confirmed and intensive exploration will start in less than 5 years' time. Large industrial developments, including a LNG plant, are being considered for the Palma – Mocimboa da Praia region. Apart from attracting industrial establishment, the potential economic growth would create an influx of people, which in turn would increase the demand for service functions such as municipal water. However, region's logistic infrastructure is still insufficient and improvement is seen to be a critical factor for the feasibility of those businesses
- Increased national and international understanding of the unique biodiversity of the Ruvuma River Basin and national commitments towards biodiversity and environmental conservation of the regional assets have resulted in the establishment of protected areas and transboundary environmental conservation projects
- Urban migration leading to an increased concentration of demand for safe and reliable water supply
- Climate Change with more unpredictable and extreme weather conditions leading to a larger degree of uncertainty especially for a rain fed agriculture

In the light of the aforementioned driving forces, both governments realise that the investment in infrastructure projects is now a priority, even though the current portfolio of development projects is relatively small.

Expanding the road network is absolutely essential for promoting rural development in the Ruvuma Basin. Investment in irrigation, energy, water supply and telecommunications is also central to stimulating local and foreign investment and in the creation of wealth and employment-generating activities.

## **5.2 Main Challenges**

It should be emphasised that the main challenge is that the Ruvuma Basin, currently being in almost pristine condition, may be negatively impacted by nearby mining and industrial developments. The



wildlife and eco-tourism potential in the Ruvuma Basin could be a tremendous asset if considered and managed properly. However, it is close to areas where large mining and industrial developments are expected and this will have an environmental influence on the Basin.

Additionally, the following key issues are noted for the Ruvuma River Basin:

Water for meeting basic needs –The coverage rate for water supply and sanitation for urban and rural areas is still far below national goals. A large portion of the population has poor access to secure water sources in both countries. The lack of access to water is reflected by the high prevalence of water-borne diseases and general low scoring on health indicators. Inter-basin water transfer schemes are deemed to be required.

Water for pro-poor rural development - A common challenge for Southern Africa is food security and national efforts are put on improving small scale and subsistence farming. The transition from rain fed farming to irrigated agriculture is a priority strategy. At the household level, access to a relatively small amount of water for productive purposes could make a substantial difference to the quality of life of the poor. Currently, micro dam and small scale agricultural support are under implementation in both Tanzania and Mozambique. The up-scaling of such initiatives is needed in the basin area.

Water for commercial agriculture – The agricultural potential of the basin is far from fully developed. With the estimated development rate of irrigation schemes and urban centres, seasonal water shortages in the tributaries are a fact. Assuring the supply and securing water for socio-economic development are a main water resources management challenge. Compared to the aspirations of the stakeholders and goals set in the national policies, the coverage of small to medium sized reservoirs for secured water supply for irrigation is not adequate. In fact, the existence of storage infrastructure is negligible. The area has good potential for irrigation/commercial agriculture, agro-forestry and agro-industry as well as mining industry development. As a starting point the formulation of a small and medium sized dam development strategy will be required.

Water for energy - Energy deficits exist in the whole of southern Africa. The growth in power and energy demand has to be met through an additional supply including possibly the development of new national generation projects. The main Ruvuma River has great hydropower potential which could be developed both for internal consumption as well as for exports. Access to modern and *renewable* energy to increase the countries' electrification is one of the means to create better living conditions and alleviate poverty.

The potential for hydro-power generation in the Ruvuma River Basin is far from fully developed. Although there are no immediate plans for large scale investments in the hydro-power development within the basin, the water managers must keep abreast with the developments of the energy sector for optimal and long-term basin planning of the shared Ruvuma watercourse. Especially, since large scale investments on the main Ruvuma River will require substantial feasibility studies and the strengthening of bi-lateral cooperation mechanisms.

Looking at the potential, power generation, could become one of the major commercial uses of the Ruvuma water resources. However, scenarios for future development of hydropower in the Ruvuma river basin and its corresponding water demand are not only based on local potential dam sites, but also on national power plans, known investment projects to be developed, and some other reasonable assumptions e.g. comparative advantages in the specific region and availability of other energy sources.

As a direct benefit, hydro-power could have great relevance both at local, national and transboundary levels. Electrification in the basin is needed and is on-going. However, considering the current plans of development in other areas in Mozambique and Tanzania, and considering the existence of coal and the off-shore findings of natural gas reserves, full development of the

hydropower potential in the Ruvuma River Basin is not likely in the coming 20 years. In Mozambique, there are plans at an advanced stage to develop new hydropower plants in the Zambezi and Lurio river basins, and this reinforces the idea that hydropower in the Ruvuma basin is not to be considered in the short or medium terms.

To prepare for meeting energy needs from renewable sources rather than from coal and natural gas, in the long-term future, the riparian states could start looking into joint development initiatives on the Ruvuma main watercourse to increase hydro-power production. The identified joint investment on the main Ruvuma watercourse tentatively referred to as the Upper Ruvuma Dam & Reservoir Multi- Purpose Project could be of mutual interest. The average energy provided by such a scheme would be in the order of 1970 GWh per year.

Among the reasons for why such an investment has not been studied in detail previously have been the general low development of large scale economic activities and the previous lack of an enabling transboundary governance framework to handle development on the shared Ruvuma River. However, with the peace and stability in the region and the JWC in place, the situation is changing.



Environmental Flow Requirements: Securing water for the future and for the environment are integral parts of the policy and legal frameworks of both countries. Any water infrastructure development must consider EFR and climate change aspects and thus new development would most likely consider this demand and allocate water to this user to a larger extent than has been traditionally done.

The environmental water requirement is recognised as a primary water use in both countries. However, no established standards exist for calculating Environmental Flow Requirements (EFR).

Water Quality: The rich aquatic biodiversity and important aquatic ecosystems are bound to encounter some pressure from the development occurring in other sectors of activities such as the energy, transport, mining, forest and agricultural sectors.

Overall, there is an insufficient appreciation of the value of water, and the effort required to make water available on a sustained basis. Inadequate attention to environmental impacts, will – if no measures are taken – result in wasting water, polluting water resources and degrading aquatic habitats.



Water Vulnerability: Vulnerability in the basin is more of a chronic nature than a short-term and acute one.

Transitory or acute vulnerability is mainly associated with disaster prone areas. Vulnerability in the basin to floods and drought is classified as moderate rather than severe, as no large settlements are located in the areas susceptible to floods. However, the human, material, social and economic impacts of floods are exacerbated by the increasing settlements in the buffer zones and flood plains of the Ruvuma River. Regarding drought, the rural communities in the Ruvuma Basin are only moderately exposed to droughts but when a drought occurs vulnerability is high because of poverty and high reliance on rain-fed crops. Flood and drought management is thus a high priority.

Chronic vulnerability is highly associated with household food insecurity and this area is a challenge. Rain fed agriculture is susceptible to climate variations, which will remain and more likely increase due to climate change trends. Irrigation development is one of the main means to reduce the vulnerability of the rain-fed dependent population. It would contribute to improved food security and would increase farmers' incomes.

Another cause of chronic vulnerability is the exposure to water borne diseases. To address this problem there is a need for improved water supply and sanitation solutions as well as on-farm water management measures to deal with bilharzia and malaria.

Water Governance: Policies, water acts, regulations and guidelines exists at an acceptable level whilst institutional efficiency in terms of water management and protection remains low. Poorly defined roles, inadequate resources in terms of skilled staff, vehicles, equipment and finance and some structural issues such as integrity and accountability aspects are some of the causes for the different institutions' incapability to efficiently undertake mandated functions.

Future development scenarios and water management challenges in the Ruvuma River Basin will require appropriate governance frameworks, at bi-lateral, national and sub-national levels. A firm governance framework requires not only a comprehensive policy and legal structure but also an institutional set-up that consists of effective coordination mechanisms, well defined roles and responsibilities, planning processes, and financing in place.

It should also be noted that in order to meet the obligations of transboundary water management, improved implementation of IWRM principles at national level is required.

Current low capacity to undertake mandated functions, such as monitoring and water resources information management (incl. water assessment, flood and drought forecasting, simple water balance calculations), water use allocation, and pollution control makes it difficult to fulfil international requirements.

The Ruvuma River Basin has few large scale users i.e. few paying users. Consequently, finance generated from economic tools such as water user fees, is not expected to meet the rising cost of water management within the given time frame (up to the year 2030). Prioritisation of activities may be necessary.

Critical issues that need to be addressed:

- Institutions are not fully consolidated, especially with regards to sector-coordination and stakeholder participation
- Inadequate financial resources i.e. few licenced users
- Rising cost of water resources management
- Skill shortage and limited institutional capacity

- Lack of accountability and procedures to ensure efficiency and good water governance
- Basic IWRM functions are not undertaken at an acceptable level



### **5.3 Addressing the Challenges**

For the IWRM of the Ruvuma River Basin, four water management challenges and corresponding strategic action areas were identified:

- Sustainable use and assurance of water supply to key water users sectors.
- Water quality and aquatic ecosystem health.
- Water related vulnerability, notably floods and droughts.
- Water governance and IWRM implementation, with special focus on the Transboundary Water Management (TWM) dimension.

These are the challenges that need to be addressed. For this, a number of strategies have been formulated. These are presented below.

#### **5.3.1 Meeting Water Demand and Allocation Priorities**

##### Background

Water demand includes consumptive and non-consumptive demand. A water demand study estimates the amount of water which needs to be reserved or allocated for a specific use. According to the water demand study, the key water demand sectors are:

- Water for urban and rural domestic needs
- Water for sustaining ecosystem health and services

- Water for agriculture
- Water for energy production
- Water for industries and commerce

#### Strategy/Policy direction

The Joint Ruvuma River IWRM Strategy aims at meeting key water allocation principles stated in national and regional governance documents, more specifically it aims at allocating water in the following priority order:

- Primary uses - domestic needs and ecological requirements
- International obligations
- Pro-poor development
- Economic development

Highest priority is given to satisfy basic human needs by securing a basic water supply for people with the unit consumption rates stated in the national policy documents. This implies that the primary objective is to ensure that sufficient quantities of raw water are available to provide for the basic water needs of the current and future population.

The other priority is sustaining aquatic ecosystems. The Ruvuma JIWRM Strategy aims to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the Ruvuma basin water resource. This implies ensuring sufficient water of an appropriate quality to sustain healthy aquatic ecosystems. Ensuring healthy aquatic ecosystems and, more generally, the pristine nature and wildlife of the Ruvuma basin is an important asset also in economic terms as the planned large scale mining and industrial developments in the vicinity of the basin increases the potential for eco-tourism as a major source of income in the Ruvuma basin. Regarding eco-system services and ecological flow requirements (EFR), the Monograph Report provides a review of methods that could be applied to the Ruvuma basin and presents resulting EFRs. This review could be used as a basis for future practices in the Ruvuma River basin.

The countries are committed to the Revised Protocol on Shared Water Courses in Southern Africa and the Joint Water Commission (JWC) agreement on the Ruvuma River Basin. These include no detailed specifications as, for example, minimum releases to the shared main Ruvuma water course. However, the countries have committed themselves to meet the general obligations related to an equitable and sustainable use of the Ruvuma River Basin. The goal is to develop a comprehensive agreement detailing and specifying general obligations and to ensure their implementation.

Prioritising water for pro-poor development before large scale commercial uses is another key issue for the joint effort embarked on by the riparian countries to ensure sustainable development on the shared Ruvuma River Basin. The overall objective of the Ruvuma JIWRM Strategy is pro-poor development. This implies actively reserving water and allocating finances for pro-poor development.

Once a reserve for water for priority uses has been secured, water for economic development should be allocated among the remaining sectors based on multi-criteria evaluations. Consideration should be given to strategically important investments for the national economy. In this respect, the Nexus water, energy and food security perspective is one important aspect, and multi-purpose use of infrastructure investments, another.

### Key strategies/strategic actions

To promote sustainable use, the key strategic actions are:

- Enforce demand management regulations and instruments including water user fees and other charges
- Reduce losses within water piped systems and irrigation schemes
- Institute water restriction measures in emergencies situation (e.g., droughts)

For the Ruvuma River Basin the strategic actions are to promote the introduction and application of WDM instruments. Efficient WDM comprises the application of various management instruments i.e. technical, regulatory, informative, and economic instruments. The Ruvuma JIWRM Strategy comprises strategic actions to promote the introduction and application of such instruments. The application of allocation rules relates to the regulatory instruments. Up-grading irrigation and water supply systems are technical tools covered under Strategic Action Area 1: Coordinated water infrastructure development. Developing allocation guidelines (targets and limits) for each sector, water use tariffs, and information packages are examples of regulatory, economic, and informative instruments covered under Strategic Action Area 4: Institutional consolidation and strengthening.

## **5.3.2 Assure Water Supply – Investing in Water Infrastructure**

### Background

The first challenge is to reserve water according to the above listed allocation principles. The second challenge is to ensure access to the allocated water. To assure a water supply of acceptable quality, there will be a need for reservoirs, irrigation infrastructure, water supply and distribution networks and pollution control structures such as waste water treatment plants.

### Strategic objective

Sustainable use and assurance of water supply to key water users sectors

### Strategy/Policy direction

Success in allocating water and finances according to the above listed principles would require a committed and dedicated water sector, actively driving basin planning and implementation towards sustainable water management with the associated outcomes of healthy people, rich biodiversity and prosperous economy.

With regards to sustainable use, the guiding principle for the Ruvuma River Basin is to go from a narrow focus on resource development to a broader orientation of options notably effective water use and use control through regulations and tariff systems. Nevertheless, the fact remains that water is not the limiting factor in the Ruvuma River Basin. There is sufficient water for development. Currently, the lack of investments in water storage and supply systems is a limiting factor for socio-economic development. The Ruvuma River



Basin, as a whole, has sufficient water resources to meet its short and long term requirements as illustrated in the Development Scenario Report. The key challenge is instead related to the need to respond to the planning objectives of each sector and to ensure timely accessibility and water delivery to the users. The reliable supply of water in sufficient quantities and required quality is a crucial input to economic growth and job creation. Until a basic level is achieved, the immediate focus for the Ruvuma River Basin will consequently remain on infrastructure development. At the same time, in order to improve the understanding of the true value of water and to safeguard this vital resource, high priority should be given to strengthening the use of water demand management (WDM) tools, notably economic tools and allocation principles.

With the current development rate in each water use sector, water shortage areas in the tributaries to the Ruvuma main watercourse can be expected if no measures are taken.

It should be noted though that agriculture and population growth are not the only driving forces for water infrastructure development. The need for hydropower generation could also require development and regulation of the Ruvuma River Basin.

#### Key Strategies/Strategic actions

By regulating the flow of water in the tributaries through small and medium dam, better distribution can be achieved over the year, ensuring an effective utilisation of the considerable surplus of water. The overall strategic objective is to meet the challenge of providing water in an optimal, sustainable and equitable manner to underpin economic development in a demand driven manner. This objective would require closer coordination between the key water user sectors, notably agriculture, energy, environmental protection and the basin water authorities in the Ruvuma River. It would also require Environmental Impact Assessments (EIAs) to be carried out for all proposed projects in the Ruvuma JIWRM strategy.

Conjunctive use of ground water will be central in the future water infrastructure development in the Ruvuma River Basin. Historically, ground water as a “hidden” resource has not been given the same attention as surface water despite the fact that groundwater is the dominant source for domestic water supply within the rural communities.

Few paying water users would require more effective and more efficient water management, including management of scarce resources. This implies investment in improved planning, incorporation of critical financial management, and commitment to focus on operations and management. In the case of ARA-Norte, the low stream of revenues from the Ruvuma basin can be partially compensated by the expected large developments in the river basins to the south, particularly the Messalo basin. However, as this would yet take some years to start, the financial support from the central government would still be required.

Substantial investment funds would be required for the water resources management process and the necessary water infrastructure. Both countries recognise that public-private partnerships would be a prerequisite for meeting the development challenge. One interesting option to be piloted is the negotiation of package land and water concessions and management contracts to encourage private operators of irrigation infrastructures.

To promote sustainable water use, the key strategic actions are:

- The enforcement of demand management regulations and instruments including water user fees and other charges
- The reduction of losses within water piped systems and irrigation schemes



- The institution of water restriction measures in emergencies situation (e.g., droughts)

To address the need for investment in the Ruvuma River Basin, the key strategic actions are:

- Contributing to coordinated development of key water use sectors through active involvement in planning and implementation of water supply and sanitation, irrigation and hydro-power projects.
- Increasing storage volume and regulations of the river system through the following strategic actions:
  - Development planning, project feasibility studies and EIAs of small and medium dams
  - Fund raising activities and actively find avenues to mobilise funding e.g. through PPPs.
  - Implementation of viable projects
  - Planning for operation and maintenance

### 5.3.3 Ensure Water Quality and Sustaining Ecosystem Services

#### Background

The planning objective of the environmental sector is the implementation of major conservation projects and increased development of eco-tourism in the Ruvuma River Basin. The plans envisage a high degree of regional integration and transboundary cooperation both with regards to the protection of ecosystems and wildlife and the development of the eco-tourism sector. As mentioned previously, the existing and proposed conservation areas cover almost half of the Ruvuma River Basin, and this must be considered in water sector planning.

#### Strategic objective

Ensure water quality and sustain aquatic ecosystem health

#### Strategy/Policy direction

Contribute to a healthy, ecologically sustainable and protected water environment by improving protection of the environment and water quality management.

#### Key Strategies/Strategic actions

Attention to the environmental aspects would be important in the basin since some of the proposed development projects are located in important environmental zones, for example the Nakatuta, Msunda and the Mululima waterfalls in Tanzania reported to contain a unique micro ecosystem and the River Messalo and the River Rumana in Mozambique, both identified as important for conservation.

In addition, deterioration of water resource quality and ecosystems due to pollution from urban, mining and agricultural activities as well as deterioration of water habitats due to exploitation is a threat. Mitigating measures, both structural and non-structural, are needed to deal with this problem.



Safeguarding the ecosystem and the development of sectors such as fishing and tourism are closely connected to knowledge of the environment flow, since the development capacity of the basin depends on respect for these environmental flows.

Environmental management and protection is a responsibility cutting across several sectors. Mainstreaming environmental aspects versus developing specific strategic actions for dealing with cross-cutting issues are often debated at an academic level. Considering the unique features of the Ruvuma River Basin and in striving to lift environmental safe-guarding high on the agenda, the key strategy for the Ruvuma JIWRM Strategy is to promote specific action projects addressing protection and conservation

Actions to maintain good quality surface and groundwater resources are necessary. This includes the implementation of a suitable pollution control framework and structural investments to prevent pollution risks from urban areas, agriculture, industrial and mining activities.

The fact that exploration and mining activities cause significant environmental impacts is well known. Such impacts include the contamination of water resources through the discharge of processing chemicals or waste into streams and rivers. Adequate storage and control of waste and tailings are therefore of major importance at any mine site thus preventing downstream environmental impacts. Impacts on water quality may also be caused by the removal of vegetation, thus opening up of new areas to erosion, causing an increase in sediment loading of downstream areas.

With regards to larger scale mining and formal prospecting activities, existing laws and regulations are adequate. Enforcement, however, is inadequate. Efforts to support artisanal and small scale mining (ASM) must be accompanied by a strengthened commitment and capacity to supervise, control and enforce existing laws and regulations. Thus, small scale miners must not work in protected areas, they are prohibited from dumping tailings straight into rivers, and once they have mined out a site, they must rehabilitate it. In line with the need for strengthened capacity to supervise and control, the coordination and cooperation between the two countries' agencies also

needs to improve. Thus, the resources needed to control and supervise mining activities in the river basin do not necessarily all need to be supplied by the Ministries of mines, as there are considerable benefits from sharing available resources between organisations such as the mines, and water and environmental ministries. The problem of gold mining is a multi-disciplinary problem and must be handled jointly between the Ministries of Water, Mineral Resources and Environment. Inter-ministerial action groups are seen as a way to improved law enforcement.

In summary:

1. Environmental water (flow and quality) at key points must be jointly determined. This implies that water bodies need to be classified and quality objectives need to be determined at basin level.
2. Protection of the Ruvuma basin water resource needs to advance for the benefit of a healthy population, sustained ecosystems and a prosperous economy. This would require an integrated cross-sectoral approach including both surface and ground water resources. Formal mechanisms, e.g. cross-sectoral working groups, for strengthening collaboration around protection, conservation and pollution control should be developed. This would also require that ecosystem priority areas should be identified and declared as protected areas.
3. Pollution control needs to be enforced.

Improved efficiency in the protection of biodiversity and maintaining water quality can be achieved mainly by increasing knowledge of current ecosystems and by implementing suitable cross-sectoral management to the priority issues and areas.

In this respect, the priority cross-cutting strategic actions are:

- The implementation of programs for pollution control of informal mining areas
- The development and the implementation of erosion management programs
- The acceleration of water source protection activities
- The determination of water requirements for sustaining aquatic ecosystems
- The establishment of an ecological status monitoring programs
- The establishment of water quality management plans

In addition, institutional strengthening actions include specific ones to enhance monitoring of water quality and pollution control functions.

The implementation of these strategic actions has high priority and would require immediate actions. Monitoring and enforcement follow up activities would require medium and long term support interventions.

### **5.3.4 Reduce Vulnerability**

#### Background

Reduction of vulnerability is highly prioritised in national policy documents and it is recognised that this strategic action area is an important corner stone of pro-poor development.



### Strategic objective

Reduce the human, material, social and economic impacts of water related disasters and climate change

### Strategies/Strategic actions

Introduce coordinated measures for climate change adaptation and disaster management, notably floods and drought, as well as accidental pollution.

