



Strategic Action Plan for the Shire River-Aquifer System



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Executive summary

Rationale for Shire River Basin SAP: Strategic Action Plans (SAPs) in transboundary watercourses are widely used tools to help countries converge toward a shared vision and set of joint actions that enhance benefits and reduce risks of water development and management. The vast majority of transboundary SAPs have been developed for surface water bodies, and only seven transboundary aquifer SAPs are known to exist. The Shire River-Aquifer System, a shared watercourse between Mozambique and Malawi, includes the Shire River Basin and multiple shared aquifers. Steps toward joint planning and management of the water resources have been minimal to date. The joint SAP for the Shire River Basin is the first on this shared water body. It is also believed to be the first SAP to explicitly focus on both surface water and groundwater using the principle of conjunctive water management – an emerging term used to describe a water management approach that actively considers and leverages the natural hydrological connection between surface water and groundwater.

Overview and aims: The Strategic Action Plan (SAP) for the Shire River Basin-Aquifer System (Shire System) is a negotiated policy document for transboundary water management between the Republic of Malawi and the Republic of Mozambique. The aim of the SAP is to initiate and guide joint development and management of the Shire River Basin and the associated critical shared groundwater aquifers according to agreed upon priorities and actions. The SAP development process was implemented by the International Water Management Institute (IWMI), with support from the University of Strathclyde (Scotland) and Chancellor College (Malawi). The project was supported by the Southern Africa Development Community - Groundwater Management Institute (SADC-GMI) under the *Conjunctive Water Resources Management Research Project in the Shire River Basin* (Shire ConWat) project. The Conjunctive Water Resources Management Research Project in the Shire River Basin

Shire River Basin Transboundary Diagnostic Analysis: The Shire River Basin Transboundary Diagnostic Analysis (TDA) is a baseline study that was conducted in 2018. The study required collection and analysis of various forms of data to investigate the current context in the Shire System and to highlight key transboundary issues. These key issues provide a strong foundation for development of the SAP. The issues identified in the TDA include the following: 1) impacts of climate variability and change, 2) degradation of the catchment and water quality, 3) lack of data to understand the system, 4) potential for harnessing additional benefits to reach the potential of the system, and 5) demands for enhanced institutional coordination.

SAP Methods: The SAP was developed through a series of joint stakeholder workshops and national consultation meetings in partnership with various institutions including ARA-Zambeze and the National Directorate of Water Resources Management in Mozambique and the Department of Water Resources in the Ministry of Agriculture Irrigation and Water Development (MoAIWD) and the Shire River Basin Management Program (SRBMP) in Malawi. The framework for SAP development moved through three stages, namely; 1) assessing the system, 2) envisioning the future, and 3) planning for a shared future. Figure i depicts the 3 stages of the SAP, drawing from previous experiences in SAP development and principles of conjunctive water management and participatory approaches.

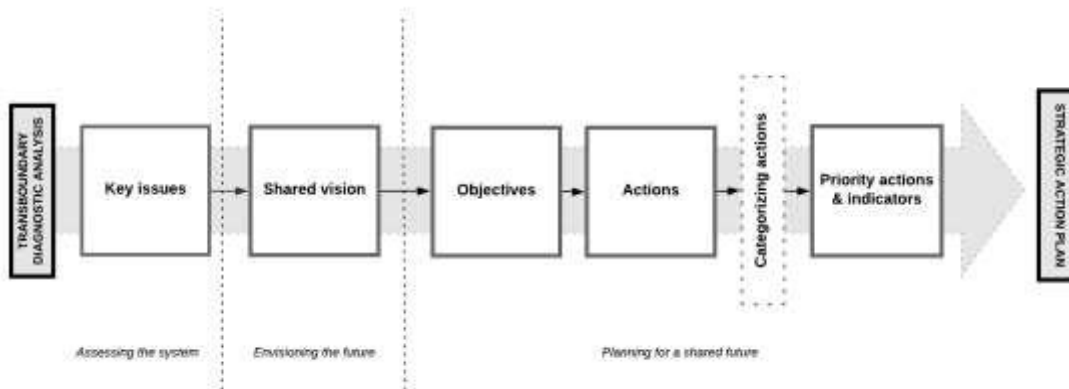


Figure i: Conceptual framework for the Shire SAP

Shared vision: The shared vision for the Shire System is as follows:

Enhanced cooperation in the development, management and utilisation of both surface water and groundwater in the Shire River Basin, conducted in a sustainable and integrated manner for improved livelihoods and socio-economic prosperity.

Objectives The SAP's four objectives are as follows:

Objective 1: To strengthen national and transboundary institutional cooperation to improve management for sustainable development and management of the basin and its shared aquifers.

Objective 2: To improve the quality and quantity of data for improved conjunctive water development and management decision making by instituting a joint monitoring system for data collection, sharing and standardization.

Objective 3: To reduce the adverse impacts of climate variability and change (i.e. floods and droughts) through joint conjunctive management of surface water and groundwater, including the use of natural infrastructure (e.g., aquifers and wetlands) and implementation of early warning systems.

Objective 4: To promote catchment management (e.g., reducing overexploitation, revitalizing natural vegetation) in order to enhance water quality, stream flow and groundwater retention/recharge.

Actions A set of actions were determined under each of the four objectives. This resulted in a final list of 39 actions, some of which are contained in Table i.

Table i: Selected actions from the Shire River Basin SAP

Objective.	Selected actions
1	<ul style="list-style-type: none"> Establish a joint Shire River Basin Committee for coordination and cooperation in conjunctive water management over the Shire River Basin and its shared aquifers. Make comparative analysis of relevant laws, policies and regulations for joint water resources management to develop recommendations for possible harmonization. Analyze investment plans in respective countries that apply to the Shire River Basin and its shared aquifers to promote joint investments (joint project implementation).
2	<ul style="list-style-type: none"> Develop a Memorandum of Understanding (MoU) on data sharing between the two Member States, taking into account the existing ZAMCOM protocol on data sharing. Conduct spatial mapping exercise on linkages between sanitation issues and groundwater and surface water pollution in order to develop a subsequent action plan to be addressed.

	<ul style="list-style-type: none"> • Develop a data sharing portal between Malawi and Mozambique that facilitates a joint information management system in consultation with Zambezi Water Resources Information System (ZAMWIS) developed under ZAMCOM.
3	<ul style="list-style-type: none"> • Integrate issues of climate variability and change into the decision-making responsibilities of the Shire River Basin Committee. • Conduct research to map flood and drought prone areas in light of climate change. • Construct water harvesting structures or dams for multipurpose use (hydro-power, irrigation, flood control).
4	<ul style="list-style-type: none"> • Develop a joint catchment management plan and guidelines for the Shire River Basin. • Capacitate village-level natural resource management through Catchment Management Committees by forming proper structures and trainings in Integrated Catchment Management. • Promote development of sustainable infrastructure in the basin to address effective management challenges in agriculture, water storage, wastewater, solid waste, afforestation and forest fires, and energy by adopting both grey and green solutions.

Categorizing actions to enable project development: Actions were contextualized within 3 categories related to project development. First, the degree of transboundary cooperation required was considered, defined by i) joint planning and execution, ii) sharing of information only, and iii) no cooperation. Second, the implementation time frame was considered, defined by i) short term (less than 2 years), ii) medium term (2 to 5 years), and iii) long term (more than 5 years and/or ongoing). Finally, the estimated budget was considered, defined by i) low budget (less than 50 000 USD), ii) medium budget (50 000 to 250 000 USD), and iii) high budget (more than 250 000 USD). These categories were utilized to enable advancement of actions toward implementation.

Uncertainty and risk categories: To gauge the relative urgency for implementation of different actions, actions were categorized according to uncertainty and risk. Future risks included 1) degree of climate risk, 2) rate of population growth, and 3) rate of economic growth. The resulting categorization of actions will aid stakeholders implementing the SAP as they prioritize actions as future trends emerge.

Indicators: While the time frame of the Shire SAP did not allow for consultation on indicators, a tentative list of potential indicators for each objective is offered should countries wish to measure progress toward SAP implementation.

Priority actions: Six priority actions were identified and elaborated further. These actions include:

Action 1.1.1: Establish a joint Shire River Basin Committee for coordination and cooperation in conjunctive water development and management over the Shire River Basin and its shared aquifers.

Action 1.2.2: Identify areas for joint study and research.

Action 2.1.1: Develop a Memorandum of Understanding on data sharing between the two Member States, taking into account the existing ZAMCOM protocol on data sharing.

Action 2.3.2: Develop a data sharing portal between Malawi and Mozambique that facilitates a joint information system in consultation with Zambezi Water Resources Information System (ZAMWIS) developed under ZAMCOM.

Action 4.1.6: Promote joint proposals to mobilise funds for specific projects within the Shire River Basin for activities related to sustainable catchment and natural resources management.

Action 4.2.2: Train personnel involved in data collection and research related to surface water and ground water and water quality issues.

Contextualizing actions in transboundary water governance of the Shire System: Management of the Shire System lies within the jurisdiction of the Member States of Malawi and Mozambique, but the shared watercourse also falls under several other international agreements and action plans that affect the

governing principles, shared protocols and planned measures in the Shire System. These include those at the international level (e.g., United Nations Convention on the Law of the Non-navigational Uses of International Watercourses), the Southern African Development Community (SADC) level (e.g., the Revised Protocol on Shared Watercourses), and the Zambezi Watercourse Commission (ZAMCOM) level (e.g., ZAMCOM Procedures for Notification of Planned Measures).

Conclusion: The SAP is the first step of many in joint conjunctive management of the surface water and groundwater in the Shire River Basin and its shared aquifers. Completion of the SAP process should trigger the start of a larger effort to implement joint actions in the Shire System. Moving forward, focus can be equally placed on i) institutionalizing the SAP through a committee under ZAMCOM, and ii) implementing actions as soon as possible, taking advantage of information about low-cost, short-term actions and those that are most urgent. The most critical element of joint management of the Shire System is the will and capacity of actors to implement activities and create tangible change on the ground. Efforts should be made by government and external stakeholders in Malawi and Mozambique to implement identified activities as soon as possible, particularly those that may be more easily implementable with or without donor support.