To address vulnerability important strategic actions - other than basic water supply and sanitation interventions – are:

- The development of climate change adaptation strategy
- The development of disaster management plans

The measures aim at forecasting natural disasters and future climate change impacts and to implement procedures to reduce the impact of these risks on the local population.

The future hydro-climatic situation may lead to different characterisation of river hydrology and water demand (due to higher evapotranspiration). However, available data at the regional level is insufficient for foreseeing trends. The effective functioning of a quality-controlled hydrologic network of measuring stations for rainfall, evaporation, water levels and river flows, groundwater and water quality is an essential requirement for this purpose.

The key objectives of a climate change strategy for the water sector are the following:

- Updating the water balance modelling, assessing the vulnerability of the population and once new data is available from climate modelling research at regional level, developing a climate change adaption strategy.
- Increasing preparedness for potential changes in productivity and increased pressure on natural resources
- Integrating climate change considerations in the short-, medium- and long-term water planning processes
- Increasing the capacity to provide information about necessary design considerations both for important infrastructure such as roads, railway and dams, with regards to flood magnitudes and safety, and irrigation infrastructure with regards to the assurance of supply and water storage planning.

Disaster management refers to all aspects of and activities relating to the planning for, implementation of and response to disasters before, during and after disaster activities. This involves mitigation, prevention, preparedness, emergency response, recovery, rehabilitation and reconstruction. It also refers to the management of risks, vulnerability and the consequence of disasters.

Disaster management is multi-sectoral and several national agencies play distinct and separate roles. With their knowledge and their information management, the water authorities play an important role in handling floods, droughts and the accidental pollution of waterways. Coordination with national disaster management institutes is essential for developing a sustainable strategy for flood and drought management.

The strategic objectives of the disaster management plan are:

- Knowledge of inundation areas for different flood magnitudes

- Functioning flood warning system
- Functioning drought warning system
- Knowledge of key pollution risks and functioning warning system for accidental pollution

### 5.3.5 Create Responsive and Efficient Water Governance

#### Background

Responsive and efficient water governance is necessary to meet international and national obligations

#### Strategic objective

To create responsive and efficient water governance

#### Strategies/Strategic actions

The key strategy is to strengthen the institutional and legal framework to meet international obligations related to the shared Ruvuma river basin.

The target beneficiaries are the Ruvuma JWC, the DWR of MoW/RBWO in Tanzania, DNA/ARA-Norte and Ruvuma basin stakeholder organisations.

Institutional development actions should be managed on three levels: the transboundary level, the national level and the stakeholders' level. For the efficient implementation of IWRM, peak performance from institutions, management and an enabling environment are essential, and herein lies a challenge in effective governance, even though its main focus is on institutional consolidation and the enhancement of management procedures.

#### 5.3.5.1 Transboundary framework required for joint management

The strategic objective is to detail and operationalize the principles of the SADC revised protocol and the Ruvuma JWC Agreement.

With the signing of the SADC Protocol, Tanzania and Mozambique have committed themselves to the principles of equitable use, no harm, prior notification and cooperation. Among others, the following principles can be noted:

- The maintenance of a proper balance between resource development for a higher standard of living for their people and conservation and enhancement of the environment to promote sustainable development
- The pursuit and establishment of a close cooperation with regard to the study and execution of all projects likely to have an effect on the regime of the shared Ruvuma watercourse
- The exchange of available information and data regarding the hydrological, hydro



geological, water quality, and the meteorological and environmental condition of shared Ruvuma watercourses

- The utilization of the Ruvuma water resources in an equitable and reasonable manner and their protection in the countries' respective territories

To meet international obligations, the following requirements must be met:

- A comprehensive agreement for the shared river basin based on the Ruvuma JIWRM Strategy study and in accordance with the orientations of the Ruvuma JWC and the SADC Protocol
- Information exchange mechanisms, compatibility of technologies and procedures for collection and management of information
- A joint river basin management institution in operation
- Harmonisation of national legislation in accordance with the terms in regional, bi-lateral or multi-lateral agreements signed and ratified by the riparian states
- International agreements transposed into national law
- Mechanisms for joint development and implementation of joint initiatives

With the signing of the Ruvuma JWC Agreement, the basic transboundary governance framework has been established. In addition, the Ruvuma JIWRM Strategy constitutes a document that comprises well-defined objectives, mutually beneficial goals and development priorities, all stated in a long-term integrated river basin management plan.

The Ruvuma JIWRM Strategy will thus constitute the basis for further advancing the transboundary governance framework. The next step will be to negotiate a comprehensive joint agreement. Important aspects to be regulated in the agreement include detailed principles for water development, water allocation between sectors and the two countries in various contexts (e.g. in normal situations and in times of drought).

To this end, the water sharing agreements are assumed to provide detailed procedures for water allocation including EFR procedures, consultation procedures, co-ordination mechanisms, systems for environmental and hydrometeorological monitoring, exchange of information, disaster management (flood, drought and accidental pollution), and development guidelines (e.g. joint or/and independent EIA studies for projects with transboundary impacts, dam safety procedures).

Joint formulation and the choice of procedures and norms would benefit from the preparation of discussion/background papers on each subject, to be prepared by independent parties. The papers should review and provide options for detailed procedures. The review project should also entail the analysis and specification of an institutional set-up for the implementation of the agreement.

Another vital task is to establish the JWC Permanent Secretariat and a Technical Committee to support the Ruvuma JWC with administration, management, coordination, communication and screening as well as M&E functions. The original objective of JWC is to “act as technical adviser to the parties (Tanzania and Mozambique) on matters relating to the conservation, development and utilization of the water resources of common interest and identify areas of cooperation related to intergraded water resources management and development”. Thus, the current functions of the JWC are merely advisory with only three officials appointed by the Ministry in each country, assigned to meet at least twice a year.

The medium-term priority action for the JWC is to establish the JWC Permanent Secretariat, a coordinating body, with competent and adequate staffing for the efficient implementation and monitoring of bi-lateral agreements and the Joint Ruvuma IWRM Strategy.

This implies that an agreement must be reached upon:

- The role of the secretariat within an existing or planned hierarchical structure of a river basin organization
- The objectives, powers, functions, roles and responsibilities of the commission and its secretariat
- The establishment structure of the secretariat
- The planning, programming, execution of tasks and reporting duties
- The preparation of procedural guidelines for specific transboundary water management issues
- The financial control and accountability

The capacities of the Permanent Secretariat would have to be strongly increased (human resources, offices, means of transport, etc.).

In the event of a joint investment on the Main Ruvuma River, the option of up-grading the cooperation mechanism to an authority must be considered. However, this is deemed a long term consideration and no strategic action project dealing with this subject is included in the current Ruvuma JIWRM Strategy.

In summary, the priority strategic actions are:

- The establishment of the Ruvuma Water Charter
- The establishment of the JWC Permanent Secretariat including the preparation of a legal and regulatory framework including procedures for the JWC Secretariat
- Technical support to the JWC Secretariat



### **5.3.5.2 National level**

Increased economic development in the River Basin will put higher demand on water resources management. To improve performance and to respond to new developments, national water governance frameworks and IWRM implementation need to advance.

Efficient water resources management requires existing structures in order to establish communication and information systems, establish regulations and financing arrangements, to conduct development works, to devise systems for accountability, to develop organisational capacity and to coordinate activities. At management level, major challenges to organisational capacity are evident. Current service efficiency of the mandated functions is low, although there are differences between the two countries. Operational tools, procedures and resources at the decentralised level do not exist to an adequate degree.

The lack of appropriate skills and know-how will prove to be a critical challenge in the sector, from water engineers to project management and leadership and governance. Increased skills and capacity are required for improved water management and governance. Important strategic actions should also focus on mobilising the skills and resources available across the entire water sector, including government, the private sector and civil society through e.g. the national procurement of consultancy services.

Another obstacle is the fact that integrated planning and water use management and infrastructure development are not as effective as required to ensure sustainable development. Enhanced water governance demands integrated governance between the water authorities and relevant ministries, notably in the environmental, agriculture and energy and mining sectors.

An institutional strengthening programme is therefore required to improve management tools and increase the service efficiency of the water management institutions. In order to meet the future water management challenges foreseen in the Ruvuma River Basin, the strategic institutional development actions singled out are deemed to be of high priority.

Regarding the legal enabling framework major efforts have been made to harmonise national legislation in accordance with regional, bi-lateral or multi-lateral agreements signed and ratified by the two governments. Further harmonisation between the countries is thus not deemed as a priority at the moment. The main priority is, instead, the enforcement of the current legislation in order to be able to comply with bi-lateral agreements and ensure a sustainable use and development of the shared Ruvuma water course.

However, at the national level some further consolidation of the legal and institutional framework is needed. In some cases the mandates overlap and existing water legislation is not fully coordinated with other sector legislation.

A legal review is required to clarify roles and responsibilities. The legal/institutional review must cover several ministry and administrative levels. Where necessary, expected results would be amendments in the legal framework.

In addition, the strategic objective is that the national basin water offices responsible for management of the Ruvuma River Basin should fulfil mandated functions at an acceptable level for ensuring a sustainable development of the basin's water resources, notably: water allocation, monitoring, information management, pollution control, basin planning, economic and financial management, sector coordination and stakeholder participation, flood and drought management, water infrastructure development and mainstreaming of cross-cutting issues e.g. gender, HIV/AIDS, pro-poor development, and environmental protection.

The strategic objectives and priority actions relevant for the joint management of the Ruvuma River Basin are presented below.



WATER ALLOCATION AND UTILISATION - Allocating water to major water users and uses, maintaining minimum levels for social and environmental use while addressing equity and development needs of society.

The strategic objective is that major water users are recognised and are managed through a licensing (or permit) system. Strategic actions to achieve the objective include:

- Reviewing legislation to clarify roles
- Accelerating registration and licensing of surface and groundwater users according to the regulations.
- Determining the social and environmental reserve at sub-catchment level and minimum release related to the international perspective.
- Setting water allocation targets/limits for all sectors including special regulation during drought events.
- Increasing institutional capacity to perform simple water balance calculations at sub-catchment level in order to examine allocation criteria for compliance with IWRM principles.
- Implementing effective regulation of water use according to legislation
- Improving water abstraction management i.e. water use compliance and enforcement
- Promoting water loss reduction.
- Formalizing commitments from different water use sectors.

MONITORING AND INFORMATION MANAGEMENT - Implement effective monitoring systems that provide essential management information and identify and respond to infringements of laws, regulations and permits. Provide essential data necessary to make informed and transparent decisions for development and sustainable management of water resources in the basin.

Adequate knowledge and information management is deemed as a key strategic task to meet future water management requirements. The strategic objective is to create an improved mechanism for monitoring, collection, management and exchange of data that is essential for the joint management and development of the Ruvuma River Basin. In this regard, the core of such a system is the monitoring systems, procedures and protocols for data exchange, i.e. the entire process of data collection, compilation, quality control, storage, dissemination and exchange of data. The necessary basis for a functioning knowledge and information management system in the Ruvuma River Basin is an improved monitoring network. The strategic actions include:

- Expansion of the monitoring systems for hydrometeorology, groundwater, water quality and sediment monitoring
- Development and installation of a comprehensive basin-wide water information system to support integrated river basin management
- Pooling of the resources between international, national and sub-national level
- Development of procedures and protocols for data sharing
- Improving capacity through target training

POLLUTION CONTROL - Managing pollution using the polluter pays principles and appropriate incentives to reduce the major pollution problems and minimise environmental and social impacts.

The strategic objectives related to pollution control in the Ruvuma River Basin are to know the extent of the pollution problem and the trends being monitored and to recognise major polluters who can be managed through a licensing (or permit) system. The main concerns in terms of water quality are the very high turbidity in certain rivers, elevated levels of nutrients as a result of human settlements, and the possible high levels of heavy metal toxins as a result of mining activities.

It is suggested that the areas in greater risk of pollution are prioritised (Table 5-1).

Table 5-1: Suggested prioritised areas and sources.

| Area                     | Explanation   |
|--------------------------|---|
| Mbinga district          | Surface mining that occurs in the area requires monitoring.   |
| Lichinga                 | Artisanal mining occur along Nzinga and Lupilichi Rivers.   |
| Tunduru                  | The area around Tunduru experience agriculture, forestry and pollution from the urban areas. The rivers health score was low in the area. |
| Border Malawi/Mozambique | The health assessment of the river judged this area the worst in the basin.   |
| Malanga                  | The area around the city of Malanga is in risk of polluting the river, this is supported by the low scores in the health assessment.      |

For further details of the status of the water quality in the basin and pollution in the basin, the reader is referred to the results of the ambient monitoring presented in Annex 3 of the Ruvuma River Basin Monograph (SADC, 2011).

In order to strengthen the pollution control functions, the priority strategic actions comprise:

- Improved knowledge of pollution sources
- Accelerated registration and licensing of polluters according to the regulations
- Increased institutional capacity to perform compliance monitoring and enforcement
- Reviewing legislation to clarify roles for pollution control
- Support to inter-ministerial coordination
- Dedicating programs to deal with priority pollution issues.

**BASIN PLANNING** - Prepare and regularly update the Basin Plan incorporating stakeholder views on development and management priorities for the basin, and using it to inform the annual work plans.

Development of national basin and sub-catchment management plans are called for in the national water policy documents of Tanzania and Mozambique. The corresponding strategic actions of the Ruvuma JIWRM Strategy include:

- Strengthening RWBO's and ARA-Norte's planning capacities
- Based on the Ruvuma JIWRM Strategy developing national sub-catchment management strategies and plans for both surface and ground water
- Integrating transboundary and national basin strategies into RWBO's and ARA-Norte's business plans and annual work plans
- Coordinating basin plans and regional/provincial plans (See below sector –coordination actions)

With regards to groundwater, the Strategy formulation process, although rudimentary due to lack of information and data, clearly demonstrated that in terms of volume, groundwater is largely an untapped resource. To ensure sustainable development of the ground water use it will be necessary as a starting point to develop an Integrated Catchment Groundwater Management Strategy.

ECONOMIC AND FINANCIAL MANAGEMENT - Apply economic and financial tools for cost recovery and behaviour change to support the goals of equitable access and sustainable benefits to society from water use.

The application of economic tools is a key instrument in enhancing water demand management (WDM). For the Ruvuma river basin the objective is to achieve water use efficiency and pollution reduction through use of economic and financial instruments. Regarding ARA-Norte, it is required to develop a Business Plan, encompassing not only the Ruvuma basin but also the other basins under their jurisdiction. This would help to define what level of tariffs could be applied, to what users now and in the future, which of their activities could be covered by these tariffs and what would be needed in terms of support from the central government.

The corresponding strategic actions of the Ruvuma JIWRM Strategy are to:

- Improve the application of economic and financial tools in water use management
- Improve billing and revenue collection through increased institutional capacity and effective customer services
- Enhance financial accountability through effective internal auditing.

SECTOR COORDINATION AND STAKEHOLDER PARTICIPATION – As a basis for decision making, implement stakeholder participation that takes into account the best interests of society and the environment in the development and use of water resources in the basin.

The strategic objectives are:

- Effective cooperation between government agencies with responsibilities for water management or water use in the basin.
- Institutionalised Stakeholders' participation.
- Increased awareness of IWRM among the general public.
- Improved knowledge, attitudes and practices in relation to local IWRM/basin management.

It is important to understand that, in most cases, water is only one of a number of inputs required for economic growth and development. Access to water for basic needs and production is important, but without access to other resources such as markets and transport infrastructure, achieving the desirable outcomes of a healthy people, healthy ecosystems and prosperous economy is not probable.

Water resource planning must be integrated into national, provincial and local planning, and must be addressed in all growth and development strategies. This implies that Ruvuma JIWRM Strategy and Implementation Plan must be integrated into the national and regional plans of Tanzania and the national and provincial plans of Mozambique.





Key strategic measures:

- Facilitate and coordinate cross-sector planning by establishing necessary partnerships, processes and protocols. Strategic actions will involve facilitating improved sector-governance and planning between relevant departments.
- Accelerate the consolidation of stakeholder participation institutions and operation i.e. to provide them with adequate resources and communication tools to perform their roles.
- Enhance the capacities of Ruvuma river basin authorities to promote community-based IWRM.
- Enhance capacities of Ruvuma basin stakeholder institutions to promote community IWRM projects and conduct appraisals.
- Construct IWRM facilities for visibility and awareness creation.

**FLOOD AND DROUGHT MANAGEMENT** - Operate floods and droughts to mitigate and minimise harm to humans, environment and economic values.

The strategic actions are closely related to the strategic actions formulated for reducing water vulnerability in the basin and include:

- Increasing knowledge of inundation areas for different flood magnitudes by developing specific studies to obtain adequate DEM (digital elevation models) and by using hydrologic and hydraulic models, in which the staff of RWBO and ARA-Norte should be trained.
- Developing functioning flood warning systems in collaboration with other institutions, namely with the INGC in Mozambique and Vice-President's Office, Disaster Management Department (VPO-DMD) in Tanzania.
- Developing functioning drought warning systems.

WATER INFRASTRUCTURE DEVELOPMENT – Drive implementation from planning, to feasibility and EIA level, to implement and ensure optimal and sustainable infrastructure development. Design, construct and maintain works, if part of the mandated functions.

The strategic objective is to increase storage volume and the regulatory functions of the river in response to the demands of the key water uses.

To this end a specific investment strategy was formulated and referred to as “Coordinated Infrastructure Development”.

GENDER AND HIV/AIDS MAINSTREAMING – Consider gender and HIV/AIDS aspects in the human resources management and in operative functions.

In Mozambique, the National Water Resources Management Strategy (NWRMS) (2007-2017) calls for increased women’s participation in WRM. However, no specific short term strategies or targets have been defined. With regards to gender, the Statutes of ARA-Norte aims at the participation of all users including women. No national guidelines for the composition and gender balance of river basin committees exist in Mozambique.

In Tanzania, the National Water Sector Development Strategy (NWSDS) up to 2015 includes the explicit objective “to ensure the active and effective participation of both women and men in WRM”. The strategy for increased participation of women in WRM is supported by national regulatory/procedural provisions stipulating a 60% representation of women in the WUGs and WUAs and specifying, for instance, that the position of treasurer should be assumed by a woman in a water user group. National procedural guidelines further state that the BWB should be represented by women organisations and that at least three out of the ten members should be women.

The strategic objectives are the equal participation of women and men in decision making on water and water management, ensuring national policies on HIV/AIDS response and institutionalising staff rights.

The strategic actions of the Ruvuma JIWRM Strategy include:

- Promoting and increasing participation of women in water affairs at all levels. This includes women holding technical staff positions within the basin water offices.
- Training staff in HIV/AIDS policies, rights and fulfilling an obligation to provide prevention and counselling procedures.

## 6 STRATEGY FRAMEWORK

The Strategy formulation process has provided substantial information about the range of institutional, social, economic, environmental and technical challenges related to water and opportunities confronting both people and institutions within the Ruvuma Basin. The review points to the numerous avenues through which such challenges are being, and can be, addressed. It also underscores the integrated dimension of IWRM and the need to view the activities proposed under the 'Development of the Ruvuma River Basin Joint IWRM Strategy' in relation to other complementary initiatives e.g. in the transport, agriculture and energy sectors.

Previous chapters have studied potential development scenarios. Specifically, a coordinated storage and regulating infrastructure to meet water demand has been studied – and the results from the multi-criteria analysis have been presented. In addition, the study indicates that a set of coordinated actions are needed to enhance water management and governance in the basin. Such supporting action projects are important to meet the future water challenges and to achieve the IWRM objectives, stated in international as well as national policies and legislation. A number of priority strategies have been formulated to address identified challenges and to contribute to sustainable development.

Even though no large-scale water infrastructure projects are foreseen, small and medium infrastructure investments need to increase substantially. There is a need to invest in priority investment projects and programmes such as knowledge and information management, and water resource protection. To meet the future water management challenges, an array of measures have been defined under the form of a Strategy Framework translated into strategic action projects (SAPs) to be implemented at short, medium or long term time frames in order to address key water management issues.

The priority management and institutional issues and actions that have been singled out are those important to fulfilling the mandates under the SADC shared Protocol and Ruvuma JWC Agreement. In planning the strategic framework, a balance of strengthening the basic framework for transboundary cooperation as well as working on national issues in water resources management has been adopted. The rationale is that it is important to focus on the national level IWRM as a way to strengthen TWM.

Following the analysis of the development scenarios the action projects were defined and composed. These actions correspond to issues highlighted in the previous chapters.

The strategic actions which have been considered and evaluated here are deemed to contribute to a desirable state for the Ruvuma River Basin with socio-economic development, reduced vulnerability, sustainable use of water and regional integration.

The proposed actions are grouped into: 1) infrastructure development, 2) environmental protection, 3) vulnerability reduction and 4) institutional strengthening. Some proposed actions have already been defined in regional/provincial plans and national water strategies. Other actions have been defined specifically in the framework of the JIWRM formulation process in response to the specific development issues in the Ruvuma river basin. Some already have financing solutions. Others must rely on the mobilisation of additional investment funds and on the regular operational budget.

It is important to recall that the Ruvuma JIWRM Strategy aims at actions in relation to the management of the water resource. In order for the water sector actions to contribute to the general socio-economic development and poverty alleviation of the basin area, these actions should be coordinated with the provincial plans which cover a broader framework of socio-economic development measures.

In summary, the Strategic Framework and Plan is based upon by the development scenarios. It translates the priority strategies into Strategic Action Projects (SAPs) consisting of structural projects and non-structural measures which would support the sustainable development of the basin. Priority areas of action are those where the authorities and members of the JWC have a direct mandate as, for example, to assure an adequate water supply at any given time, its quantity and quality while at the same time assuring its efficient, equitable and sustainable use.

For the JIWRM of the Ruvuma River Basin, four strategic action areas were identified:

- Meeting water demand and assurance of water supply to key water using sectors.
- Ensuring water quality and sustaining aquatic ecosystem health.
- Reducing water related vulnerability.
- Enhancing capacity to fulfil international and national obligations to ensure sustainable use and development.

The SAPs are organised under the challenges identified. In this respect, it should be noted that the SAPs are inter-linked and several SAPs address more than one challenge area.

The time frames and costs indicated in the strategic framework are related to the implementation phases and investment costs of the strategic action projects. The cost recovery procedure is to be assessed in detail in pre-feasibility and feasibility phases. Operation and maintenance costs and regular activities of the basin water authorities to uphold and sustain the strategic actions are seen as the responsibility of the regular staff and budgets of the designated authorities.

The non-structural SAPs (cross-cutting management and institutional issues) are intended to advance the practical implementation of key IWRM principles. SAPs are thus designed to support the introduction of new working methods until such working procedures have been institutionalised or mainstreamed into the regular functions.

Table 6-1 presents the Ruvuma JIWRM Strategy Framework. Appendix 1 comprises a detailed presentation of the SAPs and expected outcomes.

Table 6-1: Ruvuma JIWRM Strategy Framework

| Challenge            | Strategic Area                               | Action   |
|----------------------|--|--|
| Meeting Water Demand | Coordinated Water Infrastructure Development | <b>Component 1.1: National Infrastructure</b>  |
|                      |  | SAP 1.1.1: Small and medium dam strategy and feasibility study, Basin wide                       |
|                      |  | SAP 1.1.2: Construction and supervision of selected dams, Basin wide                             |
|                      |  | SAP 1.1.3 Rural water supply and sanitation, Mozambique  |
|                      |  | SAP 1.1.4: Lichinga urban water supply and sanitation, Mozambique                                |
|                      |  | SAP 1.1.5: Rural water supply and sanitation, Tanzania   |
|                      |  | SAP 1.1.6: Songea urban water supply and sanitation, Tanzania                                    |
|                      |  | SAP 1.1.7: Ruvuma-Mtwara interbasin water transfer, Tanzania                                     |
|                      |  | SAP 1.1.8: Development of extensions and planned irrigation schemes, Mozambique                  |
|                      |  | SAP 1.1.9: Development of potential irrigable areas, Mozambique                                  |
|                      |  | SAP 1.1.10 Extension of existing irrigation schemes, Tanzania                                    |
|                      |  | SAP 1.1.11: Development of planned irrigation schemes, Tanzania                                  |
|                      |  | SAP 1.1.12: Development of potential irrigable areas, Tanzania                                   |
|                      |  | SAP 1.1.13: Upgrading of existing irrigation schemes, Basin wide                                 |
|                      |  | SAP 1.1.14: Pre-feasibility and feasibility studies of selected hydro-power projects, Basin wide |
|                      |  | SAP 1.1.15: Construction of selected prioritised HP schemes, Basin Wide                          |
|                      |  | <b>Component 1.2: Joint Water Infrastructure</b>   |
|                      |  | SAP 1.2.1: Pre-feasibility of the Joint Ruvuma multipurpose project                              |
|                      |  | <b>Component 1.3: Mobilisation of investment funding</b>   |
|                      |  | SAP 1.3.1: Development of funding mechanisms and piloting, Basin wide                            |

|                              |   |  |
|------------------------------|---|--|
| Maintain WQ and River Health | Cross-Sectoral Environmental Interventions    | <b>Component 2.1: River protection projects</b>  |
|                              |   | SAP 2.1.1: Pollution control from informal mining areas                                      |
|                              |   | SAP 2.1.2: Erosion control   |
|                              |   | SAP 2.1.3: Water source protection   |
|                              |   | <b>Component 2.2 Water quality management</b>  |
|                              |   | 2.2.1: Establishment of environmental water (quantity and quality) requirements              |
|                              |   | 2.2.2: Ecological status monitoring  |
|                              |   | 2.2.3: Establishment of water quality management plans                                       |
| Reduce Vulnerability         | Climate Change and Disaster Management        | <b>Component 3.1: Climate change adaptation</b>  |
|                              |   | SAP 3.1.1. Climate change modelling and development of climate change adaptation strategy    |
|                              |   | <b>Component 3.2 Disaster management</b>   |
|                              |   | SAP 3.2.1: Development of disaster management plans and response system                      |
| Efficient Water Governance   | Institutional Consolidation and Strengthening | <b>Component 4.1: Institutional Management Framework</b>                                     |
|                              |   | SAP 4.1.1: Operationalisation of JWC   |
|                              |   | SAP 4.1.2: Institutional consolidation of the ARA Norte                                      |
|                              |   | SAP 4.1.3: Institutional consolidation of the RBWO   |
|                              |   | SAP 4.1.4: Legal review  |
|                              |   | <b>Component 4.2: Water Management</b>   |
|                              |   | SAP 4.2.1: Water use registry, permit system and control                                     |
|                              |   | SAP 4.2.2: Water pollution permit system and control   |
|                              |   | SAP 4.2.3: Enhanced Knowledge and Information System – Phase II                              |
|                              |   | SAP 4.2.4: Sub-basin plans   |
|                              |   | SAP 4.2.5: Groundwater Management Strategy   |
|                              |   | <b>Component 4.3: Promotion of Stakeholder Participation and Cross-Sectoral Coordination</b> |
|                              |   | SAP 4.3.1: Support to Ruvuma Basin Committee (RBC)   |
|                              |   | SAP 4.3.2: Support to Ruvuma Basin Water Board (RBWB)  |
|                              |   | SAP 4.3.3: Ruvuma Catchment Committee (RCC) and Water User Associations (WUAs)               |
|                              |   | SAP 4.3.4: Support to inter-ministerial coordination   |
|                              |   | SAP 4.3.5: Ruvuma River Awareness Kit  |
|                              |   | SAP 4.3.6: Community Basin Management Projects (Phase II)                                    |

Figure 6-1 overleaf, presents a spatial overview of basin planning features.



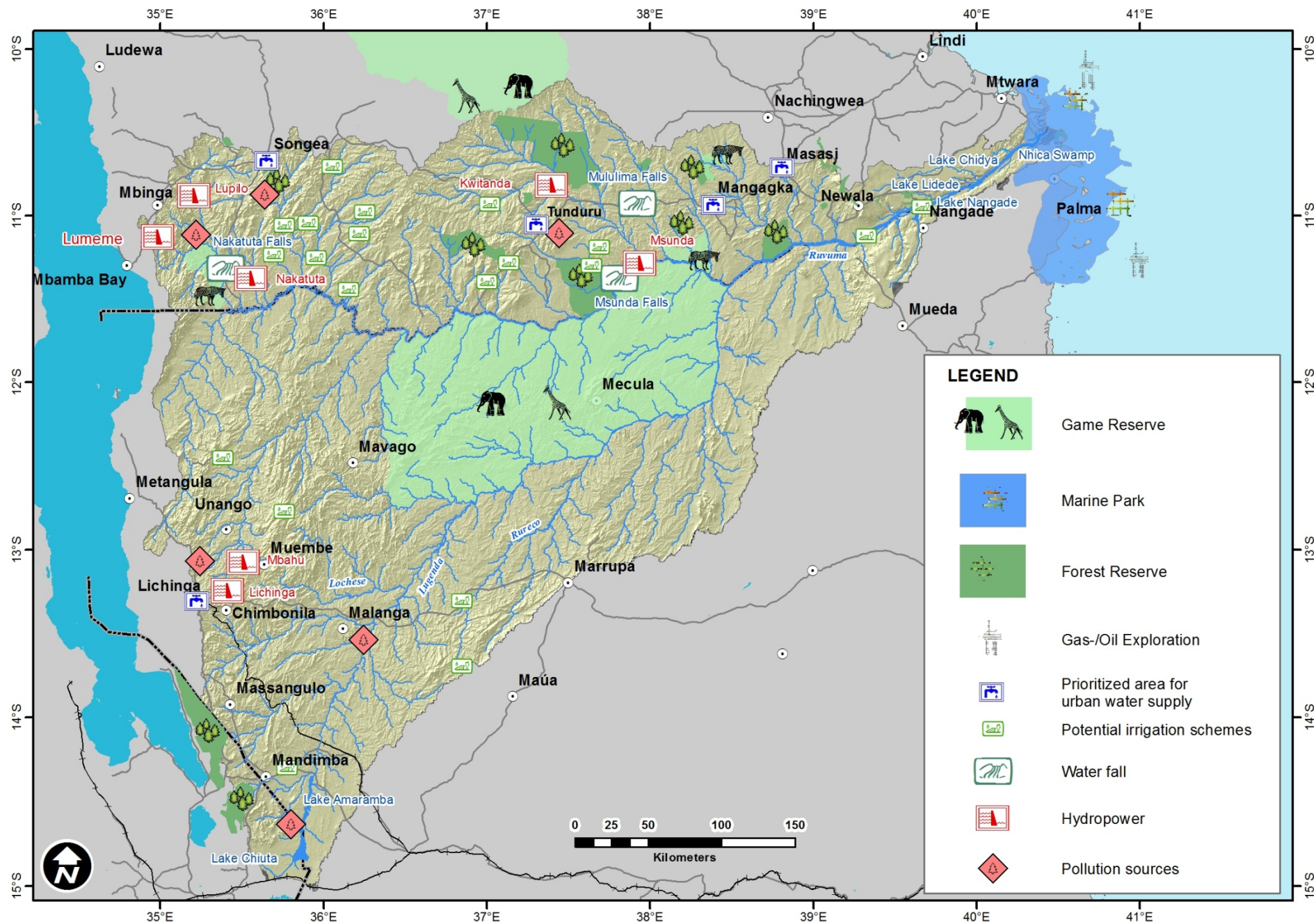


Figure 6-1: Spatial overview of key features for the planning consideration





## 7 IMPLEMENTATION APPROACH AND PLAN

### 7.1 Implementation Arrangements

The implementation of the Ruvuma JIWRM Strategy will be coordinated by the JWC with support when necessary from the planned Secretariat and Technical Committee.

DWR/MoW through its Transboundary Water Resources Unit in Tanzania and DNA through its International Rivers Office in Mozambique are the main drivers of JWC functions. The role of Ruvuma BWB/RBWO and ARA-Norte is, however, crucial and many of the functions required for transboundary water management are performed by these offices.

The role of the planned JWC secretariat would be to: i) coordinate actions and report to each riparian's high-level administration and ii) delegate implementation to the two countries.

It is assumed that the JWC Secretariat will delegate the implementation of the majority of the strategic actions to the national basin water authorities in both countries and only retain full responsibility for over-sight, coordination and specific basin wide joint actions. In relation to the latter, the Secretariat would explore the option of joint planning, joint development and joint ownership of potential investments e.g. monitoring stations, dams and hydro-power schemes to optimise the benefits while promoting mutual management.

Once in place, the Secretariat would have a responsibility to monitor the parties' compliance with the JWC protocol and the Comprehensive Bi-lateral Agreement. Apart from compliance monitoring, an operational JWC would have a responsibility to monitor the implementation of the Ruvuma Joint IWRM Strategy, which would be carried out in accordance with the agreed work plan and defined indicators.

There should be standing rules for regular meetings of the Secretariat to oversee the compliance with the JWC Agreement and later the Comprehensive Agreement and to discuss issues of mutual interest. The appropriate number of meetings would depend on delegated responsibilities, but should take place at least once a year.

There should be close cooperation between the Ruvuma JWC and the SADC Water Division, which plays an important role in TWM in the region and is already involved in the Ruvuma River Basin. SADC could provide coordinated support to different themes of the Strategy as well as make use of political processes imbedded in SADC. In particular it would be important to engage the SADC level for regional integration and out-of-basin benefit sharing projects impacting several countries in Southern Africa. Investing in large-scale hydropower production in the Ruvuma River for the benefit of the region is an example of an issue that would benefit from being lifted to a higher level.

A fee (% of budget of JIWRM Strategy and Implementation Plan) negotiated between the countries and potential external financiers would be extracted to cover operational costs.

The implementation of the Ruvuma JIWRM Strategy and Implementation Plan would be the responsibility of the JWC, through the executive organ, the JWC Secretariat. However, there should be substantial involvement of the national and sub-national water authorities, as well as the local governmental institutions (agriculture, mining, environmental, etc.), civil organisations and non-governmental organisations, and finally water users.

For the implementation of SAPs, lead institutions as well as supporting actors have been defined. To use the various supporting actors working on various themes would strengthen integrated governance, management and development of the Ruvuma River basin. It would also strengthen the capacities of parallel organisations, both government and stakeholder institutions, of the IWRM approach.

The proposed institutional set-up for the implementation of the Action Plan is presented in Figure 7-1.

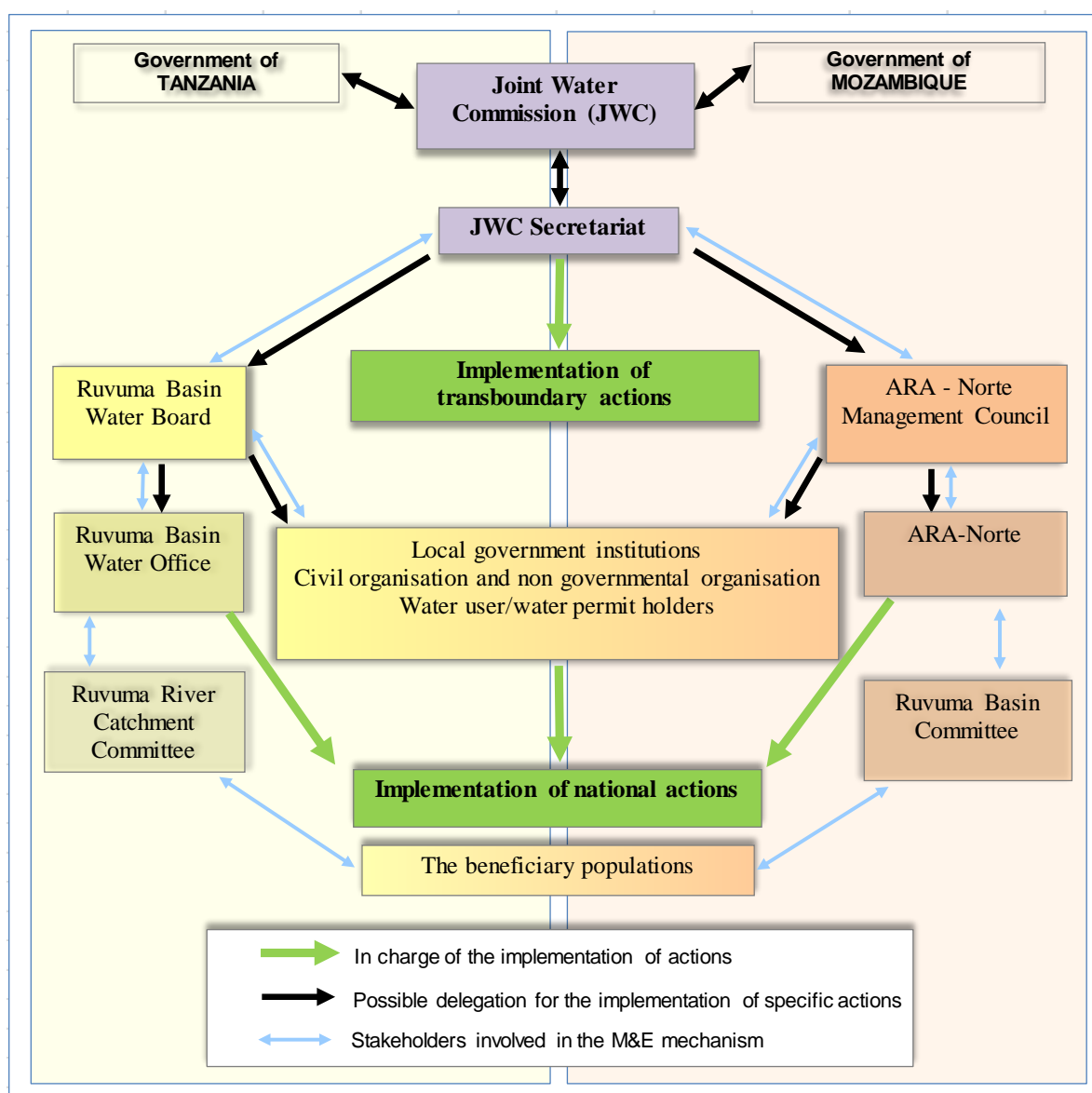


Figure 7-1 : Institutional implementation of the Ruvuma JIWRM Strategy Plan.

Details are given in Table 0-1.

The Ruvuma JIWRM Strategy Implementation Plan (Table 0-1) summarises the implementation plan with an indication of the time horizon for implementation (short, medium and long-term) and main implementing agencies. The implementation plan defines proposed lead organizations and key supporting actors that should be actively engaged in these activities. This proposed plan is meant to guide and ensure implementation of the strategic directions and describe how, when, by whom, and to what cost the different components of the strategy can be implemented. However, the plan is subject to changes upon final negotiations among the involved actors.

## **7.2 Phasing of Strategic Actions**

The Ruvuma JIWRM Strategy and implementation plan covers the period 2013 - 2030.

The implementation plan takes the different SAPs, described in detail in chapter 6 and in Appendix 1 and prioritizes them time-wise. It categorizes the SAPs in initiatives that need to be undertaken in short-term (0-2 years), medium-term (3-10 years) and long-term (10-15 years).

In prioritizing actions time-wise the main consideration has been the importance of focusing on core functions of TWM and IWRM, common actions and coordinated investment.

Table 7-1 illustrates the scheduled implementation of the actions.

Table 7-1 : Implementation schedule

| SAP      | Title   | Implementation Horizon |             |           |
|----------|---|------------------------|-------------|-----------|
|          |   | Short-Term             | Medium-Term | Long-Term |
| <b>1</b> | <b>Coordinated Water Infrastructure Development</b>                                   |                        |             |           |
| 1.1      | <u>National Infrastructure</u>  |                        |             |           |
| 1.1.1    | Small and medium dam strategy and feasibility study, Basin wide                       |                        |             |           |
| 1.1.2    | Construction and supervision of selected dams, Basin wide                             |                        |             |           |
| 1.1.3    | Rural water supply and sanitation, Mozambique   |                        |             |           |
| 1.1.4    | Lichinga urban water supply and sanitation, Mozambique                                |                        |             |           |
| 1.1.5    | Rural water supply and sanitation, Tanzania   |                        |             |           |
| 1.1.6    | Songea urban water supply and sanitation, Tanzania                                    |                        |             |           |
| 1.1.7    | Ruvuma-Mtwara interbasin water transfer, Tanzania                                     |                        |             |           |
| 1.1.8    | Development of extensions and planned irrigation schemes, Mozambique                  |                        |             |           |
| 1.1.9    | Development of potential irrigable areas, Mozambique                                  |                        |             |           |
| 1.1.10   | Extension of existing irrigation schemes, Tanzania                                    |                        |             |           |
| 1.1.11   | Development of planned irrigation schemes, Tanzania                                   |                        |             |           |
| 1.1.12   | Development of potential irrigable areas, Tanzania                                    |                        |             |           |
| 1.1.13   | Upgrading of existing irrigation schemes, Basin wide                                  |                        |             |           |
| 1.1.14   | Pre-feasibility and feasibility studies of selected hydro-power projects, Basin wide  |                        |             |           |
| 1.1.15   | Construction of selected prioritised HP schemes, Basin Wide                           |                        |             |           |
| 1.2      | <u>Joint Water Infrastructure</u>   |                        |             |           |
| 1.2.1    | Pre-feasibility of the Joint Ruvuma multipurpose project                              |                        |             |           |
| 1.3      | <u>Mobilisation of Investment Funding</u>   |                        |             |           |
| 1.3.1    | Development of funding mechanisms and piloting, Basin wide                            |                        |             |           |
| <b>2</b> | <b>Cross-Sectoral Environmental Interventions</b>                                     |                        |             |           |
| 2.1      | <u>River Protection Projects - Addressing Key Causes of Environmental Degradation</u> |                        |             |           |
| 2.1.1    | Pollution control from informal mining areas  |                        |             |           |
| 2.1.2    | Erosion control   |                        |             |           |
| 2.1.3    | Water source protection   |                        |             |           |
| 2.2      | <u>Water Quality Management</u>   |                        |             |           |
| 2.2.1    | Establishment of environmental water (quantity and quality) requirements              |                        |             |           |
| 2.2.2    | Ecological status monitoring  |                        |             |           |
| 2.2.3    | Establishment of water quality management plans                                       |                        |             |           |
| <b>3</b> | <b>Climate Change and Disaster Management</b>   |                        |             |           |
| 3.1      | <u>Climate Change Adaptation</u>  |                        |             |           |
| 3.1.1    | Climate change modelling and development of climate change adaptation strategy        |                        |             |           |
|          | <i>Consolidation and improvement of hydrological network included in 4.2.6</i>        |                        |             |           |
| 3.2      | <u>Disaster Management</u>  |                        |             |           |
| 3.2.1    | Development of disaster management plans and response system                          |                        |             |           |
|          | <i>Flood Management</i>   |                        |             |           |
|          | <i>Drought Management</i>   |                        |             |           |
|          | <i>Accidental Pollution</i>   |                        |             |           |
| <b>4</b> | <b>Institutional Consolidation and Strengthening</b>                                  |                        |             |           |
| 4.1      | <u>Institutional Management Framework</u>   |                        |             |           |
| 4.1.1    | Operationalisation of JWC   |                        |             |           |
| 4.1.2    | Institutional consolidation of the ARA Norte  |                        |             |           |
| 4.1.3    | Institutional consolidation of the RBWO   |                        |             |           |
| 4.1.4    | Legal review  |                        |             |           |
| 4.2      | <u>Water Management</u>   |                        |             |           |
| 4.2.1    | Water use registry, permit system and control   |                        |             |           |
| 4.2.2    | Water pollution permit system and control   |                        |             |           |
| 4.2.3    | Enhanced Knowledge and Information System – Phase II                                  |                        |             |           |
| 4.2.4    | Sub-basin plans   |                        |             |           |
| 4.2.5    | Groundwater Management Strategy   |                        |             |           |
| 4.3      | <u>Promotion of Stakeholder Participation and Cross-sectoral Coordination</u>         |                        |             |           |
| 4.3.1    | Support to Ruvuma Basin Committee (RBC)   |                        |             |           |
| 4.3.2    | Support to Ruvuma Basin Water Board (RBWB)  |                        |             |           |
| 4.3.3    | Ruvuma Catchment Committee (RCC) and Water Users Associations (WUAs)                  |                        |             |           |
| 4.3.4    | Support to inter-ministerial coordination   |                        |             |           |
| 4.3.5    | Ruvuma River Awareness Kit  |                        |             |           |
| 4.3.6    | Community Basin Management Projects (Phase II)  |                        |             |           |

## 7.3 Financing Arrangements

### 7.3.1 Estimated Budget

The total cost of the defined SAPs amounts to roughly 1,000 MUSD. This is the cost for strategic actions deemed important to advance water resources management including infrastructure development, water resources protection and transboundary cooperation. The foreseen coordinated infrastructure development represents 98% of the estimated budget and comprises budgets for feasibility studies, environmental mitigation and resettlement costs as well as investments costs. As illustrated in Figure 7-2, the estimated budget for infrastructure development in Tanzania is larger than in Mozambique. The reason is the anticipated large expansion of the irrigation sector on the Tanzanian side.