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Abbreviations and Acronyms

DCCMS	<i>Department of Climate Change and Meteorological Services</i>
DIKTAS	<i>Dinaric Karst Aquifer System</i>
DNGRH	<i>National Directorate of Water Resources Management</i>
EcoQOs	<i>Ecosystem Quality Objectives</i>
EGENCO	<i>Electricity Generation Company Malawi Limited</i>
GDP	<i>Gross Domestic Product</i>
GEF	<i>Global Environment Facility</i>
GEF: IW LEARN	<i>Global Environment Facility International Waters Learning Exchange and Resource Network</i>
IAEA	<i>International Atomic Energy Agency</i>
IPCC	<i>International Panel on Climate Change</i>
IWMI	<i>International Water Management Institute</i>
IWRM	<i>Integrated Water Resource Management</i>
MoAIWD	<i>Ministry of Agriculture, Irrigation and Water Development</i>
M&E	<i>Monitoring and Evaluation</i>
OKACOM	<i>Permanent Okavango River Basin Commission</i>
ORASECOM	<i>Orange-Senqu River Basin Commission</i>
PES	<i>Payment for Ecosystem Services</i>
SADC	<i>Southern African Development Community</i>
SADC-GMI	<i>Southern African Development Community-Groundwater Management Institute</i>
SAP	<i>Strategic Action Plan</i>
SDGs	<i>Sustainable Development Goals</i>
Shire ConWat	<i>Conjunctive Transboundary Water Resources Management in the Shire River Basin</i>
TDA	<i>Transboundary Diagnostic Analysis</i>
UN	<i>United Nations</i>
UNDP	<i>United Nations Development Program</i>
UNESCO	<i>United Nations Environmental, Scientific and Cultural Organization</i>
USD	<i>United States Dollar</i>
WROs	<i>Water Resource Objectives</i>
ZAMCOM	<i>Zambezi Watercourse Commission</i>
ZAMWIS	<i>Zambezi Watercourse Information System</i>

1.0 Introduction

Joint planning is a powerful vehicle for sustainable development on shared waters. Cooperative development and management of shared waters is widely recognized for its role in increasing resilience and enhancing water security (Sadoff et al., 2015). Calls for cooperation on transboundary waters exist both internationally (e.g., UN, 1997) and regionally (SADC, 2000). Further, the importance of transboundary water cooperation is reflected in Sustainable Development Goal 6.5. Cooperation on the Shire River-Aquifer System (Shire System), shared between Malawi and Mozambique, is currently not extensive. A first step toward establishing long-term cooperation is articulating a shared vision and elaborating a set of joint objectives and actions that countries can collaboratively pursue.

The Shire Strategic Action Plan: The aim of the Strategic Action Plan (SAP) for the Shire System is to initiate and guide joint management of the shared water resources according to agreed upon priorities and actions. The Shire River Basin SAP was developed through a series of joint workshops and national consultations with participants from various government institutions of the two Member States that included ARA-Zambeze (Mozambique), the National Directorate of Water Resources Management (Mozambique), the Department of Water Resources (Malawi), the Shire River Basin Management Program (Malawi), and a number of other relevant departments, from October of 2018 to April of 2019. This process was implemented by the International Water Management Institute (IWMI), with support from the University of Strathclyde (Scotland) and Chancellor College (Malawi). The Shire River Basin SAP was supported by the SADC-Groundwater Management Institute (SADC-GMI) under the *Conjunctive Transboundary Water Resources Management in the Shire River Basin* (Shire ConWat) project.

Significance and structure of the Shire River Basin SAP: The Shire River Basin SAP is pioneering in its focus on both surface water and groundwater. The vast majority of SAPs have been developed for transboundary surface water bodies (i.e. rivers, lakes, and coastal areas). Recently, development of seven transboundary aquifer SAPs have been undertaken (e.g. The Regional Strategic Action Programme for the Nubian Sandstone Aquifer System - Egypt, Libya, Sudan, Chad: GEF et al., 2013, and the Strategic Action Program for the Dinaric Karst Transboundary Aquifer System - Albania, Croatia, Bosnia and Herzegovina, Montenegro: DIKTAS, 2014). While these SAPs successfully cover transboundary water management, such transboundary aquifer SAPs tend to be *confined to* groundwater. The Shire River Basin SAP is believed to be the first to focus on a transboundary catchment and a transboundary aquifer.

The Shire SAP is structured as follows. Following the introduction in Chapter 1.0, Chapter 2.0 describes the key issues from the Shire River Basin Transboundary Diagnostic Analysis (TDA) to describe the current biophysical and socio-economic context. Chapter 3.0 summarizes the methods used to develop the SAP. Chapter 4.0 includes the main content of the SAP, including the Shared Vision, Objectives, Actions, Categories, and Indicators. This is followed by chapter 5.0, which summarizes overarching transboundary governance mechanisms within which SAP actions will be implemented. Lastly, chapter 6.0 highlights conclusions and next steps.

2.0 Key issues from the Transboundary Diagnostic Analysis

The Shire Basin: The Shire River Basin is a watershed within the Zambezi River Basin and is situated in portions of southern Malawi and central Mozambique (Figure 1, left side). The Shire River originates from the southern edge of Lake Malawi/Nyasa, flowing 490 km southwards where it joins the main stem of the Zambezi River. Inflows to Lake Malawi/Nyasa are largely unregulated due to a lack of infrastructure, so it can be assumed that decision making for water management upstream of the lake may have little impact on the lake. The Shire River Basin covers a surface area of approximately 32,000 km²; the majority of the catchment area (71%) and population (5.5 million) are located in Malawi, while the remaining part (29%) is located in Mozambique with a significantly smaller population (580,000) (NSO, 2017; Ministério de Administração Estatal 2014a, 2014b, 2014c).

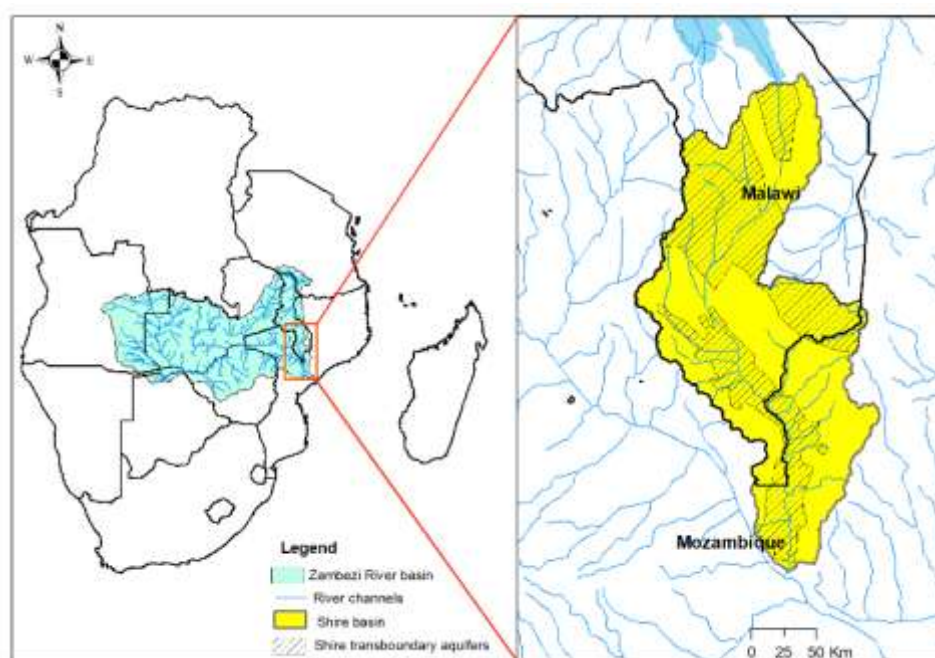


Figure 1: Map of the Zambezi River Basin, the Shire River Basin and the transboundary aquifers. The transboundary aquifers indicated on the map are based on IGRAC and UNESCO-IHP (2015).

The Shire Aquifers: A number of transboundary aquifers, including two major aquifers, are located within the Shire River Basin (Figure 1, right side). A weathered basement aquifer is located in the northern portion of the Shire River Basin. The total area of this aquifer is nearly 10,500 km², with 96% of the surface area in Malawi. In the southern portion of the Shire Basin, an alluvial aquifer exists which has its northern portions in Malawi and southern portion in Mozambique. This alluvial aquifer is nearly 5,500 km² in areas, and is divided roughly equally between the two countries. Ultimately, the aggregated area of the two aquifers cover about half of the Shire Basin.

The Transboundary Diagnostic Analysis in the Shire River Basin: Similar to other SAP processes, a Transboundary Diagnostic Analysis (TDA) of the shared watercourse was first conducted in the Shire River Basin (IWMI & SADC-GMI, 2018). The TDA is a baseline study that identifies, synthesizes and prioritizes key issues in the shared water system. By facilitating a shared understanding of the Shire System and

fostering alignment on prioritized key issues, the TDA provided a foundation for collaborative formulation of an aspirational shared vision, a set of practical objectives to achieve the vision, and a collection of actions in the SAP. The SAP thus builds on the evidence described in the TDA and the negotiated priorities of both riparian states in the water system determined through the joint workshops and national consultation meetings.

Key issues in the TDA: The biophysical and socio-economic analysis of the Shire river-aquifer system in the TDA led to the preliminary identification of five key issues, which provided a foundation for development of the SAP. These five issues address the topics of 1) climate variability and change, 2) catchment degradation and water quality, 3) lack of data, 4) the need to harness additional benefits to reach the potential of the system, and 5) the need for enhanced institutional coordination. While described briefly below, more details are provided in the Transboundary Diagnostic Analysis (IWMI & SADC-GMI, 2018).

2.1 Climate variability and change

The impacts of climate variability and change require urgent responses. The Shire System is experiencing high inter-annual climate variability (IWMI & SADC-GMI, 2018; MoAIWD, 2018). The average annual temperature shows a statistically significant increasing trend (IWMI & SADC-GMI, 2018) and rainfall patterns may continue to change. In addition, the impacts of existing climate extremes including severe floods, is extensive, as illustrated for year 2015 (Figure 2). While current early warning systems and emergency responses have undoubtedly reduced the severity of impacts, the magnitude of the growing challenge may call for additional solutions. The limited amount of infrastructure for regulating the flow of the Shire System, save the Kamuzu Barrage in Liwonde, indicates that natural infrastructure solutions for storage and flood attenuation, including the use of aquifers, hold potential. Further, both Mozambique and Malawi experience flood impacts, highlighting the potential need for internationally coordinated flood response efforts.

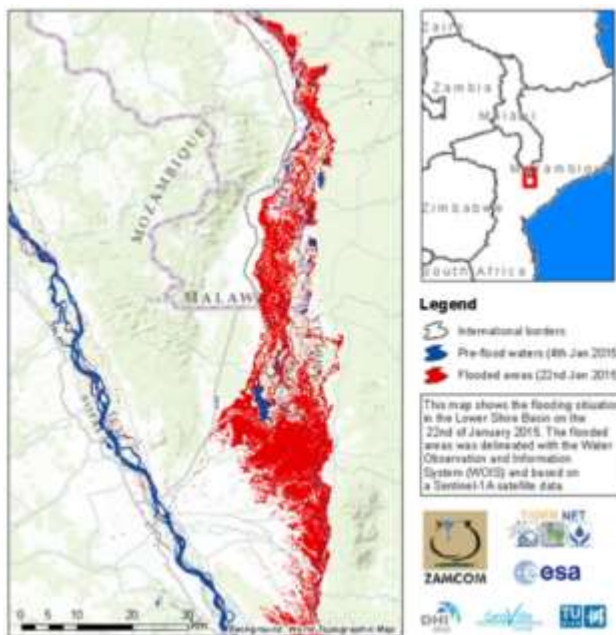


Figure 2: Flood extent on 22 January 2015 mapped based on Sentinel-1A satellite data (source DHI news website)

2.2 Catchment Degradation and Water Quality

Significant water quality challenges in both surface water and groundwater in the Shire System would benefit from coordinated action. Surface water concerns include low Dissolved Oxygen, sedimentation, and a severe infestation of aquatic weeds (Figures 3 and 4). These concerns may be driven by catchment degradation, unsustainable agricultural practices, and nutrient pollution. While groundwater quality data

is limited, potential concerns include *Faecal coliform* contamination, high Total Dissolved Solids (TDS), Iodine and Salinity. Available data suggests that these water quality challenges may become more severe in the future as fitness-for-use for various uses declines (MoAIWD, 2016).



Figure 3: Aquatic weeds floating downstream of the Shire River in Mozambique (Source: Christina Fraser, 2018)

The interconnectedness of the Shire System indicates that it is likely that groundwater and surface water quality challenges in one country may be felt in the other. Strategic action is required to ensure that water in the Shire System is safe for human consumption, ecosystem preservation and a variety of other uses. Efforts toward such action may be enhanced through the pursuit of joint monitoring and planning approaches. Such a joint assessment of the system may enable a more holistic understanding of challenges and vulnerabilities in the system for both countries.



Figure 4: Aquatic weeds with a dominance of Water Hyacinth trapped by a weed boom recently installed upstream of Kamuzu Barrage on the Shire River in Malawi (Source: Peaches Phiri, 2019)

2.3 Lack of data

Addressing constraints on data availability that limit complete understanding of conditions in the Shire System comprise cost-effective ways to improve water management. Six priority data gaps were identified, though several others exist and are highlighted in the TDA. These include:

- i) Trends in groundwater levels, particularly in shared aquifers;
- ii) Rates of groundwater flow between the two countries;
- iii) Mapping of recharge zones and understanding of recharge dynamics (i.e. direct rainfall infiltration or infiltration of surface flow);
- iv) Unknown or unquantified environmental resources and ecosystem services, particularly for Mozambique
- v) Water quality parameters for surface water and groundwater flow, including indicators of the potential implications for human and ecosystem health, and
- vi) The potential for irrigation expansion on Mozambican portions of the system.

It is expected that filling these knowledge gaps to incorporate information into decision-making could contribute to improved development and management of water resources in the Shire System.

2.4 Harnessing benefits

There are several practical opportunities to harness additional potential benefits from the Shire System. It is clear that the Shire System already provides significant benefits to both countries, evidenced by current and planned hydropower development in Malawi, irrigation development along the Shire River, and water supply gathered from shared aquifers. However, other opportunities have not yet been fully quantified and realised. For example, the potential for groundwater as a reliable source of drinking water, drought buffer, or flood mitigator and the potential for irrigation expansion in Mozambique have not yet been investigated. As such, transboundary joint management of groundwater and surface water for all uses presents an opportunity to utilise water from the most appropriate sources where and when it is best available. This may result in increased water use efficiency and resilience of the water system and its ecosystem and provide for the livelihoods of the population in the area.

2.5 Institutional coordination

Enhanced institutional coordination can improve responses to challenges and issues and can help to harness the full potential of the Shire System. Responding to climate variability, addressing catchment degradation and water quality impacts and harnessing potential benefits all require effective institutional frameworks that are aligned toward achieving these key objectives. While the water management institutions in Malawi (Figure 5) and Mozambique (Figure 6) are well-aligned, capacity limitations may constrain the ability of current national institutions to fully respond to challenges. Further, despite several overarching transboundary institutional agreements and frameworks, the sole international agreement that is aligned with the local geography of the Shire River Basin has not yet been implemented. It is important and timely to consider the potential for enhanced cross-border engagement to harness the potential of this shared system and mitigate key risks.