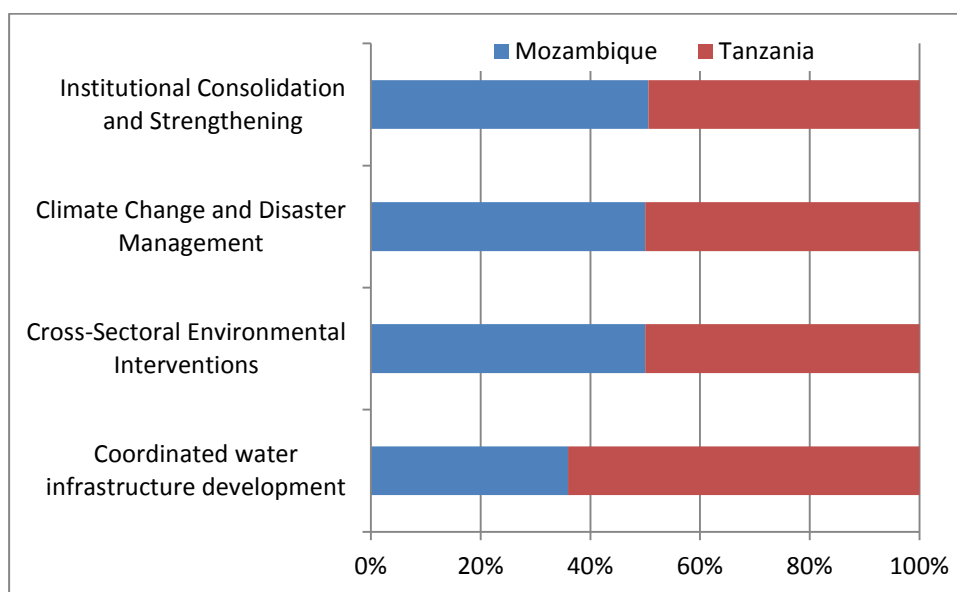


Figure 7-2: Division of budget between action areas and countries

Table 7-2 provides a detailed presentation of the budget and its various elements.

Table 7-2: Ruvuma JIWRM Strategy Total Budget (kUSD)

| Strategic Action Area                         | Tot       | Mz      | Tz      | %Mz | %Tz |
|---|-----------|---------|---------|-----|-----|
| Water infrastructure development              | 1 022 700 | 367 650 | 655 050 | 36% | 64% |
| Cross-Sectoral Environmental Interventions    | 2 200     | 1 100   | 1 100   | 50% | 50% |
| Climate Change and Disaster Management        | 1 700     | 850     | 850     | 50% | 50% |
| Institutional Consolidation and Strengthening | 16 500    | 8 350   | 8 150   | 51% | 49% |
| <b>Component</b>                              |           |         |         |     |     |
| National Infrastructure                       | 1 021 400 | 367 000 | 654 400 | 36% | 64% |
| Joint Water Infrastructure                    | 800       | 400     | 400     | 50% | 50% |
| Mobilisation of Investment Funding            | 500       | 250     | 250     | 50% | 50% |
| River Protection Projects                     | 1 300     | 650     | 650     | 50% | 50% |
| Water Quality Management                      | 900       | 450     | 450     | 50% | 50% |
| Climate Change Adaptation                     | 400       | 200     | 200     | 50% | 50% |
| Disaster Management                           | 1 300     | 650     | 650     | 50% | 50% |
| Institutional Management Framework            | 2 900     | 1 450   | 1 450   | 50% | 50% |
| Water Management                              | 2 900     | 1 600   | 1 300   | 55% | 45% |
| Promotion of Stakeholder Participation        | 10 700    | 5 300   | 5 400   | 50% | 50% |

### 7.3.2 Financing Sources

The strategic objectives of the defined financing arrangements are to:

- Ensure funding available for infrastructure investments as well as for programmes such as water use/demand management (WDM) and conservation, information management, skills development and effective planning.
- Ensure access to water by the timely translation of options into actions through effective pro-active organizing, financing and implementation strategies. This encompasses the study and planning of potential joint actions and investments.
- Guide pro-actively the allocation of financial resources so that sufficient resources are dedicated to achieving priority outcomes.

Over the coming decades, the development of the Basin would require accelerated investments in water infrastructure. Ideally these investments would be made jointly by the public and the private sector, because the private sector has not only the financial means but also the expertise required to realise water infrastructure projects. Apart from shouldering part of the investment costs, the private sector could be involved with planning activities and technological innovations.

To continue promoting public-private partnerships (PPPs) by intensifying investment promotion and marketing oriented functions and to facilitate the institutionalisation of PPPs through pilot projects, is, therefore, to be recommended, along with the mobilisation of government and external funding for the required infrastructure development.

In this respect, it would be necessary for the regional water authorities to keep abreast with regional learning processes in order to gain knowledge of suitable PPP mechanisms.

In order to successfully drive and implement PPPs, it would be necessary for the national and basin water authorities to play a strong role in taking investment opportunities for the private sector from identification phase to bankable projects and to interact with a wide range of actors. The department for Water Resources Management/RBWO in Tanzania and DNA/ ARA-Norte may need further support in this field.

In this context, it should be noted that the international community has realised the need to bridge the capacity gap for taking investment opportunities for the private sector from identification phase to bankable projects in emerging economies. In response to this identified gap, members of the international community have established the Private Infrastructure Development Group (PIDG). The PIDG is a coalition of nine development agencies and operates through seven specialized financing and project development facilities that partner with the private sector with a focus on emerging Africa and Asia. In the first ten years, between 2002 and 2012, funds committed by PIDG exceeded \$1bn to over 130 projects. Facilitated and financed projects cover several sectors and sizes including hydropower, water and sanitation and irrigation sectors. There are facilities for both the private and the public sectors to access support (e.g. in feasibility phases) and know-how (e.g. fiscal and legislative aspects at governmental level) to go from identification of opportunity to implementation and running in the form of concessions or similar.

There is an obvious opportunity to tap in to these financing and supporting facilities. Further information is provided at the PIDG web-page [www.pidg.org](http://www.pidg.org).

It is also recommended to perform an evaluation of the potential for the hydropower projects to generate carbon emission reductions (CERs) for possible sale on the international market for carbon, which in case of the Host Country (e.g. Mozambique or Tanzania) is the Clean Development Mechanism (CDM). The evaluation would assess the degree of extra emission

reductions provided by the project relative to a preliminary project baseline, estimate the volume of CERs generated by each project, and identify potential buyers of resulting CERs.

The Ruvuma JIWRM Strategy comprises actions to introduce new financing concepts, as those discussed above.

As the financial base for accelerating coordinated investments, finance from the public sector would naturally be required. This would require appropriate tariff setting and enforcement, effective and long-term financial planning as well as business and project viability. An important step would be the integration of the basin plans into the regional/provincial and national planning documents in order to ensure timely financing of the actions.

Apart from the sources of finance discussed above, support from international financing institutes (IFIs) would be necessary in order to accelerate the investment ratio. In this respect it should be noted, that several IFIs are already involved in the Ruvuma river basin mainly through WSDP Tanzania basket funding and SADC TWM funding. In addition, major NGOs are active in the basin. They could take a lead role in SAPs which address their core interests. One example is WWF. In conclusion, there are several on-going initiatives in the Ruvuma River Basin that are closely related to central aspects of the Ruvuma JIWRM Strategy. The JWC and later the Secretariat would be the natural hub for the coordination and mobilization of funds.

Costs for operation and maintenance of water infrastructure would be covered by revenue generated by the basin water authorities

Essentially regular operation costs of basin water authorities are currently based on three sources of revenue – tariffs, taxes and transfers from the central government. The Ruvuma JIWRM Strategy includes actions to increase the financial income from tariffs and taxes. Still, the Ruvuma Strategy process, as well as previous and parallel studies, indicates that these financial resources would be insufficient to meet the requirements of mandated functions for a long period of time. This implies that the basin water authorities would continue to be dependent on financial support from the central government and/or from other external sources.

It should be underlined here that, the costs indicated in the Ruvuma JIWRM Strategy framework are related to the implementation phases and investment costs. Operation and maintenance costs and regular activities of the basin water authorities to uphold and maintain the strategic actions would be the responsibility of the regular staff and the budgets of designated authorities. Bearing in mind, the large natural gas mining and processing operations that will start in Tanzania and Mozambique it could be considered that a small part of the Governments revenues should be used to support the development process in the Ruvuma basin.

The most relevant funding sources for each SAP are listed in Table 7-2.



Table 7-3: Potential funding sources per strategic action

| Challenge            | Strategic Area                               | Action  | Funding Sources  |
|----------------------|--|---|--|
| Meeting Water Demand | Coordinated Water Infrastructure Development | <b>Component 1.1: National Infrastructure</b>                                   |  |
|                      |  | SAP 1.1.1: Small and medium dam strategy and feasibility study, Basin wide      | Central Government<br>External Funding / coordination with parallel projects   |
|                      |  | SAP 1.1.2: Construction and supervision of selected dams, Basin wide            | Central Government<br>External Funding / parallel projects<br>Alternative funding sources e.g. PPP   |
|                      |  | SAP 1.1.3 Rural water supply and sanitation, Mozambique                         | Central Government and Local Authorities through taxes<br>External Funding / parallel projects e.g. WB, EC, MCC and NGOs<br>Alternative funding sources e.g. PPP   |
|                      |  | SAP 1.1.4: Lichinga urban water supply and sanitation, Mozambique               | Central Government and Local Authorities through taxes<br>External Funding / coordination with parallel projects e.g. WB, EC, MCC<br>Alternative funding sources e.g. PPP  |
|                      |  | SAP 1.1.5: Rural water supply and sanitation, Tanzania                          | Central Government and Local Authorities through taxes<br>External Funding / coordination with parallel projects e.g. WSDP basket funding and NGOs<br>Alternative funding sources e.g. PPP   |
|                      |  | SAP 1.1.6: Songea urban water supply and sanitation, Tanzania                   | Central Government and Local Authorities through taxes<br>External Funding / coordination with parallel projects e.g. WSDP basket funding<br>Alternative funding sources e.g. PPP  |
|                      |  | SAP 1.1.7: Ruvuma-Mtwara interbasin water transfer, Tanzania                    | Central Government<br>External Funding / coordination with parallel projects   |
|                      |  | SAP 1.1.8: Development of extensions and planned irrigation schemes, Mozambique | Central Government through Ministry of Agriculture. External Funding / coordination with parallel projects e.g. PROIRRI.<br>Alternative funding sources e.g. PPP. - Most of the development will be private irrigation projects i.e. 1 600 ha, and funded by the private sector. |
|                      |  | SAP 1.1.9: Development of potential irrigable areas, Mozambique                 | Central Government through Ministry of Agriculture<br>External Funding<br>Alternative funding sources e.g. PPP.  |

|  |  |  |  |
|--|--|--|--|
|  |  | SAP 1.1.10 Extension of existing irrigation schemes, Tanzania                                    | Central Government through Ministry of agriculture<br>External Funding / coordination with parallel projects<br>Alternative funding sources e.g. PPP                               |
|  |  | SAP 1.1.11: Development of planned irrigation schemes, Tanzania                                  | Central Government through Ministry of agriculture<br>External Funding / coordination with parallel projects<br>Alternative funding sources e.g. PPP                               |
|  |  | SAP 1.1.12: Development of potential irrigable areas, Tanzania                                   | Central Government through Ministry of agriculture<br>External Funding / coordination with parallel projects<br>Alternative funding sources e.g. PPP                               |
|  |  | SAP 1.1.13: Upgrading of existing irrigation schemes, Basin wide                                 | Central Governments of Mozambique and Tanzania through Ministries of Agriculture<br>External Funding / coordination with parallel projects<br>Alternative funding sources e.g. PPP |
|  |  | SAP 1.1.14: Pre-feasibility and feasibility studies of selected hydro-power projects, Basin wide | Central Governments of Mozambique and Tanzania through Ministries of Energy<br>External Funding / coordination with parallel projects  |
|  |  | SAP 1.1.15: Construction of selected prioritised HP schemes, Basin Wide                          | Central Governments of Mozambique and Tanzania through Ministries of Energy<br>External Funding / coordination with parallel projects<br>Alternative funding sources e.g. PPP, CDM |
|  |  | <b>Component 1.2: Joint Water Infrastructure</b>   |  |
|  |  | SAP 1.2.1: Pre-feasibility of the Joint Ruvuma multipurpose project                              | Contribution and cooperation from riparian countries<br>External Funding / Coordination with SADC regional power planning projects   |
|  |  | <b>Component 1.3: Mobilisation of investment funding</b>   |  |
|  |  | SAP 1.3.1: Development of funding mechanisms and piloting, Basin wide                            | Central Government<br>External Funding<br>Private sector   |

The operationalization of the JWC will require long term commitments on equal contributions from the riparian countries, Mozambique and Tanzania but will also depend on external funding. The remaining institutional SAPs will depend on funding from the central government and external sources.

## 7.4 Monitoring and Evaluation Framework (M&E)

In programmes and projects, M&E is a key management and steering tool which enables the measurement and evaluation of the performances of the actions undertaken to determine whether or not they achieve the given results and objectives. M&E includes the collection, processing, analysis, assessment and dissemination of information.

An M&E, especially of a complex programme such as the Ruvuma JIWRM Strategy, is a system involving several levels of management and coordination, in different environments. So that each level can find its way about and adopt the system, the procedure and tools must be developed in a participative manner.

As mentioned previously, the JWC, through its national organs and in future the Secretariat, would be responsible for monitoring the implementation of the Ruvuma Joint IWRM Strategy with regards to both the work plan and the defined indicators.

A strong effort is currently being made in both Mozambique and Tanzania to advance water management through the application of the TWM/IWRM principles in accordance with international conventions and regional directives as reflected in this JIWRM Strategy. The Monograph phase assessed the current performance of joint and integrated river basin management using a set of quantifiable performance indicators. The assessment showed that the practical implementation of TWM/IWRM still creates a challenge. The TWM/IWRM assessment indicators (detailed in Appendix 2) and the collected baseline data would constitute a basis for the M&E of the Ruvuma JIWRM Strategy.

The TWM/IWRM assessment indicators have been divided into three categories:

- IWRM Outcome Indicators
- Performance indicators for Transboundary Water Management (TWM)
- Performance indicators for basin water authorities

### IWRM Outcome Indicators

Success in TWM/IWRM must ultimately be measured from improvements on the ground. IWRM objectives correspond closely to progress in achieving other national goals as stated in e.g. Poverty Reduction Strategy Paper (PRSPs). It should be noted, however, that progress in achieving set targets would be attributed to the combined effect of a broad range of national actions of which IWRM implementation is one of the prerequisites.

The M&E comprises indicators covering four specific areas:

- Water for meeting basic needs (domestic use and food security)
- Water for vital ecosystems and sustained ecosystem services
- Water for socio-economic development (agriculture, energy and industry)
- Reduced water related vulnerability (extreme water related events and climate variability).

In each specific area, the quantifying indicators have been defined. Some examples include:

- proportion of total water resources used
- balance of use between states
- water efficiency index for major sectors
- economic impact of flooding and drought

The following example illustrates their use. The indicators applied and the baseline values on IWRM outcomes obtained together indicate that increased investment in water infrastructure and improved efficiency of water resources management in the Ruvuma River Basin would be essential for further progress towards creating the desirable outcomes of a healthy river basin system and optimal, sustainable and equitable use/access of the basin's water resources.

### **Performance indicators for Transboundary Water Management (TWM)**

Mozambique and Tanzania are parties of the SADC Protocol on Shared Watercourses. Thus, the Ruvuma TWM performance indicators should monitor the degree of implementation based upon this protocol. Given the transboundary dimension, the indicators relate to the institutional capacity to deal with general transboundary management functions. These include:

- The observation of the principles of unity and coherence in river basin, cooperation, precaution and prevention
- The participation in joint studies on shared river basins as the basis for negotiations on agreements
- The development of comprehensive agreements for shared river basins, in accordance with the orientations of the SADC Protocol and monitoring the enforcement of the agreements
- The development and implementation of joint initiatives
- The information exchange mechanisms, compatibility of technologies and procedures for collection and management of information
- The participation in joint shared river basin management institutions and the assurance of their technical and financial sustainability
- The harmonisation of national policy and legal framework
- The compliance monitoring.

As for the base-line situation, the assumption is that the enabling transboundary governance framework, based upon international (general) agreements and institutions, already exists. Progress towards the strengthening and operationalization of current TWM will be monitored through the application of defined indicators presented in Appendix 2.

### **Performance indicators for basin water authorities**

Performance indicators are directly linked to the mandated functions of the ARA-Norte and RBWO and monitor degrees of institutional establishment, capacity and service efficiency. Furthermore they point to the level of IWRM implementation in practice as opposed to policies i.e. the SADC Regional Water Policy and national water policies.

In this respect the indicators relate to the general core functions of national basin authorities, notably:

- water allocation
- pollution control
- basin planning
- monitoring
- information management

- economic and financial management
- stakeholder participation
- flood and drought management

Specific indicators have also been defined to monitor performance related to the cross-cutting aspects of HIV/AIDS, gender and poverty.

The plan will be subject to comprehensive reviews on regular basis i.e. every five years, in order to take into account progress and experiences of each five year period. Development of shorter term “operational plans” is moreover recommended to be developed every five years period.

## **7.5 Communication and Advocacy Arrangements**

To facilitate practical implementation, effective communication and advocacy of the Ruvuma JIWRM Strategy are instrumental in ensuring that the strategies and SAPs as well as their purposes are understood and accepted.

The strategic objectives for the communication and advocacy framework are:

- Putting in place an effective communications operational framework
- Encouraging dialogue among stakeholders at all levels
- Ensuring timely dissemination of strategies and guidelines at all levels.

Specific communication tools should be used to reach each target group. The identified key target groups for the Ruvuma JIWRM Strategy are:

- SADC - The rationale being regional coordination at policy and legal level and coordination of large scale benefit sharing interventions, especially in the energy and agricultural sectors.
- The public at large – The rationale being to benefit from people/actors with special interests in the region, be it investors, researchers, and/or developing partners.
- Basin stakeholders, including local government – Active participation of the people living in the basin and cross-sectoral involvement are pivotal factors for successful implementation of IWRM.
- National Water Sector - The rationale being “internal” awareness creation in order to ensure that the transboundary IWRM strategy is mainstreamed into national and sub-basin strategies, planning documents and management systems.

To facilitate operationalization of the communication framework, most of the communication mechanisms selected was incorporated into the Ruvuma JIWRM Strategy Action Projects (SAPs).

The following communications mechanisms for enhancing awareness and consensus on the Ruvuma JIWRM Strategy as the key guiding document have been established:

- Communication and advocacy of the Ruvuma JIWRM Strategy and coordination with SADC and development partners are proposed to be vital for an operational JWC (SAP 4.1.1)
- Development of the Ruvuma river awareness kit for the general public (SAP 4.3.6)

- Utilisation of efficient communication tools to reach basin stakeholders e.g. radio broadcasting and subject matter information packages (e.g. SAPs 1.3.1, 4.2.1, 4.3.1 and 4.3.3)
- Support to inter-ministerial coordination (SAP 4.3.4)
- Institutional training and strengthening programmes (SAP 4.1.2 and 4.1.3)
- Implementation of Community Basin Management Projects (CBMPs) to support awareness creation through “learning by doing” by way of demonstration projects on the ground (SAP 4.3.5).