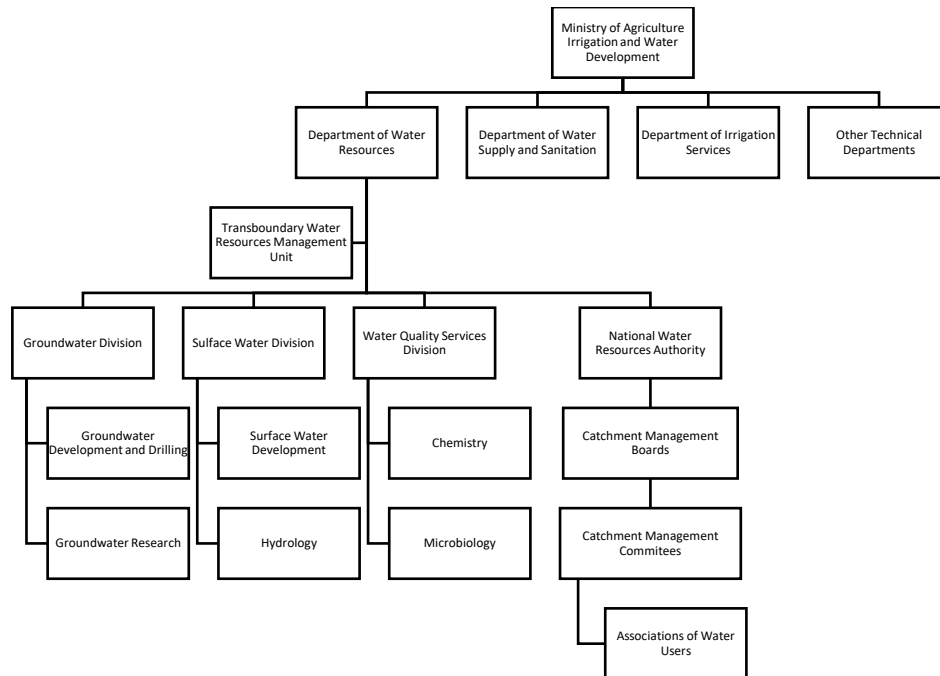


Figure 5: Institutional structure for water management in Malawi

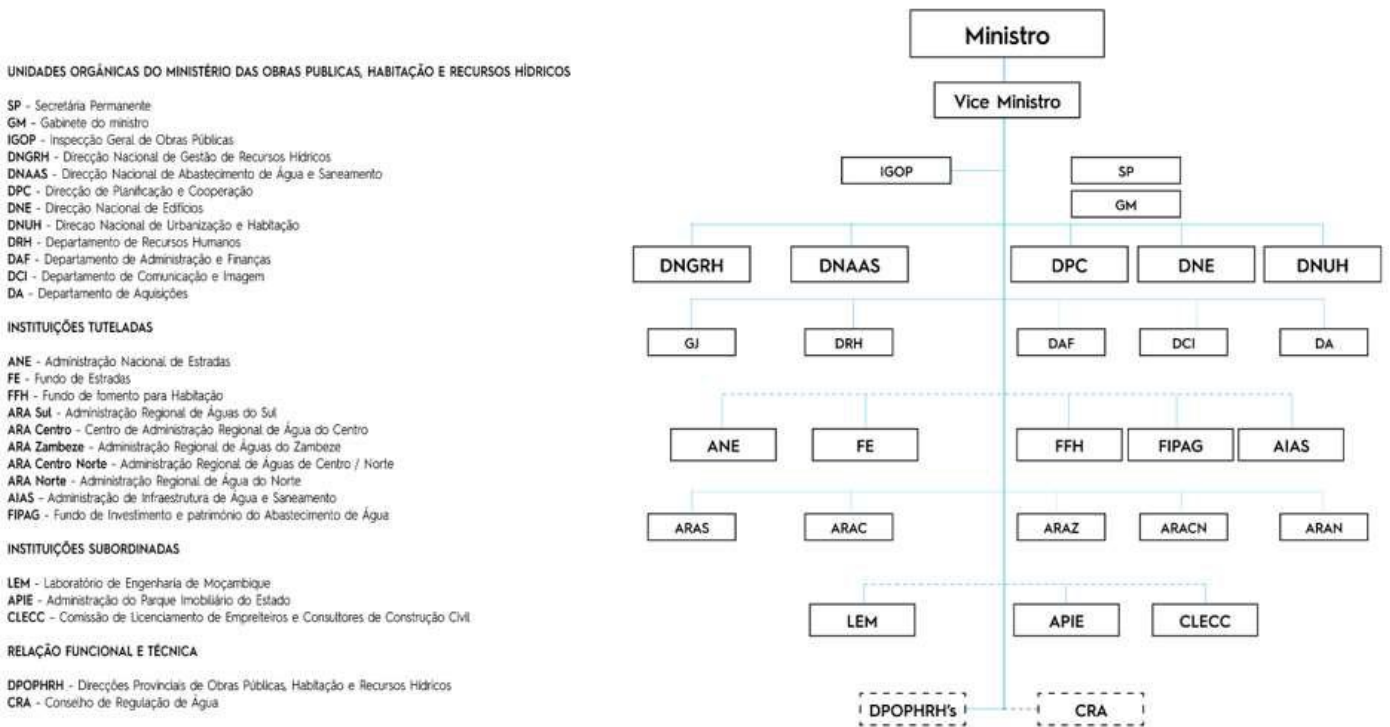


Figure 6: Institutional structures for water management in Mozambique

3.0 Methods for SAP Development

3.1 Background

Previous SAP experiences in Africa's transboundary waters: Since 2000, more than 20 transboundary SAP processes have been conducted in Africa (Kazbekov et al., 2015), where transboundary river basins cover 60 percent of the land area (Lautze & Giordano, 2005) and transboundary aquifers underlie 40 percent of the continent (Nijsten et al., 2018). Examples include the Orange-Senqu River Basin (South Africa, Botswana, Namibia, Lesotho) (ORASECOM, 2014), the Cubango-Okavango River System (Angola, Namibia, Botswana) (OKACOM, 2011) and Lake Tanganyika (Burundi, Democratic Republic of Congo, Tanzania, Zambia) (Lake Tanganyika Authority Secretariat, 2012).

The Shire River Basin SAP development process Building on existing knowledge: The process for developing the SAP¹ for the Shire System built on best-practice utilized by reputed international institutions, previous experiences of project personnel in transboundary SAP development, and emerging thought in water resources planning. The Global Environment Facility's (GEF) International Waters Portfolio and the GEF International Waters Learning Exchange and Resource Network (IW: LEARN) provide a breadth of lessons learned from transboundary SAP development around the world. In addition, the project team coordinated development of the SAP in the Ramotswa Aquifer, shared between South Africa and Botswana, and was able to draw on experiences with that process. Finally, the design of the SAP development process was influenced by emerging approaches for water resource planning which have broadened the conventional water sector silo to embrace interdisciplinarity (e.g., water-energy-food nexus, integrated water resource management) and favour methods that are adaptive to climate and socio-economic change (Hallegatte, Shah, Lempert, Brown, & Gill, 2012), promote social-ecological resilience (Rockström et al., 2014), and embrace conjunctive water management as elaborated in Box 1.

Key terms used in SAP processes are defined as follows:

Key issues: Issues with a major impact on sustainable water management and social, ecological and/or economic development, typically identified in a TDA (e.g., poor water quality driven by unsustainable land use and invasive plant species).

Shared vision: An aspirational, long-term view that outlines the desired future characteristics of the water system and/or the desired changes to the organisations that manage or rely on the water system (e.g. to assure the rational and equitable management of the aquifer system for sustainable socio-economic development and the protection of biodiversity and land resources whilst ensuring no detrimental effects on the shared aquifer countries).

Objectives: A set of goals or targets to achieve the vision, address key issues and leverage key opportunities (e.g. to mainstream environmental aspects in the integrated management of the aquifer system to conserve the dependent ecosystems and reduce the risk of loss/damage to biodiversity).

¹ The term "SAP" in transboundary water contexts stands for either Strategic Action Plan or Strategic Action Programme. The use of Strategic Action Plan does not imply a material difference from similar Strategic Action Programmes, and development of the Shire SAP draws from best practices SAPs developed under both names.

Box 1: Conjunctive Water Management

The concept of conjunctive water management (Figure 7) underlies the SAP development process in a number of ways. Stakeholders were introduced to the concept multiple times through the project, with experts presenting on conjunctive approaches and solutions. In addition, key issues drawn from the TDA pertained to surface water, groundwater, and conjunctive water management challenges, leading to objectives and actions that are relevant for both resources and interlinkages between them.

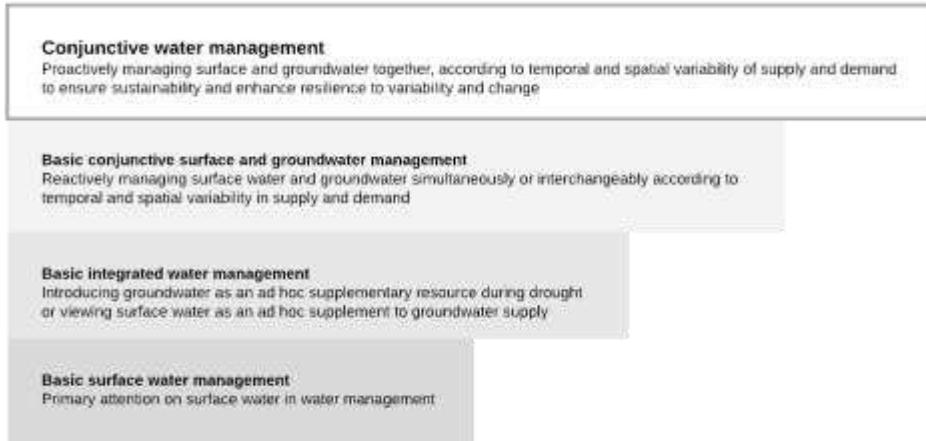


Figure 7: Conjunctive water management, in contrast to other water management approaches (IWMI, 2018)

Actions: Specific strategies, implementation steps or tasks that must be carried out to achieve the objectives; can include alternative options (e.g. establish and maintain a regional database for ecosystem and biodiversity, in view of proper management and conservation; formulate agreements on monitoring and exchange of data related to ecosystems and biodiversity).

Indicators: Measurable values or devices that support decision making, ensure accountability and measure results and impacts of actions toward the defined objectives (e.g. individuals and institutions utilizing the database related to ecosystems and biodiversity).

3.2 The Shire River Basin SAP Development Approach

Shire River Basin SAP Development Approach Overview: The SAP development process progressed from an initial assessment of the key issues in the system in the TDA to a process of envisioning the future by developing a shared vision. This was followed by planning for a shared future, which included development of joint objectives and actions. A set of categories were agreed upon and applied to the actions to contextualize and prioritize actions in the SAP (Figure 8).

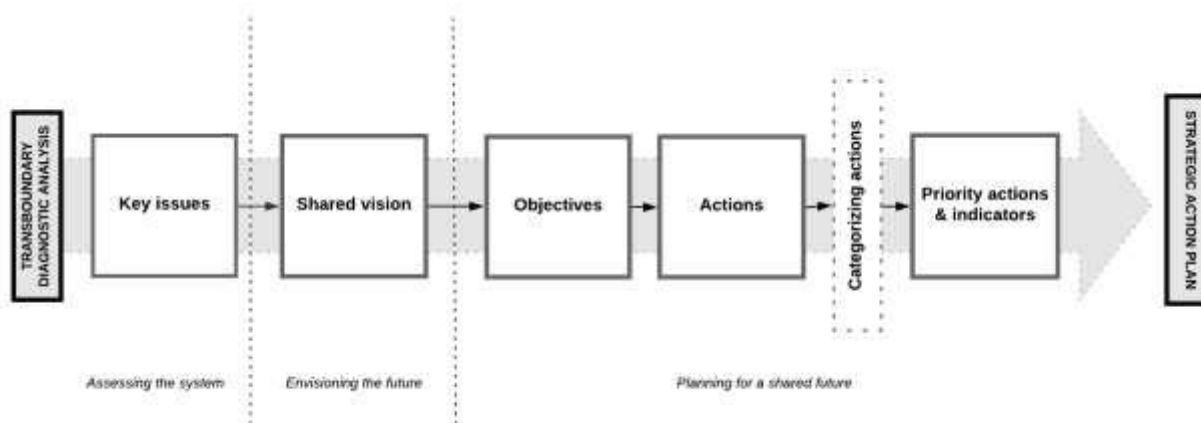


Figure 8: Conceptual framework for development of the Shire SAP

Shared Vision Envisioning the future is an important part of strategic planning to articulate the aspirational goal for the team or an organisation involved. Shared visions allow individuals participating in strategic planning to link their hopes to a well-described, desired shared future. These visions can serve various purposes, including providing a broad frame for articulating a multi-stakeholder strategy (Iwaniec & Wiek, 2014). Nearly all transboundary SAPs, including the Shire River Basin SAP that began with convergence of an aspirational shared vision for the future of a water system. In this context, a shared vision can be defined as an aspirational, long-term view that outlines the desired future characteristics of the water system and/or the desired changes to the organisations managing or relying on the water system. Examples of shared visions from other SAPs include “to achieve joint sustainable and equitable use and protection of Dinaric karst aquifer system” (DIKTAS, 2014) and “people of the region prospering from a healthy environment in the Lake Tanganyika Basin that continues to harbour high levels of biodiversity and provide sufficient natural resources to sustain future generations” (Lake Tanganyika Authority Secretariat, 2012).

Goals and Objectives Following initial visioning stages, most SAPs move directly to the planning stage. These SAPs define a handful of goals or objectives that respond directly to key issues identified in the TDA and move toward achieving the vision. These goals or objectives are then further contextualized through some combination of targets, actions, outcomes, outputs and indicators (IW & GEF, 2018). This is followed by generation of actions that each contribute to achieving an objective and the shared vision. While these are common traits, SAPs differ in the manner in which they subdivide objectives toward more targeted actions (Table 1).

Table 1: Illustrative examples of different SAP formats

	Goals	Actions	Monitoring and evaluation
Dinaric Karst Transboundary Aquifer System	Ecosystem Quality Objectives (EcoQOs)	Management actions identified for each EcoQO Management actions reflected against enabling legal or institutional framework	Indicators are determined for actions and targets throughout the SAP

Kura-Aras River Basin	Ecosystem Quality Objectives (EcoQOs)	Targets identified for each EcoQO Identification of actions planned for later date	Indicators planned for a later date
Nubian Aquifer System	Water Resource or Ecosystem Quality Objectives (WR/EcoQOs) identified and broken down into multiple sub-objectives	Targets and actions identified under various action themes (i.e., investment actions; research, training and awareness-raising actions, etc.)	Indicators included as a global list at the end of the SAP

(DIKTAS, 2014; IW & GEF, 2018)

Objectives and actions in the Shire SAP: The approach for the Shire System focused on identification of objectives to achieve the shared vision, address key issues and leverage key opportunities; SAP objectives align closely with the key issues in the Shire TDA. For each objective, actions were stratified according to three themes: institutional and legislative actions; research, training and awareness actions; and investment actions. Lastly, the breakdown of actions into themes was meant to help stakeholders generate a holistic list of joint actions that spans multiple action areas.

Categorizing actions: Actions tend to be relatively broad, demanding further characterization. Actions were categorized in two steps (Table 2). The first step applied categories relevant to project development and implementation, namely; the degree of international cooperation required, the implementation time frame and estimated budget. The second step of categorization classified the relative urgency of individual actions under future uncertainties.

Table 2: Categorizing Actions

Step	Category	Classifications
Planning for project development and implementation	Degree of international cooperation required	Actions requiring joint action planning and execution (e.g., developing shared protocols for data collection and exchange between countries)
		Actions requiring sharing of information only (e.g., compare national water laws for the purposes of joint management)
		Actions that do not require international cooperation (e.g., investing in irrigated agriculture in Mozambique)
	Time frame	Short term (less than 2 years) Medium term (2 to 5 years) Long term (more than 5 years and/or requires ongoing effort)
	Budget	Low budget (less than 50 000 USD)
		Medium budget (50 000 to 250 000 USD)
High budget (more than 250 000 USD)		
Relative urgency	Is there special urgency to implement an action given uncertain future risks?	Urgency (aggregate of 3 below) High climate risk High population growth Rapid economic development

Project development and implementation: The purpose of the project development categories was to understand requirements of, and implications for, taking SAP actions forward and to prepare actions for

uptake within national departments following SAP completion. Categories shown below were drawn from previous SAP development processes, in particular the Ramotswa Joint Strategic Action Plan, which benefited from characterising actions according to criteria that could be easily translated into project development modalities. Three categories were applied:

- i. **Degree of international cooperation required:** The scope of the SAP was meant to focus on joint actions that address transboundary issues. However, it was recognized that this scope was fluid. Three categories were applied to the actions to clarify degree of joint execution required.
- ii. **Implementation time frame:** Actions varied according to implementation time frame, ranging from easily implemented, short term actions to long-term projects.
- iii. **Estimated budget:** Actions were also classified according to their estimated budget.

Relative urgency: In the Shire System, deep uncertainties of climate change, socio-economic development, political change, and demographics require that strategic action planning processes take into consideration interdependencies between key trends and their impacts on the water system. Drawing from emerging resilience-based planning approaches (e.g., Enfors-Kautsky et al. 2018; Reed et al. 2013), elaboration of uncertainties or scenarios during the SAP process can expose these complexities and help place greater focus on actions likely to be viable under a variety of futures.

To integrate this understanding of complex systems into the SAP in a simple manner, categories were applied to the actions to answer one simple question:

Is there special urgency to implement an action given uncertain future risks?

By answering this question, stakeholders implementing the SAP should be better able to prioritize actions based on the relative urgency of actions as future trends emerge. Three *qualitative* uncertain future risks were identified as follows:

- i. **High climate risk:** Downscaled global emissions scenarios (IPCC, 2000) to the Shire River Basin suggest potentially concerning trends. The high climate risk scenario would be characterized by an increase in floods (+10% annual maximum 5-day rainfall to 2050, +23% to 2100) and droughts (+13% increase in consecutive dry days to 2050, +23% to end century), in addition to an increase in catchment runoff (MoAIWD, 2015).
- ii. **High interval population growth rate:** The medium interval population growth rate projections for Malawi and Mozambique from 2015 to 2100 would result in significant growth from the approximately 6.1 million to some 9.2 million in 2030 (840,000 for Mozambique, 8.4 million for Malawi), more than 14 million in 2050 (1.3 million for Mozambique, 13.1 million for Malawi) and more than 26 million in 2100 (2.7 million for Mozambique, 23.8 million for Malawi). The high interval population growth rates would result in an increase to nearly 37 million (UN, 2017).
- iii. **Rapid economic growth:** The Gross Domestic Product (GDP) of Malawi and Mozambique were 5.8 billion USD and 12.6 billion USD in 2017, respectively, with a GDP per capita of 311 and 427 USD. These trends indicate that the region may experience a range of slow to rapid economic growth, depending on a number of factors such as the degree of regional integration in southern Africa, diversification of the economy, and the quality and reach of social safety nets (World Bank Group, 2018).

Priority actions: Identifying actions that are most important for immediate action is important for implementation immediately following SAP development. A brief exercise of identifying priority actions resulted in a list of 6 actions that were elaborated further during a joint workshop with representatives from each country.

Indicators to monitor progress: Identifying indicators for monitoring and evaluation (M&E) can support strategic planning by promoting accountability and measuring progress toward objectives and actions. In the context of transboundary water SAPs, three types of indicators are used:

- **Process indicators:** Focused on outputs likely to lead to a desirable outcome (e.g., establishing a transboundary committee for ongoing coordination of SAP actions)
- **Stress reduction indicators:** Related to project objectives or outcomes (e.g., area treated with best management practices for non-point source pollution; kg pollution reduced)
- **Environmental status indicators:** Goal oriented and focused on improvements of ecosystem quality (e.g., improved physical, biological or chemical water parameters).

While the time frame of the Shire SAP did not allow for consultation on indicators, a tentative list of potential indicators is offered should countries wish to measure progress toward SAP implementation. Proposed indicators draw on the three indicator types shown above, and can be applied to each of the four objectives.

Timeline and stakeholder engagement: Implementation of the conceptual framework occurred from October 2018 through to March 2019. The major elements of the conceptual framework (Figure 9) were realized through implementation of three national consultations and two joint workshops (Table 3, 4). Each set of national consultations included a half to full-day meeting, conducted separately with stakeholders from each country. To expedite the process, the outcomes of each consultation were synthesized and presented back to country representatives at the subsequent consultation for review and iteration until a nearly final consensus was reached. The joint workshops brought representatives of both governments together to discuss and agree upon joint issues. Attendees are summarized in Annex I. The timeline for the SAP was from October 2018 to April 2019 (Table 3).

Table 3: Timeline for SAP development

Key elements	Oct '18	Nov '18	Dec '18	Jan '19	Feb '19	Mar '19	Apr '19
Identify key issues from TDA	X						
Present key issues; develop a shared vision (<i>National consultation 1</i>)		X					
Identify uncertainties; set objectives (<i>National consultation 2</i>)			X				
Identify actions (<i>National consultation 3</i>)					X		
Agree on joint vision and objectives, consolidate actions (<i>Joint Workshop</i>)						X	
Draft Submitted						X	
Prioritize and elaborate actions (<i>Knowledge Management Workshop</i>)							X

The dates of the national consultations and joint workshops were as follows:

Table 4: Dates of national consultations and joint workshops

	Date	Location
National Consultation 1	October 30, 2018	Tete, Mozambique
	November 1, 2018	Lilongwe, Malawi
National Consultation 2	December 11, 2018	Tete, Mozambique
	December 13, 2018	Lilongwe, Malawi
National Consultation 3	February 5, 2019	Tete, Mozambique
	February 7, 2019	Lilongwe, Mozambique
Joint Workshop	March 7 and 8, 2019	Blantyre, Malawi
Knowledge Management Workshop	April 16 and 17, 2019	Tete, Mozambique

Geographical scope, conceptual focus and cooperation: The biophysical scope of the SAP was well-defined in the TDA (i.e. the extent of the surface water in the Shire River Basin). While additional transboundary aquifers may exist in the Shire (Fraser et al., 2018) and should be considered in implementation of actions, the project team focused efforts on the two transboundary aquifers elaborated in the TDA. Particular attention was given to the major alluvial aquifer that is approximately equally divided between the two countries given the greater potential for cooperation here. While the SAP focuses on a shared water resources, not all actions require international cooperation. As such, some actions included in the SAP require cooperation, while others do not, as indicated by the categorization in section 4.3. Nonetheless, as a joint plan for transboundary water management, the conceptual focus of this document is directed primarily toward advancing cooperative actions while recognizing the somewhat fluid boundaries between joint and national actions and transboundary and domestic issues.

4.0 Vision, Objectives, Actions

The core elements of the SAP include a shared vision, four objectives, and 39 actions. These actions were further contextualized by applying a set of categories to the actions.