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## **APPENDICES**



## **Appendix 1: Description of Strategic Action Projects**

### **Action Area 1: Coordinated water infrastructure development**

Challenge area: Sustainable use and assurance of water supply to key water using sectors

Strategic Area: Coordinated water infrastructure development

Priority measures:

This following field consists of three components. The first one is dedicated to national water related infrastructure and the second one to potential joint investments on the main Ruvuma River. The national infrastructure projects include i) Development of small and medium size dams, ii) Development of drinking water supply and sanitation, iii) Development of hydro agricultural infrastructure, and iv) Development of hydropower production. The third addresses investment funding and aims at piloting the use of un-conventional sources of financing e.g. PPP and CDM mechanisms.

#### **Component 1.1: National infrastructure**

This component concerns development in the fields of hydro-agricultural, hydropower, water supply and sanitation and the need for reservoirs to assure the supply of water at the right time to these water use sectors. Specifically, this component deals with small and medium size dam projects for water supply, irrigation, and hydropower – including off-river projects for water supply, irrigation, and hydropower.

##### **Small and medium size dams**

As indicated by the development scenario studies it is anticipated that existing schemes would be extended and planned projects implemented in a medium term perspective, while other areas classified as suitable for irrigation would be expected to be equipped in the long term perspective. The implementation of the identified hydropower plants would be expected on a short, medium or long term basis depending on the relevance of the projects. The potential development of these water use sectors would require implementation of small and medium water regulating and storage infrastructure.

The strategic objective would be to develop the storage capacity and guarantee the supply to priority users.

The specific objective of this critical development project would be to identify, assess and prioritise small and medium-sized dams for future development and to implement priority projects.

In summary, the development and rehabilitation of small and medium-sized dams is important for several reasons, among others: for providing reliable irrigation water to support expanding small- and medium-scale commercial agriculture, including livestock watering, for guarding against droughts and supporting food security amongst subsistence farmers, for ensuring adequate water supply to small towns where existing supplies have reached or are due to reach their limits, for facilitating the supply of hydroelectric power to small towns and growth points, and for developing storage capacity and regularising water use in the basin, at large.

The strategic actions– in coordination with the regional (Tanzania) / provincial (Mozambique) authorities for the detailed planning of the Ruvuma River Basin and the private sector – are to:

- Set up a small and medium size dam strategy based upon the needs of developing storage capacity as emphasized in the water balance analysis.

- Undertake feasibility studies and implement a minimum of ten (10) small and medium size dams up to the year 2030.

The proposed strategy for the implementation of small and medium size dams has to be formulated in the short term to be in line with the development of the irrigation and water supply projects within the basin. The Small and Medium size Dam Development Strategy for the Ruvuma River Basin is meant to address the fragmented development and uncoordinated planning and resource mobilisation for small and medium size dam development. The Strategy identifies potential dam sites, existing dams and runoff-abstraction points and designs a clear strategy for small and medium size dam development/rehabilitation as well as relevant stakeholders. It also includes an outline of resource mobilisation that would facilitate future investigations and funding for actual dam construction. The rehabilitation and construction of the prioritised dams are projected for the medium and long term implementation phases.

Strategic Action Projects (SAPs):

| <b>SAP 1.1.1: Small and medium dam strategy, Ruvuma basin</b> |  |
|---|--|
| <b>Objective:</b>   | <ul style="list-style-type: none"> <li>▪ Formulate the strategy to develop additional small and medium size dams in the basin.</li> <li>▪ Carry out a pre-feasibility/ feasibility study for each one of the identified dams in the small and medium size dam strategy for the Ruvuma basin.</li> </ul>  |
| <b>Location:</b>  | Basin wide   |
| <b>Executing Agencies:</b>                                    | RBWO. ARA-Norte  |
| <b>Description of action(s):</b>                              | <p>Strategy phase:</p> <ul style="list-style-type: none"> <li>▪ Assess the need of new water storage in the basin</li> <li>▪ Identify potential small and medium sized dam sites (approximately 20 sites)</li> <li>▪ Screen the most interesting dams sites</li> <li>▪ Assess the impact of such infrastructure development by sub basin</li> </ul> <p>Feasibility phase:</p> <ul style="list-style-type: none"> <li>▪ Undertake EIAs and propose mitigation measures</li> <li>▪ Analyse the financing and implementation options for the most relevant dams projects</li> </ul> <p>Tentative sites in Tanzania are: Tunduru, Mangaka and Masasi for urban water supply. The alternative of withdrawing water from a wear structure on the main Ruvuma River is proposed to be investigated for the case of Mangaka.</p> <p>Tentative sites in Mozambique are: Lichinga for urban water supply and Unango, Maniamba, Chilolo, Metangula for small scale hydro-power and irrigation purposes.</p> |
| <b>Time frame:</b>  | 2015-2020. 2 years   |
| <b>Cost:</b>  | 350,000 USD - Strategy phase<br>800,000 USD (80 000 USD per dam) – Feasibility phase   |

| <b>SAP 1.1.2: Implementation/rehabilitation of prioritized dams, Ruvuma basin</b> |   |
|---|---|
| <b>Objective:</b>   | <ul style="list-style-type: none"> <li>▪ Implementation of the prioritized dams and rehabilitation of the existing ones</li> <li>▪ Increased storage capacity within the basin and evasion of periodical water shortage</li> </ul>  |
| <b>Location:</b>  | Basin wide  |
| <b>Description of action(s):</b>  | <ul style="list-style-type: none"> <li>▪ Mobilizing funds to build/rehabilitate the required dams</li> <li>▪ Establishing a partnerships to implement civil works</li> <li>▪ Constructing and supervising works</li> <li>▪ Implementing the Environmental Management Plans (EMP)</li> </ul> |
| <b>Time frame:</b>  | 2015-2025. 4 years / 10 dams (between 1 and 3 years per dam depending upon the  |

|              |   |
|--------------|---|
| <b>Cost:</b> | <p>volume of the reservoir. 1 year for rehabilitation per existing dam)</p> <p>Indicative costs: for 10 dams (2 with storage capacity of 20 Mm<sup>3</sup>, 5 with storage capacity of 10 Mm<sup>3</sup> and 3 with 5 Mm<sup>3</sup>):</p> <p>195,000,000 USD in total (40,000,000 USD per dam with a storage capacity of 20 Mm<sup>3</sup>, 20,000,000 USD per dam with a storage capacity of 10 Mm<sup>3</sup> and 10,000,000 USD per dam with storage capacity of 5 Mm<sup>3</sup>)</p> <p>\$50,000,000 USD for rehabilitation of existing infrastructures</p> |
|--------------|---|

## **Water supply and sanitation**

The overall objective here is to develop basic infrastructure (urban and rural water supply) in order to improve the population's living standards, and to allow economic development

The long-term target is to achieve 100% coverage of adequate water supply and sanitation systems.

The strategic actions – in coordination with the regional (Tanzania) / provincial (Mozambique) authorities for the detailed planning of the Ruvuma River Basin and the private sector - are:

- Scaling-up of urban and rural water supply and sanitation services delivery to meet national policy targets in Tanzania
- Scaling-up of urban and rural water supply and sanitation services delivery to meet national policy targets in Mozambique.

The supports to the development of basic services would be implemented in short, medium and long terms. Some projects in the Water Supply and Sanitation (WSS) sector are already in progress or in the planning stage. However, as discussed in the national strategic documents of both countries (PRONASAR, WSDP, MDG, MKUKUTA, etc.), to achieve the ambitious goals of the water supply and sanitation sector in both urban and rural areas, support to the development of these basic services would be a long term task.

Strategic Action Projects (SAPs):

|                                  |  |
|----------------------------------|--|
| <b>SAP 1.1.3:</b>                | <b>Rural water supply and sanitation investments, Mozambique</b>   |
| <b>Objective:</b>                | Scaling-up of rural water supply and sanitation services delivery to meet PRONASAR targets   |
| <b>Location:</b>                 | Mozambique   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ drilling of boreholes/rehabilitation of wells</li> <li>▪ installation of hand pumps</li> <li>▪ construction of piped systems using pumped water from boreholes or gravity fed water from springs</li> <li>▪ employment of local NGOs for facilitating communities and Consulting Firms for assisting communities in carrying out designs and supervising construction of WSS facilities</li> <li>▪ expansion of the existing supply chain of private retail outlets for stocking and supplying pumps, the installation of pumps and the provision of spare parts and after-sale services for hand pumps and mechanized pumps</li> <li>▪ construction of latrines at schools and demo latrines and the promotion of the uptake and retrofitting of improved household sanitation technologies and hygiene behaviour</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 5 years   |
| <b>Cost:</b>                     | 500,000 USD  |



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| <b>SAP 1.1.4:</b>                | <b>Lichinga urban water supply and sanitation</b>   |
| <b>Objective:</b>                | Improve access to water supply and sanitation for the population of Lichinga municipality   |
| <b>Location:</b>                 | Mozambique  |
| <b>Description of action(s):</b> | <p>Currently, a project called Niassa Provincial town water and sanitation project is underway. The project involves a water supply piping system, and the rehabilitation and expansion of the water treatment plant and pumping station plus public and household latrines for Lichinga.</p> <p>The present amount of water supplied from Locumue Dam is in the order of 2 800 m<sup>3</sup>/d (1 Mm<sup>3</sup>/year). This is a severe obstacle to the expansion of the water services and well below the estimated current water demand. The development of the new water storage infrastructure required would have to be assessed through the SAP “Study and formulation of a small and medium size dam strategy for the Ruvuma basin, including feasibility studies for the most relevant dams”. Key actions are:</p> <ul style="list-style-type: none"> <li>▪ Extension of the water supply piping system, and the household latrine system</li> <li>▪ Development of new water storage infrastructure for Lichinga area (SAP 1.1.2)</li> </ul> |
| <b>Time frame:</b>               | 2013-2020.  |
| <b>Cost:</b>                     | Total 2,400,000. 1,500,000 USD for studies, 900,000 USD for the future expansion of the water supply and sanitation networks  |

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| <b>SAP 1.1.5:</b>                | <b>Rural water supply and sanitation investments, Tanzania</b>  |
| <b>Objective:</b>                | Scaling-up of rural water supply and sanitation services delivery to meet MKUKUTA targets   |
| <b>Location:</b>                 | Tanzania  |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ drilling of boreholes/rehabilitation of wells</li> <li>▪ installation of hand pumps</li> <li>▪ construction of piped systems using pumped water from boreholes or gravity fed water from springs</li> <li>▪ employment of local NGOs (Facilitation Services Providers-FSPs) for facilitating communities and Consulting Firms (Technical Services Providers-TSPs) for assisting communities in carrying out designs and supervising construction of WSS facilities</li> <li>▪ expansion of the existing supply chain of private retail outlets for stocking and supplying pumps, the installation of pumps and the provision of spare parts and after-sale services for hand pumps and mechanized pumps</li> <li>▪ construction of latrines at schools and demo latrines and the promotion of the uptake and retrofitting of improved household sanitation technologies and hygiene behaviour</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 5 years  |
| <b>Cost:</b>                     | 500,000 USD   |
| <b>Funding:</b>                  | Basket funding under the WSDP   |

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|----------------------------------|--|
| <b>SAP 1.1.6:</b>                | <b>Songea Urban Water Supply and Sanitation, Tanzania</b>  |
| <b>Objective:</b>                | Improve access to water supply and sanitation for the population of Songea municipality  |
| <b>Location:</b>                 | Tanzania (Songea)  |
| <b>Description of action(s):</b> | <p>The major urban centre is Songea, where new storage facilities for water supply would be required in the future. The existing plans to develop new water sources for the years 2015 – 2025 are to improve Upper Ruhila water sources by constructing and impounding a reservoir dam and to carry out a long term investigation of the water quantity and quality of the Ruhimba/Lumecha rivers, both being future potential sources of water.</p> <p>N.B. The two rivers concerned are located outside of the Ruvuma basin (i.e. in the Lake Nyasa basin). However, investments are required to meet demands coming, in part, from the Ruvuma River basin. The project can hence be considered as an intra-basin project, one that should be implemented in cooperation with the Lake Nyasa Basin Water Office.</p> |

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|--------------------|--|
|                    | <p>All the actions linked to the project:</p> <ul style="list-style-type: none"> <li>▪ Detailed Engineering Design</li> <li>▪ Preparation of EIA and EMP</li> <li>▪ Preparation of tender documents</li> <li>▪ Construction and supervision to improve the water supply and sewerage in Songea Municipality</li> </ul> |
| <b>Time frame:</b> | 2013-2020. 3 years   |
| <b>Cost:</b>       | 2,400,000 USD  |
| <b>Funding</b>     | Basket funding under the WSDP  |

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| <b>SAP 1.1.7:</b>                | <b>Ruvuma-Mtwara inter basin water transfer</b>  |
| <b>Objective:</b>                | Improve access to water supply and sanitation to satisfy future demand in Mtwara Municipality  |
| <b>Location:</b>                 | Tanzania (Mtwara)  |
| <b>Description of action(s):</b> | <p>To meet predicted industrial and municipal water demands Mtwara will need to develop alternative water supply sources. A strategic action plan would aim at investigating the possibility of augmenting the water supply through an inter-basin transfer scheme from the Ruvuma Basin to the Mtwara municipality. The option of mobilizing the surface water resource would have to be compared with alternative options, such as seawater desalination or further groundwater exploration.</p> <p>All the actions linked to the project:</p> <ul style="list-style-type: none"> <li>▪ Assessment of the demand for Mtwara municipality</li> <li>▪ A prefeasibility study to locate alternative water intake sites, from the Ruvuma or from tributaries, including an assessment of the need for storage.</li> <li>▪ A prefeasibility study on a water transfer scheme</li> </ul> |
| <b>Time frame:</b>               | 2015-2020. 1 year  |
| <b>Cost:</b>                     | 500,000 USD  |

### **Development of hydro-agricultural infrastructure**

Off-river projects for the development of the irrigation sector are dealt with here.

The strategic objective is to increase agricultural production and contribute to food security through the development of new irrigation infrastructures.

The strategic actions – in coordination with the Ministry of Agriculture and Irrigation for the detailed planning of irrigation development in the Ruvuma River Basin and the private sector – are to:

- Contribute to a sustainable rehabilitation and development of between 38 000 - 40 000 ha of irrigated agriculture in Tanzania up to the year 2030.
- Contribute to a sustainable rehabilitation and development of between 1 000 - 10 000 ha of irrigated agriculture in Mozambique up to the year 2030.

Coordination between relevant authorities is a priority action, to be initiated in the short term perspective. The associated strategic actions related to inter sector coordination are detailed under Institutional Actions. The rehabilitation of the prioritised irrigation schemes are foreseen for the short term implementation phase, while extensions and construction of new schemes are foreseen for the medium and long term implementation phases.

Strategic Action Projects (SAPs):

|                                  |   |
|----------------------------------|---|
| <b>SAP 1.1.8:</b>                | <b>Development of extensions and planned irrigation schemes, Mozambique</b>   |
| <b>Objective:</b>                | Increase agricultural production and contribute to food security through the development of new irrigation infrastructures.   |
| <b>Location:</b>                 | Mozambique  |
| <b>Description of action(s):</b> | Construction and implementation of new irrigation schemes. Potential areas are Lussanhando, Nahavara, and Mandimba.   |
| <b>Time frame:</b>               | 2015-2020. 1 year, once the preliminary studies have been finalised   |
| <b>Cost:</b>                     | 2,000,000 USD. The development of private irrigation projects represents, in the Mozambique part of the basin, an area of 1 600 ha. These are not included as SAPs. |
| <b>Expected outcome:</b>         | 1800 ha equipped for irrigation   |

|                                  |  |
|----------------------------------|--|
| <b>SAP 1.1.9:</b>                | <b>Development of potential irrigable areas, Mozambique</b>  |
| <b>Objective:</b>                | Increase agricultural production and contribute to food security through the increase irrigated areas.   |
| <b>Location:</b>                 | Mozambique   |
| <b>Description of action(s):</b> | Build the required infrastructure and equip the farmers in order to develop irrigated areas in the following districts: Muembe, Mandimba, Maua, Marrupa, Majune and Sanga. |
| <b>Time frame:</b>               | 2020-2030. 5 years (2 000 ha/year), once the preliminary studies have been done  |
| <b>Cost:</b>                     | 90,000,000 USD   |
| <b>Expected outcome:</b>         | Up to 9 000 ha equipped  |

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|----------------------------------|--|
| <b>SAP 1.1.10:</b>               | <b>Extension of existing irrigation schemes, Tanzania</b>  |
| <b>Objective:</b>                | Increase agricultural production and contribute to food security through the extension of existing irrigation schemes. |
| <b>Location:</b>                 | Tanzania   |
| <b>Description of action(s):</b> | Build the infrastructures required for the extension of irrigation schemes.  |
| <b>Time frame:</b>               | 2015-2030. 10 years (2 000 ha/year), once the preliminary studies have been undertaken                                 |
| <b>Cost:</b>                     | 96,000,000 USD   |
| <b>Expected outcome:</b>         | 19 200 ha equipped for irrigation  |

|                                  |   |
|----------------------------------|---|
| <b>SAP 1.1.11:</b>               | <b>Development of planned irrigation schemes, Tanzania</b>  |
| <b>Objective:</b>                | Increase agricultural production and contribute to food security through the development of new irrigation infrastructures. |
| <b>Location:</b>                 | Tanzania  |
| <b>Description of action(s):</b> | Construction and implementation of the new irrigation schemes, already planned.   |
| <b>Time frame:</b>               | 2015- 2025. 6 years (2 000 ha/year), once the preliminary studies have been done  |
| <b>Cost:</b>                     | 80,000,000 USD  |
| <b>Expected outcome:</b>         | 11 400 ha equipped for irrigation   |

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| <b>SAP 1.1.12:</b>               | <b>Development of potential irrigable areas, Tanzania</b>  |
| <b>Objective:</b>                | Increase agricultural production and contribute to food security through the increase irrigated areas. |
| <b>Location:</b>                 | Tanzania   |
| <b>Description of action(s):</b> | Build the required infrastructure and equip the farmers in order to develop irrigated areas.           |
| <b>Time frame:</b>               | 2025-2030. 1 year (2 000 ha/year), once the preliminary studies have been undertaken                   |
| <b>Cost:</b>                     | 19,000,000 USD   |
| <b>Expected outcome:</b>         | Up to 1 900 ha equipped for irrigation   |

|                                  |  |
|----------------------------------|--|
| <b>SAP 1.1.13:</b>               | <b>Upgrading of existing irrigation schemes, Ruvuma Basin</b>  |
| <b>Objective:</b>                | Increase the efficiency of the infrastructure and improve management with regards to future requirements.  |
| <b>Location:</b>                 | Basin wide   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Identify the schemes with low efficiency in terms of irrigation and management</li> <li>▪ Evaluate irrigation infrastructures and management structures</li> <li>▪ Propose an upgraded program for the identified schemes</li> <li>▪ Carry out the upgrading program (approximately 15 000 ha)</li> </ul> |
| <b>Time frame:</b>               | 2015-2025. 5 years   |
| <b>Cost:</b>                     | 92,000,000 USD ( 6,000 USD/ha)   |
| <b>Expected outcome:</b>         | Between 30 000 and 40 000 ha of irrigated schemes assessed and upgraded  |

## Development of hydropower production

Off-river projects for hydropower are dealt with here.

The strategic objective is to promote renewable energy by increasing the production of hydropower in the basin.

The strategic action – in coordination with the regional (Tanzania)/ provincial (Mozambique) authorities for the detailed planning of the Ruvuma River Basin and the private sector – is to undertake feasibility studies and implement the most viable small- and medium size hydropower schemes.

Since some of the schemes are projected for important environmental zones, comprehensive feasibility studies, EIA studies and broad based decision making are defined as priority actions. The rehabilitation and construction in accordance with the most viable schemes are foreseen for the medium and long term implementation phases.

Strategic Action Projects:

|                                  |  |
|----------------------------------|--|
| <b>SAP 1.1.14:</b>               | <b>Pre-feasibility and feasibility studies for the evaluation of potential sites</b>   |
| <b>Objective:</b>                | Increase the production of hydropower in the basin   |
| <b>Location:</b>                 | Tanzania and Mozambique  |
| <b>Description of action(s):</b> | Identified schemes are in different phases of planning. Several schemes have not undergone pre-feasibility and feasibility studies. Thus, this project would provide for the screening of sites and for pre-feasibility and feasibility studies of selected prospects. |
| <b>Time frame:</b>               | 2015-2020. 1 year  |
| <b>Cost:</b>                     | 800,000 USD  |

|                                  |   |
|----------------------------------|---|
| <b>SAP 1.1.15:</b>               | <b>Implementation of small- and medium size hydropower schemes</b>  |
| <b>Objective:</b>                | Increase the production of hydropower in the basin.   |
| <b>Location:</b>                 | Tanzania and Mozambique   |
| <b>Description of action(s):</b> | <p>Carry out the required studies i.e. EIAs and detailed design</p> <p>Construction and supervision of selected viable schemes as well as the associated transmission lines.</p> <p>Tentative locations for identified schemes in Tanzania : Lupilo, Combined Nakatuta, Lumeme, Msunda falls, Kwitanda Hydropower Plants</p> <p>Tentative locations for identified schemes in Mozambique: Mbahu Hydropower Plant.</p> <p>Other tentative sites are: Unango, Maniamba, Chilolo, B3 and Metangula</p> |
| <b>Time frame:</b>               | 2015-2025. 5 years  |
| <b>Cost:</b>                     | 240,000,000 USD for the construction and supervision and approximately 700,000 USD in environmental costs   |

## Component 1.2: Joint water Infrastructure on the main Ruvuma River

Background: A potential joint project referred to as the Ruvuma River Multi-Purpose Project has been identified on the main Ruvuma River. The project would include two reservoirs and three run-off hydro-power schemes. This action has been included in the high development scenario. Investment costs are tentatively estimated at 950,000,000 USD. The costs of feasibility studies, including geotechnical studies, are estimated at 1,500,000 USD. There are no immediate drivers for a transboundary and multipurpose project and the development of such a project would need further studies at the pre-feasibility and feasibility levels before its viability could be determined.