4.1. Vision & Objectives

Shared vision for the Shire: The shared vision for the Shire System encompasses the joint aspirations for the future of the water resources of stakeholders from Malawi and Mozambique. It highlights the importance of conjunctive water management through the mention of both surface water and groundwater, and includes terms of “sustainable” and “integrated” to promote sustainable development and integrated water resources management. Finally, the vision emphasizes the importance of the impact of transboundary cooperation on people living within the catchment by promoting the goals of improved livelihoods, and ultimately, socio-economic prosperity. The shared vision for the Shire System is as follows:

Enhanced cooperation in the development, management and utilisation of both surface water and groundwater in the Shire River Basin, conducted in a sustainable and integrated manner for improved livelihoods and socio-economic prosperity.

Objectives: The four objectives for the Shire System cover a range of issues, highlighting a combination of biophysical topics like climate variability and change and catchment degradation in objectives 1 and 4, to joint data and monitoring and improved international cooperation in objectives 2 and 3. These four objectives cover a broad scope for action, and achievement of these objectives would contribute significantly to the principles of conjunctive water management. The process for generating and synthesizing objectives was iterative, as summarized in Annex II. The final four objectives are:

Objective 1: To strengthen national and transboundary institutional cooperation to improve development and management of water resources for sustainable development of the basin and its shared aquifers.

Objective 2: To improve the quality and quantity of data for improved conjunctive water management for decision making by instituting a joint monitoring system for data collection, sharing and standardization.

Objective 3: To reduce the adverse impacts of climate variability and change (i.e. floods and droughts) through joint conjunctive management of surface water and groundwater, including the use of natural infrastructure (e.g., aquifers and wetlands) and implementation of early warning systems.

Objective 4: To promote catchment management (e.g., reducing overexploitation, revitalizing natural vegetation) in order to enhance water quality, stream flow and groundwater retention.

4.2 Actions

Overview: Actions identified through the Shire River Basin SAP cover a broad scope of activities for improved water resources development and management. Many actions are novel in their ambitions to address transboundary issues with joint actions, while others are improvements that should enhance current water resources development and management efforts. Recurring themes in the actions include

1) to improve the quality and quantity of information feeding into decision making processes by improving data and monitoring and/or by conducting comprehensive studies and 2) to improve the structure and activity of institutions at national/transboundary and local level to achieve the objectives.

4.2.1 Actions for Objective 1

Actions for objective 1 are meant to strengthen national and transboundary institutional cooperation. Most actions address efforts to establish institutions, clarify transboundary priorities, and harmonize or develop relevant policies (actions 1.1.1 to 1.1.3). Other actions are to address the potential trade-offs and synergies between existing efforts to develop the Shire System, including analysis of relevant investment plans (action 1.3.1). This focus on institutional arrangements and joint planning is accompanied by capacity building actions, including training in Integrated Water Resources Management (IWRM) in a manner that integrates important water resources development and management principles (action 1.2.1).

Objective 1: To strengthen national and transboundary institutional cooperation to improve water resources development and management for sustainable development of the basin and its shared aquifers.

1.1 Institutional and legislative actions

- 1.1.1 Establish a joint Shire River Basin Committee for coordination and cooperation in conjunctive water resources management over the Shire River Basin and its shared aquifers.
- 1.1.2 Create a local committee in each country for coordinating efforts to manage the Shire River Basin, ensuring that all districts are well presented (Figure 9).

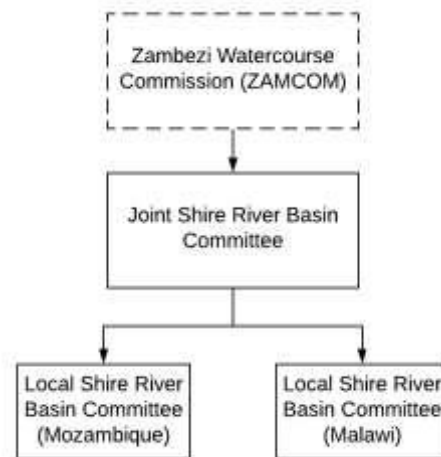


Figure 9: Suggested structure for joint management of the Shire River Basin Committee

- 1.1.3 Ensure priority issues of transboundary surface water and groundwater management are clearly articulated and agreed upon.
- 1.1.4 Make comparative analysis of relevant laws, policies and regulations for joint water resources management to develop recommendations for possible harmonization.

1.2 Research, training and awareness actions

- 1.2.1 Identify areas for joint training in e.g. IWRM using appropriate technology and indigenous knowledge.
- 1.2.2 Identify areas for joint studies and research.

1.3 Investment actions

- 1.3.1 Analyze investment plans in respective countries that apply to the Shire River Basin and its shared aquifers to promote joint investments (joint project implementation).
- 1.3.2 Provide resources that will promote advancement in institutions, use of relevant equipment, and capacitation and training of personnel.

4.2.3 Actions for Objective 2

Actions for objective 2 are meant to improve the quality and quantity of data for improved conjunctive water resources management decision making. While many of the actions address the need to develop data sharing protocols and a portal to house the data (e.g., actions 2.1.1, 2.3.3), others directly address specific areas of joint research for the countries to pursue such as an assessment of flood-prone areas (action 2.2.2). While many actions are specific to joint efforts for the transboundary system, others are mere routine actions that already exist within the Water Resources Development and Management Departments of the Member States (e.g., action 2.3.1).

Objective 2: To improve the quality and quantity of data for improved conjunctive water resources management for decision making by instituting a joint monitoring system for data collection, sharing and standardization.

2.1 Institutional and legislative actions

- 2.1.1 Develop a Memorandum of Understanding (MoU) on data sharing between the two Member States, taking into account the existing ZAMCOM protocol on data sharing.

2.2 Research, training and awareness actions

- 2.2.1 Conduct a comprehensive research study to establish the hydrological/ hydrogeological (e.g. quantity and quality) status of water resources in the Shire River Basin and aquifers contained within, particularly in light of climate change scenarios and the need for hydrogeological information (e.g. recharge zone maps, water quality maps and geological cross-sections that include soil type).
- 2.2.2 Conduct research to investigate linkages between land and water tenure and aquifer use in order to develop recommendations.
- 2.2.3 Conduct spatial mapping exercise on linkages between sanitation issues, groundwater and surface water pollution in order to develop a subsequent action plan to be addressed.
- 2.2.4 Implement training programmes on data collection, analysis and reporting.
- 2.2.5 Conduct exchange visits to countries or shared watercourses that have successfully implemented similar transboundary data programs.

2.3 Investment actions

- 2.3.1 Promote mobilization of resources for the implementation of the joint monitoring system for quantity, quality, use and abstraction, (including acquisition of monitoring equipment).
- 2.3.2 Set up new monitoring stations that will enable generation of relevant weather and climatological data, in addition to critical surface water and groundwater data to trace pollution sources and ambient water quality parameters.
- 1.1.1 Develop a data sharing portal between Malawi and Mozambique countries that facilitates a joint information management system in consultation with Zambezi Water Resources Information System (ZAMWIS) developed under ZAMCOM.

4.2.3 Actions for Objective 3

Actions for objective 3 are meant to reduce the impacts of climate variability and change. Several of the actions focus on the need to structure institutions to address the emerging challenges of climate change (e.g., action 3.1.1). Several other actions highlight the lack of knowledge and clarity around the potential trends and impacts of climate variability and change (e.g., action 3.2.2). Despite this lack of information, some actions also reflect ambitions to make on-the-ground investments that improve resilience (e.g., action 3.3.2).

Objective 3: To reduce the adverse impacts of climate variability and change through joint conjunctive management of surface water and groundwater, including the use of natural infrastructure (e.g., aquifers and wetlands) and implementation of early warning systems.

3.1 Institutional and legislative actions

- 3.1.1 Integrate issues of climate variability and change into the decision-making responsibilities of the Shire River Basin Committee (Action 1.1.1).
- 3.1.2 Integrate issues of climate variability and change into the local committees in each country (Action 1.1.2).

3.2 Research, training and awareness actions

- 3.2.1 Train personnel involved in collecting and analysing information related to surface water and groundwater about climate variability and change.
- 3.2.2 Undertake research and monitor issues of climate variability and change in the basin.
- 3.2.3 Develop an integrated decision support system for predicting and responding to climate variability and change.
- 3.2.4 Develop guidelines for standardisation of methods of data collection and analysis for surface water, groundwater, climate variability and climate change.
- 3.2.5 Conduct research to map flood and drought prone areas in light of climate change.

3.3 Investment actions

- 3.3.1 Develop a joint model for monitoring and early warning for floods and droughts.

- 3.3.2 Construct water harvesting structures or dams for multipurpose use (hydro-power, irrigation, flood control).

4.2.4 Actions for Objective 4

Actions for objective 4 are meant to improve catchment management to enhance water quality, stream flow and groundwater retention. The large number of actions covering a range of efforts reflects a holistic approach to achieving the objective. Some actions focus on early-stage institutional and policy structures, such as the need to sign a joint accord regarding commitments to address catchment management and to develop a joint plan and guidelines for the catchment (actions 4.1.1 and 4.1.2). Several actions also recognize the importance of local-level stakeholders in achieving the objective, by including actions that enhance public awareness about catchment management and capacitate village-level natural resources management (actions 4.2.1 and 4.2.4). The actions also address the need for on-the-ground investments to improve catchment management (action 4.3.1).

Objective 4: To promote catchment management (e.g., reducing overexploitation, revitalizing natural vegetation) in order to enhance water quality, stream flow and groundwater retention.

4.1 Institutional and legislative actions

- 4.1.1 Develop a joint catchment management plan and guidelines for the Shire River Basin.
- 4.1.2 Sign a joint accord or agreement regarding commitments to address catchment management in the basin at the relevant level(s) of government.
- 4.1.3 Implement measures to better enforce legislation and policy relevant to catchment management.
- 4.1.4 Promote good practices for acceptable levels of water quality in the basin according to national and international guidance (e.g., Malawi and Mozambique Water Quality Standards, World Health Organization Guidelines).
- 4.1.5 Set water extraction standards in alignment with SADC policy.
- 4.1.6 Promote joint proposals to mobilise funds for specific projects within the Shire River Basin for activities related to sustainable catchment and natural resources management.

4.2 Research, training and awareness actions

- 4.2.1 Capacitate village-level natural resource management through Catchment Management Committees by forming proper structures and trainings in Integrated Catchment Management.
- 4.2.2 Train personnel, professionals and decision makers involved in collecting and researching information related to surface water, groundwater, water quality and catchment management.
- 4.2.3 Conduct assessment of the quality and quantity of water resources in the Shire River Basin, including land use and land/forest cover.
- 4.2.4 Enhance capacity building and public awareness about catchment management, including addressing the links between student enrollment and education quality to the future health of the catchment.
- 4.2.5 Promote the utilization of water resources for rural households and other uses in the catchment.

- 4.2.6 Promote research on groundwater recharge (natural and managed) within the basin for their proper water resources management and protection.

4.3 Investment actions

- 4.3.1 Promote development of sustainable infrastructure in the basin to address effective management challenges in agriculture, water storage, wastewater, solid waste, afforestation and forest fires, and energy by adopting both grey and green solutions.
- 4.3.2 Extend and modernize the monitoring network for both surface water and groundwater in terms of quality, quantity and other parameters relevant for catchment degradation.
- 4.3.3 Promote investment of public-private partnerships in the Shire River-Aquifer System (e.g. wildlife protection) and Payment for Ecosystem Services (PES) schemes.

4.3 Categorization of Actions

Categorized actions: Actions are characterized according to the three project development categories - degree of international cooperation, time frame and estimated budget, and the level of implementation urgency associated with uncertainty and risk (Table 5). Annex III contains more detailed information on the relative urgency according to trends of climate risk, population growth and economic growth.

Distribution of actions across project development categories: Categorization of the total of 39 actions according to the degree of international cooperation required resulted in formulation of 14 actions that require joint planning and execution, 13 actions that require sharing of information only and 12 actions that require no cooperation. This trend is logical due to the transboundary nature of the watercourse and critical interlinkages on both surface and groundwater. Categorization of actions according to the implementation time frame resulted in 14 short-term actions, 14 medium-term actions, and 11 long-term actions. It is expected that as short-term actions are achieved, subsequent actions may emerge and cascade into ongoing improvements to water management in the Shire System. Lastly, categorization of the actions according to estimated budget resulted in 17 actions as low budget, 20 as medium budget, and 2 as high budget. This trend may reflect the level of ambition of stakeholders at early stages of cooperation over the shared resources.

Distribution of actions across relative urgency categories: Categorization of actions based on relative urgency resulted in 8 actions that are especially urgent under all three uncertainties and are as follows:

1. Establishment of a a joint Shire River Basin Committee for coordination and cooperation in conjunctive water management over the Shire River Basin and its shared aquifers.
2. Creation of a local committee in each country for coordinating efforts to manage the Shire River Basin, ensuring that all districts are well represented.
3. Analyzing investment plans in respective countries that apply to the Shire river Basin and its shared aquifers to promote joint investments (joint project implementation).
4. Conducting a comprehensive research study to establish the hydrological/ hydrogeological (e.g. quantity and quality) status of water resources in the Shire River Basin and aquifers contained within, particularly in light of climate change scenarios and the need for hydrogeological information (e.g. recharge zone maps, water quality maps and geological cross-sections that include soil type).

5. Conducting a comprehensive research study to establish the hydrological/ hydrogeological (e.g. quantity and quality) status of water resources in the Shire River Basin and aquifers contained within, particularly in light of climate change scenarios and the need for hydrogeological information (e.g. recharge zone maps, water quality maps and geological cross-sections that include soil type).
6. Constructing water harvesting structures or dams for multipurpose use (hydro-power, irrigation, flood control).
7. Promotion of research on groundwater recharge (natural and managed) within the basin for proper water resources development, management and protection
8. Promotion and development of sustainable infrastructures in the basin to address effective management challenges in agriculture, water storage, wastewater, solid waste, afforestation and forest fires, and energy by adopting both grey and green solutions.

Some of these actions are similar in their focus on tangible, on-the-ground activities, such as constructing water harvesting structures or implementing catchment management structures. Other actions are similar in their focus on improving the quality of information feeding into joint planning processes, such as to conduct a comprehensive research study on the hydrological/hydrogeological status of the resources and to extend and modernize the monitoring network. The full allocation of relative urgency applied to each action according to high climate risk, high population growth, and rapid economic development can be found in Annex III.

Table 5: Actions categorized according to transboundary/national, implementation time frame, estimated budget, urgency

Action	International cooperation, (x=not required, xx=sharing information only, xxx=high cooperation)	Time frame (+=short, ++=medium, +++=long)	Estimated budget (\$, \$\$, \$\$\$)	Urgency (low, medium high)
<i>Objective 1</i>				
1.1.1 Establish a joint Shire River Basin Committee for coordination and cooperation in conjunctive water management over the Shire River Basin and its shared aquifers.	xxx	+++	\$\$	✓✓✓
1.1.2 Create a local committee in each country for coordinating efforts to manage the Shire River Basin, ensuring that all districts are well represented.	x	+++	\$	✓✓✓
1.1.3 Ensure priority issues of transboundary surface water and groundwater management are clearly articulated and agreed upon.	xxx	+	\$	
1.1.4 Make comparative analysis of relevant laws, policies and regulations for joint water resources management to	xxx	++	\$\$	✓

develop recommendations for possible harmonization.				
1.2.1 Identify areas for joint training in water resources development and management e.g. IWRM using appropriate technology and indigenous knowledge.	xxx	+	\$\$	✓✓
1.2.2 Identify areas for joint studies and research	xxx	+	\$	
1.3.1 Analyze investment plans in respective countries that apply to the Shire River Basin and its shared aquifers to promote joint investments (joint project implementation).	xx	+++	\$	✓✓✓
1.3.2 Provide resources that will promote advancement in institutions, use of relevant equipment, and capacitation and training of personnel.	x	+++	\$	✓
Objective 2				
2.1.1 Develop an MoU on data sharing between the two Member States, taking into account the existing ZAMCOM protocol on data sharing.	xxx	+	\$	✓✓
2.2.1 Conduct a comprehensive research study to establish the hydrological/hydrogeological (e.g. quantity and quality) status of water resources in the Shire River Basin and aquifers contained within, particularly in light of climate change scenarios and the need for hydrogeological information (e.g. recharge zone maps, water quality maps and geological cross-sections that include soil type).	xx	++	\$\$	✓✓✓
2.2.2 Conduct research to investigate linkages between land and water tenure and aquifer use in order to develop recommendations.	xx	++	\$\$	✓✓
2.2.3 Conduct spatial mapping exercise on linkages between sanitation issues and groundwater and surface water pollution in order to develop a subsequent action plan to be addressed.	xxx	++	\$\$	✓
2.2.4 Implement training programmes on data collection, analysis and reporting.	xx	+	\$\$	✓✓

2.2.5 Conduct exchange visits to countries or shared watercourses that have successfully implemented similar transboundary data programs.	xxx	+	\$	
2.3.1 Promote mobilization of resources for the implementation of the joint monitoring system for quantity, quality, use and abstraction (including acquisition of monitoring equipment).	x	+++	\$	✓✓
2.3.2 Develop a data sharing portal between Malawi and Mozambique that facilitates a joint information system in consultation with Zambezi Water Resources Information System (ZAMWIS) developed under ZAMCOM.	x	+	\$\$	✓
Objective 3				
3.1.1 Integrate issues of climate variability and change into the decision-making responsibilities of the Shire River Basin Committee (1.1.1).	xxx	+++	\$\$	✓✓
3.1.2 Integrate issues of climate variability and change into the local committees of each country (1.1.2).	x	++	\$	✓✓
3.2.1 Train personnel involved in collecting data and analysing information related to surface water and ground water about climate variability and change.	x	+	\$	✓
3.2.2 Undertake research and monitor issues of climate variability and change in the basin.	xx	++	\$\$	✓
3.2.3 Develop an integrated decision support system for predicting and responding to climate variability and change.	xxx	+++	\$\$	✓✓
3.2.4 Conduct research to map flood and drought prone areas in light of climate change.	xxx	+	\$\$	✓✓
3.3.1 Develop a joint model for monitoring and early warning for floods and droughts.	xxx	++	\$\$	✓✓
3.3.2 Construct water harvesting structures or dams for multipurpose use (hydro-power, irrigation, flood control).	xx	+++	\$\$\$	✓✓✓
Objective 4				

4.1.1	Develop a joint catchment management plan and guidelines for the Shire River Basin.	xxx	+	\$\$	✓✓
4.1.2	Sign a joint accord or agreement regarding commitments to address catchment management in the basin at the relevant level(s) of government.	xxx	+	\$\$	✓✓
4.1.3	Implement measures to better enforce legislation and policy relevant to catchment management.	x	+	\$\$	✓✓
4.1.4	Promote good practices for the exploration and preservation of water quality in the basin according to national and international guidance (e.g., Malawi and Mozambique Water Quality Standards, World Health Organization guidelines).	xx	+++	\$	
4.1.5	Set water extraction standards in alignment with SADC policy.	xx	++	\$\$	✓✓
4.1.6	Promote joint proposals to mobilise funds for specific projects within the Shire River Basin for activities related to sustainable catchment and natural resources management.	xx	++	\$	✓✓✓
4.2.1	Capacitate village-level natural resource management through Catchment Management Committees by forming proper structures and training in Integrated Catchment Management.	x	+++	\$\$	✓✓
4.2.2	Train personnel involved in collecting and researching information related to surface water, groundwater, water quality and catchment management.	x	+	\$	✓
4.2.3	Conduct assessment of the quality and quantity of water resources in the Shire River Basin, including land use and land/forest cover.	xxx	++	\$\$	✓
4.2.4	Enhance capacity building and public awareness about catchment management, including addressing the links between student enrollment and education quality to the future health of the catchment.	x	+++	\$	✓✓