Strategic Objective: The reservoirs HP2 and HP4 are expected to serve multiple functions such as hydropower generation, irrigation development, environmental flow, drought mitigation, flood protection, support to fishing, etc. The other run-off hydropower cascades HP4, HP5 and HP6 would contribute to hydropower production for local and national demand.

The strategic actions are to:

- Initiate discussions at the national and SADC levels and undertake a study of the potential and the feasibility of including such a project in national and SADC energy sector plans.
- Undertake a pre-feasibility study and make recommendations for feasibility studies.

The regional integration study is deemed highly relevant and projected, time wise, for the short term phase. Depending on the outcome of this study, a pre-feasibility study would be undertaken during the medium or long-term implementation phases.

Strategic Action Projects (SAPs):

|                                  |   |
|----------------------------------|---|
| <b>SAP 1.2.1:</b>                | <b>Pre-feasibility of the Joint Ruvuma multipurpose project</b>   |
| <b>Objective:</b>                | Study the potential and feasibility of including this project in national and SADC energy sector plans                |
| <b>Location:</b>                 | Basin wide  |
| <b>Description of action(s):</b> | Analyse the viability of the identified joint multi-purpose project and make recommendations for a feasibility study. |
| <b>Time frame:</b>               | 2020-2030. 3 years.   |
| <b>Cost:</b>                     | 800,000 USD   |

### Mobilisation of investment funding

The development of the Basin will require substantial investments in water infrastructure over the coming decades, notably dams in Mozambique. Ideally these investments will be made jointly between the public and the private sector. The reason being that the private sector has not only the financial means but also the expertise required to realise water infrastructure projects. Apart from shouldering part of the investment costs, the private sector can be involved with planning activities and technological innovations.

The specific objective is to promote new funding mechanisms and to facilitate the institutionalisation of these through pilot projects.

|                                  |  |
|----------------------------------|--|
| <b>SAP 1.3.1:</b>                | <b>Development funding mechanisms and piloting</b>   |
| <b>Objective:</b>                | Promote new funding mechanisms and facilitate the institutionalisation of these through pilot projects   |
| <b>Location:</b>                 | Basin wide   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Create awareness and consensus among Ministries, private sector stakeholders and water users about different options and modalities for Public Private Partnership (PPP) in Irrigation and drainage (I&amp;D / water supply and sanitation (WSS) infrastructure management and development, assess the overall potential for improved and/or expanded I&amp;D/WSS service delivery using a PPP approach, and describe the necessary actions for creating an enabling</li> </ul> |

|                    |  |
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|                    | <p>environment for PPP in the irrigation and water supply and sanitation sector,</p> <ul style="list-style-type: none"><li>▪ Prepare possible PPP transaction models to help the Governments of both countries engage the private sector in public water service provision.</li><li>▪ On the basis of agreed transaction models, prepare 2 PPP pilot operations in I&amp;D / WSS for implementation.</li><li>▪ Prepare CDM projects i.e. prepare Project Idea Note (s) (PINs) for use in presenting the hydro-power projects to potential purchasers of the CERs resulting from each project.</li><li>▪ Reinforce throughout the financial systems regarding sourcing and disbursement of funds to projects.</li></ul> |
| <b>Time frame:</b> | 3 years. 2015-2020   |
| <b>Cost:</b>       | 500,000 USD  |

## **Action Area 2: Cross-sectoral Measures for Protection and Conservation**

Overall objective: A healthy, ecologically sustainable and protected water environment.

Challenge area: Ensure water quality and sustain aquatic ecosystem health

Strategic area: Coordinated measures for ecosystem conservation and river protection

Priority measures:

The following field (field 2) contains two components: Component 2.1: River protection, and Component 2.2: Water quality management and Component. Included in these components are measures for the protection of the water sources, biodiversity, soil preservation, management of the water quality.

The actions linked to this field are planned to be initiated on a short and medium term planning horizon and require long term monitoring and follow up activities.

### **Component 2.1: River Protection**

Strategic Objective: Addressing key causes of environmental degradation.

Strategic Actions:

- Pollution control of informal mining areas
- Erosion control
- Water source protection

The implementation of these actions would be carried out on a short term basis. However, monitoring and enforcing activities would continue and would be followed up throughout medium and long term implementation phases.

Strategic Action Projects (SAPs):

|                                  |  |
|----------------------------------|--|
| <b>SAP 2.1.1:</b>                | <b>Pollution control of informal mining areas</b>  |
| <b>Objective:</b>                | To pilot pollution control measures related to artisanal and small scale mining. These actions, considered informal and sometimes illegal, make it difficult to plan and develop mitigation measures.<br>To assess the possibilities of constructing small siltation dams in the tributaries with extensive gold mining activities. If deemed feasible, siltation dams would rapidly improve water quality.  |
| <b>Location:</b>                 | Tanzania (Tunduru), Mozambique (Niassa - Lupilichi area)   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Study possible solutions to deal with mining sector pollution</li> <li>▪ Determine the ownership, operation and maintenance responsibility of potential tailing dams. A legal body such as miner association, local administrations or the basin water authorities must be responsible for the dams.</li> <li>▪ Carry out feasibility studies followed by design, construction and management of tailing and settling dams</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 2 years   |
| <b>Cost:</b>                     | 800,000 USD  |



|                                  |   |
|----------------------------------|---|
| <b>SAP 2.1.2:</b>                | <b>Erosion control</b>  |
| <b>Objective:</b>                | Identify, prioritise and rehabilitate priority erosion points in catchment areas.   |
| <b>Location:</b>                 | Basin wide  |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Survey of catchment areas and mapping of erosion points caused by the removal of vegetation, and opening up of new areas for farming and mining, which causes an increase in the sediment loading of downstream areas.</li> <li>▪ Prioritisation for rehabilitation and control</li> <li>▪ Rehabilitation</li> <li>▪ Monitoring and enforcement of controlling measures</li> </ul> |
| <b>Time frame:</b>               | 2015-2020. 3 years implementation and 2 years follow up activities  |
| <b>Cost:</b>                     | 400,000 USD   |

|                                  |  |
|----------------------------------|--|
| <b>SAP 2.1.3:</b>                | <b>Water source protection</b>   |
| <b>Objective:</b>                | Demarcation and management of water source protection areas  |
| <b>Location:</b>                 | Basin wide   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Demarcation of water sources protection areas i.e. map out, delineate and provide legal protection of important water catchments, groundwater recharge areas and wetland.</li> <li>▪ Creation of community awareness</li> <li>▪ Training and strengthening Water Associations and User Groups, Environmental Committees and/or Village Land Use Plans Committees</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 3 years implementation and 2 years follow up activities   |
| <b>Cost:</b>                     | 100,000 USD  |

## **Component 2.2: Water Quality Management**

Strategic objective: the protection of biodiversity for the purpose of preserving the existing rich fauna and flora of the basin and to maintain good water quality. This would be attained primarily by increasing knowledge of current ecosystems and by developing suitable management packages which would:

- Establish the flow requirements for sustaining aquatic ecosystems
- Establishing an ecological status monitoring program
- Establish water quality management plan

The implementation of the SAPs is planned for the short term phase. The SAPs would then require a medium and long term monitoring plan.

Strategic Action Projects (SAPs):

|                                  |  |
|----------------------------------|--|
| <b>SAP 2.2.1:</b>                | <b>Establish the environmental water requirements</b>  |
| <b>Objective:</b>                | Establish the environmental flow requirements (quantity and quality) necessary to achieve a desired state of health in aquatic ecosystems in order to meet biodiversity protection targets and maintain a desired level of output of ecosystem services, taking trade-offs (value of water use) into account   |
| <b>Location:</b>                 | Basin wide   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Carry out a comprehensive, multidisciplinary environmental flow assessment for the Ruvuma river system, based on:                             <ul style="list-style-type: none"> <li>○ Ecological baseline studies (filling gaps from this study, in particular for the estuary and lakes)</li> <li>○ Socio-economic baseline studies (to establish the demand for aquatic ecosystem services)</li> <li>○ Estimates of values of water use</li> <li>○ Consultation with stakeholders</li> <li>○ Introduce environmental consideration in water licensing procedures</li> <li>○ Commence international negotiations on environmental flow criteria</li> </ul> </li> <li>▪ Expected outcomes are:                             <ul style="list-style-type: none"> <li>○ A comprehensive baseline description of aquatic ecosystems and their condition, the socio-economic value of aquatic ecosystem services, and the value of water use.</li> <li>○ Flow requirements defined for every significant river reach, wetland and the estuary.</li> <li>○ Ecological thresholds and specifications defined in a monitoring plan</li> </ul> </li> </ul> |
| <b>Time frame:</b>               | 2013-2015. 18 months   |
| <b>Cost:</b>                     | 300,000 USD  |

|                                  |   |
|----------------------------------|---|
| <b>SAP 2.2.2:</b>                | <b>Ecological status monitoring</b>   |
| <b>Objective:</b>                | Monitoring biodiversity change in the basin and understanding the main drivers of change  |
| <b>Location:</b>                 | Basin wide  |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Identification of the items included in the monitoring system (item = unity of observation, e.g. woody vegetation, land cover, etc.)</li> <li>▪ Identification, for each item, of one or several indicators (= quantitative data that allow to describe the state of an item)</li> <li>▪ Description, for each indicator, of the data collection and analysis protocols: methods implemented location, duration, frequency, cost, etc.</li> <li>▪ Identification of data providers (that is stakeholders able to implement – or which already implement – protocols)</li> <li>▪ Definition of a collaborative agreement between the body in charge of the management of the monitoring system and data providers</li> <li>▪ Definition of the procedures for information dissemination among stakeholders</li> </ul> |
| <b>Time frame:</b>               | 2020-2025. 18 months  |
| <b>Cost:</b>                     | 300,000 USD   |

|                                  |  |
|----------------------------------|--|
| <b>SAP 2.2.3:</b>                | <b>Establish a water quality management plan</b>   |
| <b>Objective:</b>                | Maintain the quality of surface and groundwater supplies through improved water quality information and standards  |
| <b>Location:</b>                 | Basin wide   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Establish baseline water quality conditions and determine deviations from natural conditions</li> <li>▪ Develop water quality targets for fresh water bodies based upon their potential use taking into account human health, and maintenance of biodiversity and ecosystem integrity, and undertake appropriate modelling to define detailed, spatially-explicit water quality requirements.</li> <li>▪ Identify main threats to water quality and possible interventions to prevent the deterioration of water quality, based on a review of best practice. Such interventions could be regulatory measures or incentive measures.</li> <li>▪ Develop a water quality management plan</li> <li>▪ Implement effective monitoring systems for water quality (in coordination with EKIS actions).</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 2 years implementation and 2 years follow up activities   |
| <b>Cost:</b>                     | 300,000 USD  |

### **Action Area 3: Climate Change and Disaster Management**

This component deals with vulnerability reduction actions other than infrastructure interventions.

Overall objective: Eliminate or reduce the human, material, social and economic impacts of floods, drought and climate change

Challenge area: Reduce water related vulnerability, notably food insecurity and floods and droughts

Strategic Area: Coordinate measures for climate change adaptation and disaster management

Priority Measures:

The measures aim at forecasting natural disasters and future climate change impacts and at implementing procedures to reduce the impact of these risks on the local population. The River Basin population is moderately prone to disasters and climate changes impacts. Although it is not seen as a short term priority action, the need to establish robust systems is not negotiable.

Strategic Actions:

- Develop a climate change adaptation strategy
- Develop disaster management plans

Strategic Action Projects (SAPs):

|                                  |  |
|----------------------------------|--|
| <b>SAP 3.1.1:</b>                | <b>Climate change modelling and development of adaptation strategy</b>   |
| <b>Objective:</b>                | Study climate change impacts on water resources and plan adaptation measures   |
| <b>Location:</b>                 | Basin wide   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Carry out a climate change sensitivity analysis of potential development scenarios</li> <li>▪ Assess the vulnerability of the Ruvuma River Basin to climate change.</li> <li>▪ Develop a climate change adaptation strategy for the basin (drawing from national scale policies and strategies)</li> <li>▪ Communicate to stakeholders</li> <li>▪ Integrate the climate change strategy into provincial and regional plans</li> </ul> |
| <b>Time frame:</b>               | 2 years. 2013-2020   |
| <b>Cost:</b>                     | 400,000 USD  |

|                                  |  |
|----------------------------------|--|
| <b>SAP 3.2.1:</b>                | <b>Development of disaster management plans and response systems</b>   |
| <b>Objective:</b>                | Establish a flood and drought disaster management framework  |
| <b>Location:</b>                 | Basin wide   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Determine the procedure for the issue of emergency notification by/to the States</li> <li>▪ Prepare emergency plans and evacuation plans</li> </ul> <p>Flood management,</p> <ul style="list-style-type: none"> <li>▪ Determine flood risks (where, frequency, damages) and how to manage the consequences e.g. undertake flood studies and prepare inundation maps, flood protection plans and landuse planning recommendations</li> <li>▪ Develop the necessary flood simulation tools to determine the design parameters required to create essential infrastructure flood resistance</li> <li>▪ Reduce flood risk by planning, prioritising and implementing flood control structures, dams, dykes and weirs</li> <li>▪ Establish early warning systems</li> </ul> <p>Drought management:</p> <ul style="list-style-type: none"> <li>▪ Forecast modelling to enable long-term sensitivity forecast for drought warnings</li> <li>▪ Post-drought analysis</li> <li>▪ Establishment of drought management procedures that are coordinated with national rescue authorities. Protocols should be signed between involved institutions defining the responsibility of each regarding data collection, management and dissemination during the dry season and during a drought, at national and transboundary levels</li> <li>▪ Drought Management Plans</li> </ul> <p>Disaster management related to accidental pollution are:</p> <ul style="list-style-type: none"> <li>▪ Mapping of pollution sources, risks and potential impact</li> <li>▪ Set-up effective and rapid notification and communication systems, including for accidental pollution</li> <li>▪ Prepare emergency action plans for accidental pollution</li> </ul> |
| <b>Time frame:</b>               | Implementation phase: 3 years. 2013-2020   |
| <b>Cost:</b>                     | Total 1,300,000 USD. 800,000 USD for flood management. 300,000 USD for drought. 200,000 USD for accidental pollution.  |

## Action Area 4: Institutional Consolidation and Strengthening

The fourth component is related to water management and institutional requirements coming about from the foreseen increased development as well as international and national obligations of the water authorities.

Overall objective: A committed and dedicated water sector, actively co-operating and contributing towards sustainable water management and associated outcomes

The specific objective of this component is to enhance capacity at the national and regional level to address the challenges of water resources management in Tanzania and Mozambique and strengthen the institutional framework for water resources development.

Challenge area: Water Governance

Strategic Area: Institutional Consolidation and Strengthening

Priority Measures:

The priority actions are divided into three main components, explicitly Component 4.1: Institutional Management Framework, Component 4.2: Water Resources Management and Component 4.3: Promotion of Stakeholder Participation and Cross-sectoral Coordination. The actions in this field are planned to be carried out on short, medium and long term horizons as shown in the following sections.

### Component 4.1: Institutional Management Framework

The general aim of this component is to provide the JWC and its member countries with the legal and operational mechanisms they will need for effective implementation of the Joint IWRM principles.

|                                  |   |
|----------------------------------|---|
| <b>SAP 4.1.1:</b>                | <b>Operationalization of JWC</b>  |
| <b>Objective:</b>                | Establishment of a common legal framework at basin level and the composition of a Charter on Water  |
| <b>Location:</b>                 | Basin wide  |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>Establishment of the Ruvuma Water Charter (Comprehensive bi-lateral agreement) including information workshops and negotiations activities.</li> <li>Establishment of JWC Permanent Secretariat and Technical Committee</li> <li>Technical support to operationalization of JWC Permanent Secretariat and Technical Committee including annual meetings of JWC, consultancies, compliance review activities and periodical M&amp;E of i) implementation progress of Ruvuma JIWRM Strategy and ii) IWRM outcome and institutional performance indicators</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. Establishment phase: 2 years. Support phase: 5 years   |
| <b>Cost:</b>                     | Total 1,200,000 USD. Establishment phase: 450,000 USD. Support phase: 750,000 USD (150,000 USD/year)  |

|                                  |  |
|----------------------------------|--|
| <b>SAP 4.1.2:</b>                | <b>Institutional consolidation of the ARA Norte</b>  |
| <b>Objective:</b>                | Institutions fully operational   |
| <b>Location:</b>                 | Mozambique   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Prepare Business Plan, encompassing not only the Ruvuma basin but also the other basins under their jurisdiction.</li> <li>▪ Fill vacant positions</li> <li>▪ Provide training of high and medium level staff with short and oriented courses in the key water management functions and basin issues, notably hydrology, hydrogeology, water quality and environmental management. Training can be implemented in collaboration with universities (Eduardo Mondlane, UniLúrio)</li> <li>▪ Establish technical sub-departments and/ or prepare detailed ToR for each staff/technical function</li> <li>▪ Strengthen the Lichinga branch office</li> <li>▪ Acquire equipment and vehicles for the basic operation of functions</li> <li>▪ Establish the Fiscal and Management Board</li> <li>▪ Develop operational procedures for key functions and inter-ministerial coordination</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 5 years   |
| <b>Cost:</b>                     | 800,000 USD  |

|                                  |   |
|----------------------------------|---|
| <b>SAP 4.1.3:</b>                | <b>Institutional consolidation of the RBWO</b>  |
| <b>Objective:</b>                | Institutions fully operational  |
| <b>Location:</b>                 | Tanzania  |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Fill vacant positions</li> <li>▪ Provide training of high and medium level staff with short and oriented courses in the key water management functions and basin issues, notably hydrology, hydrogeology, water quality and environmental management. Training can be implemented in collaboration with universities</li> <li>▪ Establish technical sub-departments and/ or prepare detailed ToR for each staff/technical function</li> <li>▪ Strengthen the Songea branch office</li> <li>▪ Acquire equipment and vehicles for the basic operation of functions</li> <li>▪ Develop operational procedures for key functions and inter-ministerial coordination</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 5 years  |
| <b>Cost:</b>                     | 800,000 USD   |

|                                  |   |
|----------------------------------|---|
| <b>SAP 4.1.4:</b>                | <b>Legal review</b>   |
| <b>Objective:</b>                | Clarification of institutional roles and responsibilities   |
| <b>Location:</b>                 | Tanzania and Mozambique   |
| <b>Description of action(s):</b> | Make a legal review in order to clarify institutional roles and procedures, notability for water licencing, water quality monitoring and management, pollution control and EIA studies as well as inter-sectoral decision making. |
| <b>Time frame:</b>               | 6 months. 2013-2015.  |
| <b>Cost:</b>                     | 100,000 USD   |



## Component 4.2: Water Resources Management

The aim in both countries as stated in national policy and legislation is to develop financially autonomous basin water authorities with adequate physical infrastructure, tools and human resources to undertake mandated functions. This component focuses on strengthening the water management capacity. Notably, this component addresses the key functions of water use management, monitoring and information management, basin planning, economic and financial management.

Strategic objectives: The basin water institutions, RBWO in Tanzania and ARA-Norte in Mozambique, are fulfilling mandated functions and drive implementation.

### WATER UTILISATION, ALLOCATION AND ECONOMIC AND FINANCIAL MANAGEMENT

|                                  |  |
|----------------------------------|--|
| <b>SAP 4.2.1:</b>                | <b>Water use registry, permit system and control</b>   |
| <b>Objective:</b>                | Water use managed through a permit system  |
| <b>Location:</b>                 | Tanzania and Mozambique  |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Detailed inventory of all the users, notably irrigation. Inventory of abstraction points for different uses (drinking water, irrigation, industrial water, wetlands, flood retreat cropping and pasture land)</li> <li>▪ Develop an easily accessible information system on irrigation that includes data on irrigable soils, areas with irrigation infrastructure, land under irrigation, water consumptions, crops, average efficiencies and water tariffs</li> <li>▪ Improve the water abstraction database and permit registry</li> <li>▪ Undertake a basin related tariff study and develop a legally recognised document (Ministerial Diploma) that defines the tariffs for water use (Mozambique)</li> <li>▪ Institutionalise licensing and concession procedures in accordance with existing laws and regulations as well as agreed water allocation principles</li> <li>▪ Institutionalise simple water assessment and balance modelling</li> <li>▪ Provide technical assistance and consultancies to support tariff study</li> <li>▪ Provide information packages and resources for stakeholder consultations and negotiations with major users</li> <li>▪ Devise a plan for compliance monitoring and revenue collection.</li> </ul> |
| <b>Time frame:</b>               | 2013-2015. 2 years   |
| <b>Cost:</b>                     | 300,000 USD  |

## POLLUTION CONTROL

|                                  |   |
|----------------------------------|---|
| <b>SAP 4.2.2:</b>                | <b>Water pollution permit system and control</b>  |
| <b>Objective:</b>                | Pollution managed through a permit system   |
| <b>Location:</b>                 | Tanzania and Mozambique   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Improve effluent discharge database</li> <li>▪ Undertake a basin related tariff study and develop a legally recognised document (Ministerial Diploma) that defines the tariffs for effluent discharge (Mozambique)</li> <li>▪ Provide information packages and resources for stakeholder consultations and negotiations with major users</li> <li>▪ Introduce a licencing process and establish database of permit holders</li> <li>▪ Enforce water quality standards</li> <li>▪ Develop participatory pollution watch mechanisms</li> <li>▪ Devise a plan for compliance monitoring</li> <li>▪ Promote self-monitoring through ensuring that measuring devices are installed by key pollution permit holders</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 2 years  |
| <b>Cost:</b>                     | 300,000 USD   |

## MONITORING AND INFORMATION MANAGEMENT

|                                  |  |
|----------------------------------|--|
| <b>SAP 4.2.3:</b>                | <b>Enhanced Knowledge and Information System – Phase II</b>  |
| <b>Objective:</b>                | The objective is “to improve efficiency of the collection, management and exchange of information that is vital for transboundary water resources management.”   |
| <b>Location:</b>                 | Basin wide   |
| <b>Description of action(s):</b> | <p>The action components comprise:</p> <ul style="list-style-type: none"> <li>▪ Expanding (purchasing and installation) the monitoring systems for hydrometeorology, groundwater, water quality and sediment monitoring</li> <li>▪ Developing and installing a comprehensive basin-wide water information system to support integrated river basin management</li> <li>▪ Developing the Ruvuma River Basin database to provide data of important features of the basin. This database should be updated periodically in order to be able to monitor progress and define action plans in line with the development and changing needs</li> <li>▪ O&amp;M costs</li> <li>▪ Provide training</li> </ul> |
| <b>Duration:</b>                 | Establishment phase 5 years. Medium term= 2020-2025 to long term 2020-2030   |
| <b>Cost:</b>                     | <p>Expansion of surface water monitoring stations, 250,000 USD</p> <p>Expansion of Groundwater Monitoring System, 300,000 USD</p> <p>Office IT upgrading, 130,000 USD</p> <p>Other mobile field equipment 470,000 USD</p> <p>Technical Assistance 350,000 USD</p> <p>TOTAL: 1,500,000 USD</p>  |

## BASIN PLANNING

|                                  |   |
|----------------------------------|---|
| <b>SAP 4.2.4:</b>                | <b>Sub-basin plans</b>  |
| <b>Objective:</b>                | Sub-catchment plans should be prepared in conformity with the Ruvuma JIWRM Strategy taking into recognition optimal and sustainable water requirements of all sectors   |
| <b>Location</b>                  | Tanzania and Mozambique   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Undertake simple sub-basin water balance modelling</li> <li>▪ Identify key local potential and challenges</li> <li>▪ Prepare sub-basin plans with the active participation of the stakeholders</li> <li>▪ Integrate regional (Tanzania) and provincial (Mozambique ) planning documents</li> <li>▪ Integrate RBWO and ARA-Norte business plans and annual work plans.</li> <li>▪ Update the basin plans regularly in intervals of 5 years</li> </ul> |
| <b>Time frame:</b>               | 2015-2030   |
| <b>Cost:</b>                     | 300,000 USD   |

|                            |   |
|----------------------------|---|
| <b>SAP 4.2.5:</b>          | <b>Groundwater Management Strategy</b>  |
| <b>Objective:</b>          |   |
| <b>Location</b>            | Tanzania and Mozambique   |
| <b>Project components:</b> | <ul style="list-style-type: none"> <li>▪ Existing groundwater use to be assessed, all larger groundwater users to be registered</li> <li>▪ Borehole data collection procedures to be established at basin level and borehole data to be submitted to and maintained by MoW (MAJI) and DNA</li> <li>▪ Support to MoW (MAJI) and DNA to update and maintain respective National Groundwater Data Archives</li> <li>▪ Develop and implement a Groundwater Monitoring Strategy</li> <li>▪ Groundwater vulnerability study (including assessment of groundwater depended ecosystems)</li> <li>▪ Develop and implement a groundwater protection strategy</li> <li>▪ Conduct groundwater resource assessment to a level comparable to surface water at high potential areas, including groundwater surface water interaction</li> <li>▪ Develop a strategy to promote formal and prioritise conjunctive use of surface water/groundwater</li> <li>▪ Develop adequate institutional capacity to fulfil the mandatory groundwater management functions</li> <li>▪ Provision for strategic support to water service institutions in the development of plans for groundwater development, management and monitoring, as well as for the operation and maintenance of groundwater infrastructure. Roles and responsibilities to be clearly defined and streamlined</li> <li>▪ Promote groundwater management aspects to be incorporate as a natural component into all water plans</li> <li>▪ Develop a communication strategy to promote groundwater management aspects among water users and managers</li> </ul> |
| <b>Time frame:</b>         | 2015-2020. 2 years implementation and 2 years follow up activities  |
| <b>Cost:</b>               | 500,000 USD   |

## Component 4.3 Promotion of Stakeholder Participation and Cross-sectoral Coordination

The general aim of this component is to create the conditions for effective, responsible users participation at all stages of IWRM.

The idea of effective user participation in the processes of decision-making, implementation and assessment of the actions carried out is a core element in Integrated Water Resources Management.

The strategic objectives are:

- Institutionalised stakeholder participation
- Effective cooperation between government agencies with responsibilities for water management or water use in the basin

Key strategic measures are to:

- Accelerate the establishment of stakeholder participation institutions and operation i.e. to provide them with adequate resources and communication tools to perform their roles.
- Facilitate cross-sector planning through establishing necessary partnerships, processes and protocols.
- Increase awareness among the general public.

Like most of the institutional activities proposed, this component includes actions that would need support over a long period of time before these actions could be fully institutionalised/fully seen as permanent functions.

|                                  |  |
|----------------------------------|--|
| <b>SAP 4.3.1:</b>                | <b>Support to Ruvuma Basin Committee</b>   |
| <b>Objective:</b>                | Effective role of the Ruvuma Basin Committee   |
| <b>Location:</b>                 | Mozambique   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Training</li> <li>▪ Develop detailed functions and priorities</li> <li>▪ Technical support and effective communication tools (meetings, preparation of folders, outreach activities, workshops, radio campaigns, field inspections etc.)</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 3 years   |
| <b>Cost:</b>                     | 200,000 USD  |

|                                  |   |
|----------------------------------|---|
| <b>SAP 4.3.2:</b>                | <b>Support to Ruvuma Basin Water Board</b>  |
| <b>Objective:</b>                | Increase the capacities and the effectiveness of the Ruvuma Basin Water Board                                     |
| <b>Location:</b>                 | Tanzania  |
| <b>Description of action(s):</b> | Technical assistance (meetings, workshops, field inspections, outreach activities and information campaigns etc.) |
| <b>Time frame:</b>               | 2013-2020. 3 years  |
| <b>Cost:</b>                     | 100,000   |
| <b>Funding:</b>                  | WSDP  |

|                                  |   |
|----------------------------------|---|
| <b>SAP 4.3.3:</b>                | <b>Ruvuma Catchment Committee and Water Users Associations</b>  |
| <b>Objective:</b>                | Finalize the institutional set-ups for stakeholders participation in IRWMD in Tanzanian part of Ruvuma Basin  |
| <b>Location:</b>                 | Tanzania  |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Establish remaining stakeholder institutions</li> <li>▪ Training</li> <li>▪ Technical support and effective communication tools (meetings, preparation of folders, outreach activities, workshops, radio campaigns, field inspections etc.)</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 3 years  |
| <b>Cost:</b>                     | 200,000   |
| <b>Funding:</b>                  | WSDP  |

|                                  |   |
|----------------------------------|---|
| <b>SAP 4.3.4:</b>                | <b>Support to inter-ministerial coordination</b>  |
| <b>Objective:</b>                | Integrated and coordinated planning   |
| <b>Location:</b>                 | Tanzania and Mozambique   |
| <b>Description of action(s):</b> | <ul style="list-style-type: none"> <li>▪ Creation of inter-ministerial working groups</li> <li>▪ Elaboration of procedures for cooperation (identification of priority areas for cross-sectoral actions e.g. EIA, clarification of responsibilities, elaboration of procedures for exchange of data, )</li> <li>▪ Support coordinated planning and enforcement activities.</li> </ul> |
| <b>Time frame:</b>               | 2013-2020. 2 years.   |
| <b>Cost:</b>                     | 100,000 USD   |

|                                  |  |
|----------------------------------|--|
| <b>SAP 4.3.5:</b>                | <b>Ruvuma River Awareness Kit</b>  |
| <b>Objective:</b>                | The web-based River Awareness Kit would be established to support dissemination of information to various types of stakeholders including researcher, investors and NGOs. The website would present the key characteristics and main features of the Ruvuma River Basin Monograph with corresponding key documents. The River Awareness Kit would be a dynamic tool, convenient for providing information, and also for the participation from the general public. |
| <b>Location:</b>                 | Basin wide   |
| <b>Description of action(s):</b> | <p>The actions involved are:</p> <ul style="list-style-type: none"> <li>▪ The creation of a map tool summarizing all the knowledge on the river basin/s</li> <li>▪ The running of a website for rising awareness, information exchange and promotion of investment opportunities for the general public</li> </ul>   |
| <b>Time frame:</b>               | 2015-2020. Establishment phase: 1 year   |
| <b>Cost:</b>                     | 100,000 USD  |

|                                  |  |
|----------------------------------|--|
| <b>SAP 4.3.6</b>                 | <b>Community Basin Management Projects (Phase II)</b>  |
| <b>Objective:</b>                | <p>The main purposes of the CBMP interventions under the SWCSP fall within two categories.</p> <ol style="list-style-type: none"> <li>1. The enhancement of capacities of river basin organizations: <ul style="list-style-type: none"> <li>▪ River basin organizations promoting community-based IWRM.</li> <li>▪ Basin stakeholder institutions familiar with conducting community project appraisals.</li> <li>▪ Community projects being financed from earmarked CBMP funds.</li> <li>▪ District Offices providing on-going monitoring &amp; support to communities in O&amp;M and related extension services.</li> </ul> </li> <li>2. Construction of IWRM facilities for visibility and awareness creation: <ul style="list-style-type: none"> <li>▪ Improved knowledge, attitudes and practices in relation to local IWRM/basin management</li> <li>▪ Increased access to water supply services.</li> </ul> </li> </ol> |
| <b>Location</b>                  | Tanzania and Mozambique  |
| <b>Description of action(s):</b> | Build on lessons learnt during Phase I and prepare, plan and implement community driven basin management projects under the implementation framework developed during Phase I.   |
| <b>Time frame:</b>               | 2015-2025. 10 years  |
| <b>Cost:</b>                     | 10,000,000 USD (3 million every 3 years)   |





## ***Appendix 2: Monitoring and Evaluation Indicators***



# RUVUMA OBJECTIVES AND OUTCOME INDICATORS

Table 0-1: Specific Objectives and Outcome Indicators for Ruvuma River Basin Water Resources Management

## Ruvuma River Basin Objectives and Indicators

| OBJECTIVE   | INDICATOR  | RUVUMA BASE-LINE   | TARGET  |
|---|--|--|---|
| Optimal, sustainable and equitable water use including transboundary use  | <ul style="list-style-type: none"> <li>Proportion of total water resources used</li> <li>Water efficiency index for hydroelectricity, agriculture and livestock</li> <li>Balance of use between riparian states</li> </ul>   | <ul style="list-style-type: none"> <li>0.6% of MAR</li> <li>Lack of information but efficiency from the few irrigation schemes is estimated to be low.</li> <li>Moz to Tza ratio about 50%.</li> </ul>   | Water use allocation in accordance with Ruvuma River Basin Transboundary IWRM strategy (and future International Comprehensive Agreement on the Ruvuma River Basin) |
| Reduction of vulnerability of climate change and extreme events i.e. floods and droughts  | <ul style="list-style-type: none"> <li>Number of people and economic activities at risk (e.g. from flood inundation maps)</li> <li>Economic impact of flooding and drought (humans, environment and economic values)</li> <li>System for Early Warning (EWS) in place (yes/no)</li> <li>Storage and Regulating infrastructure in place (yes/no)</li> </ul> | <ul style="list-style-type: none"> <li>No of people at risk to be estimated by estimating number of people in the following flood prone areas: Lugenda is a flood prone area on Tza side, Kilambo, Mahurange and Mayembechini are flood prone areas on Moz side.</li> <li>No economic figures exist but type of impacts are i) farming areas get destroyed and ii) people get immobilised</li> <li>No but some steps have been taken</li> <li>No except 2 small dams for urban water supply</li> </ul> | EWS in place<br>Increased coverage of storage and regulating infrastructure in place  |
| Water storage satisfactory for social and economic development  | <ul style="list-style-type: none"> <li>Volume of storage capacity</li> </ul>   | <ul style="list-style-type: none"> <li>No storage capacity in the basin over 5000m<sup>3</sup></li> </ul>  | Development of water storage in accordance with future national basin plans   |
| Surface water quantity and quality satisfactory to sustain environmental (river) health (fish and plant life) and social and economic development and environmental health (drinking, irrigation, livestock, fish and plant life biodiversity and eco-services) | <ul style="list-style-type: none"> <li>% of time environmental flow requirements is maintained during dry spells.</li> <li>% of water bodies with improved environmental quality</li> </ul>  | <ul style="list-style-type: none"> <li>No data</li> <li>T, Oxygen, Iron- almost 100% within acceptable range</li> <li>Conductivity, TDS Turbidity, pH- locally not within acceptable range</li> </ul>  | 100%<br>100% of WQ samples fall within national WQ standards  |

Source: Adapted from "Development of IWRM key performance indicators for African Transboundary Basins management", International Network of Basin Organisation (INBO), draft 2010

Table 0-2: Related MDG Benchmarking Objectives and Indicators for Ruvuma River Basin

| Objective  | Indicator   | Ruvuma Base-line <sup>2</sup>   | Target (MDGs 2015)     | IWRM Contribution  |
|--|---|---|------------------------|--|
| <b>Goal 1: Eradicate extreme poverty and hunger</b>  |   |   |                        |  |
| Target 1.A: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day  | Proportion of population below \$1 (PPP) per day                                      | <ul style="list-style-type: none"> <li>Ruvuma region, Tza<sup>3</sup>: 41% (below 0.33 US\$)</li> <li>Mtwara region, Tza: 38% (below 0.33 US\$)</li> <li>Niassa Province, Moz: 70%</li> <li>CD Province, Moz: 57%</li> </ul>                          | Tza: 19%<br>Moz: 44%   | <p>Water as a factor of production in agriculture, industry and other types of economic activity</p> <p>Investments in water infrastructure and services act as a catalyst for local and regional development</p>  |
| Target 1.C: Halve, between 1990 and 2015, the proportion of people who suffer from hunger  | Prevalence of underweight children under-five years of age                            | <ul style="list-style-type: none"> <li>Tza: National 21.9 % (2005).</li> <li>Stunted children Ruvuma Tanzania 40% (Ruvuma, Mtwara, Lindi 2004)</li> <li>Prevalence of chronic malnutrition</li> <li>Niassa, Moz: 50%</li> <li>CD, Moz: 54%</li> </ul> | Tza: 14,4%<br>Moz: 17% | <p>Water as a direct input into irrigation, including supplementary irrigation, for expanded grain production</p> <p>Reliable water for subsistence agriculture, home gardens, livestock tree crops</p> <p>Sustainable production of fish, tree, crops and other foods gathered in common property resources</p> |
| <b>Goal 7: Ensure environmental sustainability</b>   |   |   |                        |  |
| Target 7.A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources | Proportion of land area covered by forest<br>Proportion of total water resources used | <ul style="list-style-type: none"> <li>16% Forest</li> <li>22% open woodland</li> <li>45% grass and shrubland</li> <li>0.6% of MAR</li> <li>28% Niassa Game Reserve</li> </ul>  | N/A                    | Improved water management including pollution control and sustainable levels of abstraction are key factors in maintaining ecosystem integrity   |
| Target 7.B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss  | Proportion of terrestrial and marine areas protected                                  |   |                        |  |

<sup>2</sup> Source: Annex 1: Socio-economic description of the Ruvuma, Annex 3: Environmental description of the Ruvuma basin

<sup>3</sup> Poverty and Human Development Report 2005

| Objective   | Indicator  | Ruvuma Base-line <sup>2</sup>  | Target (MDGs 2015)   | IWRM Contribution  |
|---|--|--|--|--|
| Target 7.C: Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation | Proportion of population using an improved drinking water source | <ul style="list-style-type: none"> <li>Tza: Ruvuma and Mtwara: 40-70% depending on District</li> <li>Moz: Niassa with 56% and Cabo Delgado with 70%</li> </ul> | Tanzania:<br>Rural: 65% by 2015<br>Urban: 90% by 2015<br><br>Mozambique:<br>Rural: 70% 2015<br>Urban: 70% 2015 | Actions to ensure access to adequate and safe water for poor and poorly serviced communities |
|   | Proportion of population using an improved sanitation facility   |  | Tanzania:<br>Rural: 95% by 2010<br>Urban: 30% by 2010<br><br>Mozambique:<br>Rural: 50% 2015<br>Urban: 80% 2015 |  |

# TRANSBOUNDARY IWRM PERFORMANCE INDICATORS

Table 0-3 : Transboundary IWRM Performance indicators.

| IWRM objective  | Outcome indicator  | Baseline Ruvuma   |
|---|--|---|
| <b>Institutional and Legal Enabling Framework Objectives and Indicators<sup>4</sup></b>   |  |   |
| An institutional and legal framework and agreed regulations for optimal, sustainable and equitable utilization of shared river basins is in place | <p>Comprehensive agreement developed for shared river basin based on joint basin studies and following the orientations of the SADC Protocol</p> <p>Information exchange mechanisms, compatibility of technologies and procedures for collection and management of information in place</p> <p>Joint shared river basin management institution/mechanism established and operational</p> <p>Harmonisation of national legislation in accordance with the terms in regional, bi-lateral or multi-lateral agreements signed and ratified by riparian states</p> <p>International agreements transposed to national law</p> <p>Mechanisms for joint development and implementation of joint initiatives</p> | <p>JWC agreement signed, ratified and transposed to national law in both countries committing the parties to the general principles of sustainable development and use, preventions of harm, equity and co-operation.</p> <p>Information management and exchange not in place</p> <p>Joint studies as basis for comprehensive agreement under implementation</p> <p>National processes for harmonisation of national laws are in progress</p> |
| <b>IWRM Performance Indicators Transboundary River Basin Organisations<sup>5</sup></b>  |  |   |
| Planning Process  |  |   |
| Clear planning processes  | There is a planning process with well-defined objectives, mutually beneficial goals and development priorities, all stated in a long-term integrated river basin management plan   | Ruvuma Basin Joint Integrated Water Resources Management Strategy under development   |
| Recognition of development constraints  | Development options in basin management plans recognize resource development constraints   | Development scenarios to be studied 2011  |
| Plan implementation and completion  | There is evidence that basin management plans are completed  | No plans developed as yet   |
| Coordinating Indicators   |  |   |
| International coordination of water management  | Basin management programmes use coordination mechanisms between riparian to maximise the opportunity to share benefits of water use  | To some extent  |

<sup>4</sup> Interpreted from the SADC Protocol and SADC Strategy

<sup>5</sup>Sources: "Development of IWRM performance indicators for African Transboundary Basins management", International Network of Basin Organisation (INBO)

| <b>IWRM objective</b>                        | <b>Outcome indicator</b>   | <b>Baseline Ruvuma</b>   |
|--|--|--|
| Existence of overarching reporting mechanism | An overarching body coordinates actions and reports to each riparian's high-level administrators   | JWC Secretariat in place   |
| Consensus-based decision-making              | Water sharing uses a consensus approach to broker agreements on a basin basis  | N/A as yet   |
| Transparent monitoring                       | Each riparian's water sharing procedures use transparent monitoring mechanisms to account for activities   | No adequate monitoring in place  |
| Coordination with local action               | Transboundary basin management plans coordinate with the actions of small-scale local water institutions in each riparian e.g. local water management plans  | Transboundary IWRM Strategy for the Ruvuma will consider provincial development plans.   |
| A range of coordination tools are used       | Dialogues, memoranda of understanding, or joint programs of action are used to manage water between countries  | Joint programmes, JWC meeting twice a year   |
| Business plan uses coordination mechanisms   | The river basin organization uses business plans which specify coordination mechanisms between riparian countries  | No   |
| Funding indicators                           |  |  |
| On-going funding for basin management        | Financing for river basin management exists and is on-going despite changes in the administration of each riparian   | To some extent   |
| Sufficient funding for basin management      | Funding for river basin management is adequate to address at least priority natural resources management issues  | Funding is a major constrain in general and for the Ruvuma basin in particular. One reason is the low level of water user payments to cover operational costs. |
| Investment guidelines                        | Funding for river basin management operates within international investment guidelines which prescribe outcomes in transparency, accountability, benefit shares & sustainability (poverty reduction, economic development & environmental flows) | To some extent. Investments must undergo EIA   |
| Investment accountability                    | There are explicit procedures in place which ensure transparent reporting of the results of investing in basin management programs   | National reporting procedures in place   |
| Donor coordination                           | Coordination between donor organizations exists to ensure programs and projects are linked, do not duplicate action and address common goals   | Yes (WSDP and SWCSP)   |

## PERFORMANCE INDICATORS FOR THE BASIN WATER AUTHORITIES<sup>6</sup>

Table 0-4 : Performance Indicators for the ARA-Norte in Mozambique.

| Function   | Water Management Objectives   | Progress indicator   | Unit/ definition  | BASE LINE   | COMMENT  |
|--|---|--|---|---|--|
| <b>WATER ALLOCATION</b><br>Allocating water to major water users and uses, maintaining minimum levels for social and environmental use while addressing equity and development needs of society.   | Major water users are known and are managed through a licensing (or permit) system.                 | Number of surface and groundwater users licensed according to the regulations.       | Number.<br>Number of licenses issued. May be further subdivided by use.   | 7 are licensed (5 in Ruvuma basin for surface water)<br>(2 in Cabo Delgado and 5 in Niassa) | 35 registered water users ( 27 in Cabo Delgado and 8 in Niassa)<br>10 registered in Ruvuma basin |
|  | Water allocation is in line with sustainable use, economic efficiency and social equity principles. | Water allocation criteria include use efficiency, economic benefit and social goals. | Review.<br>Examine allocation criteria for compliance with IWRM principles.   | No<br>EFR is a criteria but in practical it is not evaluated as yet                         | Water licence is so far given without criteria   |
|  |   | % of time environmental and social reserve is maintained in major water courses.     | %.<br>Number of records from water resource monitoring stations with flows lower than the reserve divided by the total records x 100. A determination of the reserve is required. | No records  |  |
| <b>POLLUTION CONTROL</b><br>Managing pollution using polluter pays principles and appropriate incentives to reduce most important pollution problems and minimise environmental and social impact. | The extent of the pollution problem is known and progress being measured.                           | % of surface water quality samples complying with water quality objectives.          | %.<br>Number of samples below set standard. Simplest approach is to base the determination on measurements of a few key water quality parameters.                                 | No monitoring is undertaken   |  |
|  |   | % of ground water quality samples complying with water quality objectives.           | %.<br>Number of samples below set standard. Simplest approach is to base the determination on   | No monitoring is undertaken   |  |

<sup>6</sup> UNDP/CAP-NET



| Function  | Water Management Objectives   | Progress indicator  | Unit/ definition   | BASE LINE                                  | COMMENT   |
|---|---|---|--|--|---|
|   | Major polluters are known and are managed through a licensing (or permit) system.   | Number of polluters licensed according to the regulations.  | measurements of a few key water quality parameters.<br>Number.<br>Number of licenses issued.   | No data<br>No licences issued              | Known areas with visible bad WQ are Lupilichi Village in Sanga district in Niassa<br><br>Suspect other areas e.g. Lichinga downstream where they use poisonous plant for fishing. |
| <b>BASIN PLANNING</b><br>Prepare and regularly update the Basin Plan incorporating stakeholder views on development and management priorities for the basin, and using it to inform the annual work plans of the RBO. | Basin planning synthesises technical and social priorities for the basin and acts as a basis for action and accountability to the stakeholders.                     | Water management activities driven by Basin plan.<br><br>Stakeholder priorities reflected in the basin plan.  | Review.<br>Examine the link between the basin plan and current water management activities.<br><br>Review.<br>Examine the basin plan for stakeholder consultation and content.   | No basin plan<br><br>N/A                   | A transboundary IWRM strategy will be developed during 2012. Development of basin management plans are called for in Water Policy   |
| <b>MONITORING</b><br>Implement effective monitoring systems that provide essential management information and identify and respond to infringements of laws, regulations and permits.                                 | The water allocation system is effective and permits are being complied with.<br><br>The Pollution control system is effective and permits are being complied with. | Proportion of water allocation permit holders complying with permit conditions.<br><br>Proportion of water pollution permit holders complying with permit conditions. | %.<br>From monitoring visits the number not complying with conditions divided by the total number of visits.<br><br>%.<br>From monitoring visits the number not complying with conditions divided by the total number of visits. | No data<br><br>No pollution permit holders |   |

| Function  | Water Management Objectives   | Progress indicator   | Unit/ definition  | BASE LINE  | COMMENT   |
|---|---|--|---|--|---|
|   | Knowledge of water resource availability is a basis for management.               | Number of water resource monitoring stations producing reliable data.          | Number.<br>Number of stations with reliable data records.<br>Minimum required network   | No ground water monitoring stations<br><br>36 Rainfall stations. 5 are in operation.   | Data reported to DNA on monthly basis. DNA process and analyse and package.<br><br>Rainfall SADC HYCOS only on Tza side but ARA Norte can download.   |
|   |   |  |   | 14 hydrometric/runoff stations (4 giving fairly reliable river runoff data)            | In 1975 92 hydrometric stations and 123 rainfall stations. Major upgrading of monitoring network is required to comply with WMO's recommendations for "minimum required network"  |
|   |   | Total water storage capacity.  | M <sup>3</sup> .<br>The water storage capacity in artificial storage structures above a minimum size (5,000 M <sup>3</sup> ). | Two dams exists<br>Locumuè dam (capacity 2800M <sup>3</sup> /d) and Chilucuto dam      |   |
|   |   | % groundwater monitoring stations with declining water levels.                 | %.<br>Comparison of water levels over a 5 year period.  | No monitoring wells<br>No data<br>No area identified for placement of monitoring wells | Provincial directorate of housing and work have the borehole data base<br>Number of borehole by district  |
| <b>ECONOMIC AND FINANCIAL MANAGEMENT</b><br>Applying economic and financial tools for cost recovery and behaviour change to support the goals of equitable access and sustainable benefits to society from water use. | Water use efficiency improving through use of economic and financial instruments. | Charges and fees for water allocation favour the poor and efficient water use. | Review.<br>Examine for the application of economic and financial tools in water allocation.                                   | Yes, to some extent  | Regarding the water use and exploitation, the waters are classified into waters of common use and waters of private use. Waters of common use are those consumed by a family, for domestic purposes, cattle and small scale irrigation, with no use of mechanisation. Waters of common use are free – they do not require any licence or concession nor is any payment of tariffs involved. |

| Function   | Water Management Objectives   | Progress indicator   | Unit/ definition  | BASE LINE  | COMMENT   |
|--|---|--|---|--|---|
|  |   | % revenue received.  | %.<br>Total revenue divided by the total amount billed.   | 19 %   |   |
|  | Pollution reducing through use of economic and financial instruments.   | Pollution charges give incentive to reduce pollution.  | Review.<br>Examine for the application of economic and financial tools in water pollution.          | No pollution permits have been issued  | Although the water law and the statutes give the power to ARA Norte to issue licences for effluent discharge and to revoke licences, pollution control is regarded to be the responsibility of the Ministry of Environmental Coordination. Unclear roles and responsibilities |
|  |   | % revenue received.  | %.<br>Total revenue divided by the total amount billed.   | N/A  |   |
| <b>INFORMATION MANAGEMENT</b><br>Provide essential data necessary to make informed and transparent decisions for development and sustainable management of water resources in the basin. | Essential information is processed and packaged at the right level for specific managers and stakeholders to support transparent decision making and to gain commitment and political support for the decisions made. | Data base is established in formats compatible with other river basin organisations.                           | Review.<br>Data base is transferable across basins in the country and for transboundary systems.    | No   | Backup of data. No back up. Not for hydrological data. None for water users' registry etc. virus etc.<br>Office package<br>GIS<br>8 computers<br><br>5 HQ, 2 Lichinga, 1 in Monte<br>HQ has internet, 2 modems. No internet in sub-offices.                                   |
|  |   | Water management information is available to managers and other stakeholders as required.                      | Review.<br>Examine availability of basin data and reports on water resources management indicators. | Data and records are available but fragmented  | A single data base for all data is planned under the SWCSP  |
| <b>STAKEHOLDER PARTICIPATION</b><br>Implement stakeholder participation as a basis for decision making that takes  | Effective cooperation between government agencies with responsibilities for water management or water use in the basin.   | Number of meetings of Government agencies with water interests to consult and collaborate on water management. | Number.<br>Number of formal or ad hoc meetings at interagency level.                                | Supposed to meet twice a year<br>Not yet a meeting this year<br>Last meeting with RBC 2009 march | Ruvuma Basin Committee established with representation of relevant Ministries but with no decision making power.  |

| Function   | Water Management Objectives  | Progress indicator   | Unit/ definition  | BASE LINE                                      | COMMENT  |
|--|--|--|---|--|----------|
| into account the best interests of society and the environment in the development and use of water resources in the basin. | Stakeholder participation is institutionalised in the management of the river basin. | Formal stakeholder structures established with clear roles and responsibilities in water resources management. | Review.<br>Examine basin water management structure for stakeholder organisations and allocated management roles. | Yes the RBC has internal regulations           | As above |
|  |  | Basin stakeholders (male and female) represented in decision making bodies at all levels.                      | Number.<br>Representatives from stakeholders serving in government water management structures.                   | No specific quota<br>Less than 50% in practice |          |
|  |  |  |   |  |          |

Table 0-5 : Additional suggested indicators.

| Function   | SUGGESTED WMO   | SUGGESTED PROGRESS INDICATOR   | SUGGESTED UNIT   | VALUE   | COMMENT   |
|--|---|--|--|---|---|
| <b>FLOOD AND DROUGHT MANAGEMENT</b><br>Operating floods and droughts to mitigate and minimise harm to humans, environment and economic values. | Knowledge of inundation areas for different flood magnitudes  | Length of river analysed for flood inundation (flood frequency, hydraulic studies and topographical surveys)                           | Number<br>Kilometres analysed river  | None  | Needed in Flood prone areas<br>Lugenda is a flood prone area in the Ruvuma<br>Farming areas get destroyed<br>People get immobilised |
|  | Functioning flood warning system  | Number of forecasts or warnings issued for floods  | Number<br>Sent bulletins to stakeholders per year  | None  | Needed in Flood prone areas   |
|  |   | Number of forecasts or warnings issued for low flows   | Number<br>Sent bulletins to stakeholders per year  | None  |   |
|  | Functioning drought warning system  |  |  |   |   |
| <b>WATER INFRASTRUCTURE DEVELOPMENT</b><br>Design, construction and maintenance of works   | Increase storage volume and regulatory functions of the river   | Number of Project Feasibility studies  | Review of evidence   | None  | Detailed plan exist for one dam in Lichinga under the SWCP  |
|  |   | Funds raised   |  |   |   |
|  |   | Number of Projects implemented   |  |   |   |
|  |   | Operation and maintenance  |  |   |   |
| <b>GENDER MAINSTREAMING</b><br>Women involvement in decision making and water management   | Women shall be fully involved in the development and implementation of policies, processes and management of development programs at all levels | % participation of women in water affairs at all levels<br>% of involvement of women in the provision of water and sanitation services | % of professional staff and technicians that are women<br>% of women representation in stakeholder organisations | 5 women out of 30 staff members<br>2 in technical department<br><br>No updated data of % women in the RBC |   |

|  |  |   |           |                         |
|--|--|---|-----------|-------------------------|
| <b>HIV/AIDS<br/>MAINSTREAMING</b>                        | HIV/AIDS policy in place and implemented   | Policy in place   | Yes or No |                         |
| National policies on HIV/AIDS response institutionalised | Staff trained and familiar of HIV/AIDS policies , rights and obligation as well as access to prevention and counselling procedures | % of staff trained<br><br>% of staff with access to prevention and counselling procedures as provided for in policy | %         | No information obtained |

Table 0-6 : Performance Indicators for the Ruvuma and Southern Coast Basin Water Office (RBWO) in Tanzania.

| Function   | Water Management Objectives   | Progress indicator   | Unit/ definition   | BASE LINE  | COMMENT   |
|--|---|--|--|--|---|
| <b>WATER ALLOCATION</b>  |   |  |  |  |   |
| Allocating water to major water users and uses, maintaining minimum levels for social and environmental use while addressing equity and development needs of society.  | Major water users are known and are managed through a licensing (or permit) system.                 | Number of surface and groundwater users licensed according to the regulations.       | Number.<br>Number of licenses issued. May be further subdivided by use.  | Ruvuma basin:<br>31 water use licences in accordance to the old Act.<br>12 for spring/stream<br>19 for spring/gr.w | 25 applications in licensing process in accordance with the new Act.  |
|  | Water allocation is in line with sustainable use, economic efficiency and social equity principles. | Water allocation criteria include use efficiency, economic benefit and social goals. | Review.<br>Examine allocation criteria for compliance with IWRM principles.  | Not at the moment. Old regulation still in operation.  | On-going process to review criteria/regulation. Environmental flow will be one criteria according to new Act  |
|  |   | % of time environmental and social reserve is maintained in major water courses.     | %.<br>Number of records from water resource monitoring stations with flows lower than the reserve divided by the total records x 100.<br>A determination of the reserve is required. | No data<br>/monitoring in place.   | Very little abstractions and hence no major problem with environmental and social reserve. However, there are problems with low flow in some tributaries. |
| <b>POLLUTION CONTROL</b>   |   |  |  |  |   |
| Managing pollution using polluter pays principles and appropriate incentives to reduce most important pollution problems and minimise environmental and social impact. | The extent of the pollution problem is known and progress being measured.                           | % of surface water quality samples complying with water quality objectives.          | %.<br>Number of samples below set standard. Simplest approach is to base the determination on measurements of a few key water quality parameters.                                    | 80% of water quality samples conform with standards  | A monitoring plan has been developed with monitoring points at areas which potential polluting activities   |
|  |   | % of ground water quality samples complying with water quality objectives.           | %.<br>Number of samples below set standard. Simplest approach is to base the determination on measurements of a few key water  | 100% but high EC at some places  |   |

| Function   | Water Management Objectives   | Progress indicator  | Unit/ definition   | BASE LINE  | COMMENT  |
|--|---|---|--|--|--|
|  | Major polluters are known and are managed through a licensing (or permit) system.   | Number of polluters licensed according to the regulations.                      | quality parameters.<br><br>Number.<br>Number of licenses issued.   | Major polluters have not been registered.<br><br>No discharged licenses have been issued |  |
| BASIN PLANNING   |   |   |  |  |  |
| Prepare and regularly update the Basin Plan incorporating stakeholder views on development and management priorities for the basin, and using it to inform the annual work plans of the RBO. | Basin planning synthesises technical and social priorities for the basin and acts as a basis for action and accountability to the stakeholders. | Water management activities driven by Basin plan.                               | Review.<br>Examine the link between the basin plan and current water management activities.                  | Activities in line with 5-year plan  | A transboundary IWRM strategy will be developed during 2012. Basin management plan shall be developed for the Ruvuma basin under the WSDP. |
|  |   | Stakeholder priorities reflected in the basin plan.                             | Review.<br>Examine the basin plan for stakeholder consultation and content.                                  | N/A<br>No basin plan as yet  |  |
| MONITORING   |   |   |  |  |  |
| Implement effective monitoring systems that provide essential management information and identify and respond to infringements of laws, regulations and permits.                             | The water allocation system is effective and permits are being complied with.   | Proportion of water allocation permit holders complying with permit conditions. | %.<br>From monitoring visits the number not complying with conditions divided by the total number of visits. | No data  | No compliance monitoring is undertaken   |
|  | The Pollution control system is effective and permits are being complied with.  | Proportion of water pollution permit holders complying with permit conditions.  | %.<br>From monitoring visits the number not complying with conditions divided by the total number of visits. | N/A<br>No licenses as yet  |  |
|  |   | Knowledge of water resource availability is a basis for management.             | Number of water resource monitoring stations producing   | Number.<br>Number of stations with reliable  | No ground water monitoring stations  |



| Function  | Water Management Objectives   | Progress indicator   | Unit/ definition  | BASE LINE   | COMMENT  |
|---|---|--|---|---|--|
|   |   | reliable data.   | data records.<br>Minimum required network   | 42 Rainfall stations. (13 producing fairly reliable data)<br><br>8 hydrometric/runoff stations (6 giving continuous river flow data)<br><br>Little information on rating curves | undertaken 2011<br><br>In July 2010 – 2 hydrometric stations were reconstructed within the Ruvuma basin.<br><br>SADC HYCOS – 2 automatic Hydrometric stations were taken in operation and one station is producing data from 10th of august 2010.<br><br>Major upgrading of monitoring network is required to comply with WMO's recommendations for "minimum required network" |
|   |   | Total water storage capacity.  | M <sup>3</sup> .<br>The water storage capacity in artificial storage structures above a minimum size (say 5,000 M <sup>3</sup> ). | No water storage above the minimum size in the basin  | 3 smaller charcoal dams located in Nanyamba and Tandahimba   |
|   |   | % groundwater monitoring stations with declining water levels.                 | %.<br>Comparison of water levels over a 5 year period.  | No ground water monitoring stations   |  |
| <b>ECONOMIC AND FINANCIAL MANAGEMENT</b>  |   |  |   |   |  |
| Applying economic and financial tools for cost recovery and behaviour change to support | Water use efficiency improving through use of economic and financial instruments. | Charges and fees for water allocation favour the poor and efficient water use. | Review.<br>Examine for the application of economic and financial tools in water allocation.                                       | Yes to some extent. Water abstraction below 22 100 litres is free of charge   |  |

| Function  | Water Management Objectives   | Progress indicator   | Unit/ definition  | BASE LINE                                     | COMMENT                                    |
|---|---|--|---|---|--|
| the goals of equitable access and sustainable benefits to society from water use.   | Pollution reducing through use of economic and financial instruments.   | % revenue received.  | %.<br>Total revenue divided by the total amount billed.   | 46.5 %  | Large water users not paying               |
|   |   | Pollution charges give incentive to reduce pollution.  | Review.<br>Examine for the application of economic and financial tools in water pollution.          | Not introduced in practice                    |  |
|   |   | % revenue received.  | %.<br>Total revenue divided by the total amount billed.   | N/A   |  |
| INFORMATION MANAGEMENT  |   |  |   |   |  |
| Provide essential data necessary to make informed and transparent decisions for development and sustainable management of water resources in the basin. | Essential information is processed and packaged at the right level for managers and stakeholders to support transparent decision making and to gain political support for the decisions made. | Data base is established in formats compatible with other river basin organisations.                           | Review.<br>Data base is transferable across basins in the country and for transboundary systems.    | No  | A single data base for all data is planned |
|   |   | Water management information is available to managers and other stakeholders as required.                      | Review.<br>Examine availability of basin data and reports on water resources management indicators. | Data and records are available but fragmented |  |
| STAKEHOLDER PARTICIPATION   |   |  |   |   |  |
| Implement stakeholder participation as a basis for decision making that takes into account the  | Effective cooperation between government agencies with responsibilities for water management or water use in the basin.   | Number of meetings of Government agencies with water interests to consult and collaborate on water management. | Number.<br>Number of formal or ad hoc meetings at interagency level.                                | BWB to meet twice a year                      |  |

| Function  | Water Management Objectives  | Progress indicator   | Unit/ definition  | BASE LINE  | COMMENT  |
|---|--|--|---|--|--|
| best interests of society and the environment in the development and use of water resources in the basin. | Stakeholder participation is institutionalised in the management of the river basin. | <p>Formal stakeholder structures established with clear roles and responsibilities in water resources management.</p> <p>Basin stakeholders (male and female) represented in decision making bodies at all levels.</p> | <p>Review.<br/>Examine basin water management structure for stakeholder organisations and allocated management roles.</p> <p>Number.<br/>Representatives from stakeholders serving in government water management structures.</p> | <p>Stakeholder institutions are under establishment</p> <p>WRM Act of 2009:<br/>BWB 10 members.<br/>At least 3 women.</p> <p>WUAs 60% women.</p> | 3 WUAs (2 in the Ruvuma basin) have been established |

Table 0-7 : Additional suggested indicators.

| Function   | SUGGESTED  | SUGGESTED PROGRESS INDICATOR   | SUGGESTED UNIT   | VALUE  | COMMENT   |
|--|--|--|--|--|---|
| <b>FLOOD AND DROUGHT MANAGEMENT</b><br>Operating floods and droughts to mitigate and minimise harm to humans, environment and economic values. | Knowledge of inundation areas for different flood magnitudes   | Length of river analysed for flood inundation (flood frequency, hydraulic studies and topographical surveys)                           | Number<br>Kilometres analysed river  | None   | There is a need for the following rivers, Kilambo, Mahurange and Mayembechini |
|  | Functioning flood warning system   | Number of forecasts or warnings issued for floods  | Number<br>Sent bulletins to stakeholders per year  | None   | As above  |
|  | Functioning drought warning system   | Number of forecasts or warnings issued for low flows   | Number<br>Sent bulletins to stakeholders per year  | None   | As above  |
| <b>WATER INFRASTRUCTURE DEVELOPMENT</b><br>Design, construction and maintenance of works   | Increase storage volume and regulatory functions of the river  | Number of Project Feasibility studies<br>Funds raised<br>Number of Projects implemented<br>Operation and maintenance                   | Review of evidence   | None   |   |
| <b>GENDER MAINSTREAMING</b><br>Women involvement in decision making and water management   | Women shall be fully involved in the development and implementation of policies, processes and management of development programs at all levels                                | % participation of women in water affairs at all levels<br>% of involvement of women in the provision of water and sanitation services | % of professional staff and technicians that are women<br>% of women representation in stakeholder organisations | 5% of the professional staff<br>60% of women representation in stakeholder organisations to be established |   |
| <b>HIV/AIDS MAINSTREAMING</b><br>National policies on HIV/AIDS response institutionalised  | HIV/AIDS policy in place and implemented<br>Staff trained and familiar of HIV/AIDS policies , rights and obligation as well as access to prevention and counselling procedures | Policy in place<br>% of staff trained<br>% of staff with access to prevention and counselling procedures as provided for in policy     | Yes or No<br>%   | No policy on HIV/AIDS prepared by the RBWO.<br><br>1 staff trained   |   |