4.2.5 Promote the utilization of water resources for rural households and other uses in the catchment.	x	++	\$	
4.2.6 Promote research on groundwater recharge (natural and managed) within the basin for their proper water resources management and protection.	xx	++	\$	✓✓✓
4.3.1 Promote development of sustainable infrastructure in the basin to address effective management challenges in agriculture, water storage, wastewater, solid waste, afforestation and forest fires, and energy by adopting both grey and green solutions.	xx	++	\$\$\$	✓✓✓
4.3.2 Extend and modernize the monitoring network for both surface water and groundwater in terms of quality, quantity, and other parameters relevant for catchment degradation.	xx	++	\$\$	✓✓✓
4.3.3 Promote investment of public-private partnerships in the Shire River-Aquifer System (e.g. wildlife protection) and PES schemes.	x	+	\$	✓

4.4 Priority Actions

Six priority actions were identified during the Knowledge Management Workshop in April of 2019. Each of these priority actions was further investigated in joint breakout groups with representatives from Malawi and Mozambique to co-develop them into implementable projects. These priority actions, elaborated further in Annex IV, are as follows:

Action 1.1.1: Establish a joint Shire River Basin Committee for coordination and cooperation in conjunctive water resources management over the Shire River Basin and its shared aquifers.

Action 1.2.2: Identify areas for joint study and research.

Action 2.1.1: Develop a Memorandum of Understanding on data sharing between the two Member States taking into account the existing ZAMCOM protocol on data sharing.

Action 2.3.2: Develop a data sharing portal between Malawi and Mozambique countries that facilitates a joint information system in consultation with Zambezi Water Resources Information System (ZAMWIS) developed under ZAMCOM.

Action 4.1.6: Promote joint proposals to mobilise funds for specific projects within the Shire River Basin for activities related to sustainable catchment and natural resources management.

Action 4.2.2: Train personnel involved in collecting and researching information related to surface water and ground water and water quality issues.

4.5 Indicators for Each Objective

Indicators are measurable values or devices that support decision making, ensure accountability and measure results and impacts of actions toward the defined objectives.

4.5.1 Indicators for Objective 1

Objective 1 is to reduce the adverse impacts of climate variability and change (i.e. floods and droughts) through joint conjunctive management of surface water and groundwater, including the use of natural infrastructure (e.g., aquifers and wetlands) and implementation of early warning systems. Potential indicators for measuring progress include:

- Establishment and activity of committees or institution established and operationalised for decision making responsibility about climate variability and change at the ZAMCOM level and at local level.
- Establishment of an integrated decision support system, joint model, and or joint information management system created and actively utilised to predict and responding to climate variability and change.
- Number of interventions for climate resilience (e.g. flood protection) implemented by local committees at country level.
- Number of of accurate early warnings enabled by the early warning system.
- Reduction in number of households affected by climate-related events.
- Increase in agricultural productivity according to precipitation trends.

- Total economic losses from climate-related events.
- Establishment of water use stress levels and efficiency

4.5.2 Indicators for Objective 2

Objective 2 is to improve the quality and quantity of data for improved conjunctive water management decision making by instituting a joint monitoring system for data collection, sharing and standardization. Potential indicators for measuring progress include:

- Signed Memorandum of Understanding on data sharing between Malawi and Mozambique countries.
- Number of exchange visits conducted to countries or shared watercourses that have successfully implemented data sharing programs.
- Number of new monitoring stations established or existing ones improved to enable generation of weather and climate data.
- Development and utilisation of a data sharing portal between Malawi and Mozambique.

4.5.3 Indicators for Objective 3

Objective 3 is to strengthen national and transboundary institutional cooperation to improve water resources development and management for sustainable development of the basin and its shared aquifers. Potential indicators for measuring progress include:

- Number of laws, policies, and regulations harmonized and/or developed on topics related to joint water resources management.
- Structures in place for ongoing analysis of investments plans between countries that apply to the Shire River Basin and its shared aquifers.

4.5.4 Indicators for Objective 4

Objective 4 is to promote catchment management (e.g., reducing overexploitation, revitalizing natural vegetation) in order to enhance water quality, stream flow and groundwater retention. Potential indicators for measuring progress include:

- Establishment and utilisation of joint Catchment Management Plan and Guidelines created for the Shire River Basin
- Achievement of joint accord or agreement signed regarding commitments to address catchment management in the basin.
- Assessment of water resource quality and quantity in the Shire River Basin completed.
- Degree of modernization and expansion of the monitoring system for the quality and quantity of surface water and groundwater.
- Number of waste disposal structures implemented in villages, markets, agricultural and urban areas.
- Number of afforestation efforts implemented (trees planted to hold sediment; protected areas designated).
- Reduction in the annual mass of aquatic weeds received at hydropower stations.

- Reduction in sediment loading (total suspended solids) in the surface water.
- Increase in Dissolved Oxygen in the surface water.

5.0 Transboundary Governance Frameworks

The Shire River Basin is governed separately by national-level institutions in each country, and the SAP is the first joint plan developed between the two Member States, Malawi and Mozambique, and applied to the Shire System. The SAP falls under several international agreements and action plans that must be considered during implementation.

5.1 International Frameworks

Mozambique and Malawi are party to several international agreements, the Sustainable Development Goal (SDG) process, and more than five regional water frameworks.

5.1.1 UN Convention on the Law of the Non-navigational Uses of International Watercourses (1997)

The United Nations Convention on the Law of the Non-navigational Uses of International Watercourses was adopted by the UN General Assembly on 21 May, 1997. The general principles of the convention include equitable and reasonable utilization and participation, an obligation not to cause significant harm, the general obligation to cooperate, regular exchange of data and information, and that no use of an international watercourse enjoys inherent priority over other uses. The convention also addresses notification of planned measures, the protection, preservation and management of ecosystems and a number of other topics.

5.1.2 2030 Agenda and the Sustainable Development Goals (SDGs) (2015)

The SDGs are a set of 17 global goals for sustainable development, set for the year 2030 by the United Nations General Assembly in 2015. They are part of Resolution 70/1 of the UN General Assembly, called “Transforming our World: the 2030 Agenda for Sustainable Development” or the “2030 Agenda). SDG 6 is “to ensure availability and sustainable management of water and sanitation for all”. Targets under SDG 6 address equitable access to safe and affordable drinking water and sanitation and hygiene, improved water quality, water use efficiency and water stress, and ecosystem health. Target 6.5 highlights the role of transboundary cooperation of water resources with the target to “by 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate”.

5.2 Southern African Development Community (SADC) Regional Frameworks

5.2.1 SADC Revised Protocol on Shared Watercourses (2000)

In recognition of the UN Convention on the Law of the Non-navigational Uses of International Watercourses and Agenda 21, the Revised Protocol on Shared Watercourses was signed by members of the SADC in 2000. The objective of the protocol is to foster closer cooperation for judicious, sustainable and coordinated management, protection and utilisation of shared watercourses, and to advance the SADC agenda of regional integration and poverty alleviation. To achieve this objective, the protocol includes provisions for promotion and facilitation of the establishment of shared water courses

agreements and institutions, advancement of sustainable, equitable and reasonable utilisation of the shared watercourses, promotion of coordinated and integrated, environmental sound development and management of shared watercourses, and promotion of the harmonisation and monitoring of legislation and policies for planning, development, conservation, protection and allocation of shared water resources (SADC, 2000).

5.2.2 SADC Regional Water Policy (2005)

The SADC Regional Water Policy was established to provide a framework for “sustainable, integrated and coordinated development, utilization, protection and control of national and transboundary water resources in the SADC region, for the promotion of socio-economic development and regional integration and improvement of the quality of life of all people in the region”. The policy is informed by 12 policy principles, guided by international and SADC-level agreements regarding water management. The policy addresses the following sections:

- i) Regional Cooperation in Water Resources Management
- ii) Water for Development and Poverty Reduction
- iii) Water for Environmental Sustainability
- iv) Security from Water-related Disasters
- v) Water Resources Information and Management
- vi) Water Resources Development and Management
- vii) Regional Water Resources Institutional Framework
- viii) Stakeholder Participation and Capacity
- ix) Financing Integrated Water Resources Development and Management in the Region

While the policy provides a framework for approaching policy and legislation about the various topics, it does not include prescriptive legislation. The Regional Water Policy was intended to be implemented through a Regional Water Strategy (SADC, 2005).

5.2.3 SADC Regional Water Strategy (2006)

The Regional Water Strategy gives effect to the Regional Water Policy, by detailing how the policy might be implemented. More detailed 5-year strategic plans are meant to emerge out of the Regional Water Strategy to articulate who will conduct what activities and at what time. The strategy follows the same set of topics as the Regional Water Policy, detailing a number of high-level strategies for implementing the framework of the policy. For example, the chapter addressing regional cooperation in water resources management includes strategies such as “promote linkages between water sector and other sectoral institutions at a regional, shared watercourse and national level” and “strengthen the capacity of relevant regional and national institutions in dispute resolution” (SADC, 2006).

5.2.4 SADC Regional Strategic Action Plan on Integrated Water Resources Development and Management: Phase IV (2016-2020)

The SADC Regional Strategic Action Plans (RSAP) operationalize the SADC Regional Water Policy and Strategy through implementation steps to be conducted over a specified time period (e.g., 5 years). Phase IV addresses the 2016-2020 period. The plan focuses around 8 major programme areas, including 1)

regional instruments for cooperation, 2) establishment and strengthening of oceanic states cooperation and shared watercourse institutions, 3) gender mainstreaming, youth and stakeholder engagement, 4) capacity development and research, 5) infrastructure development, operation and maintenance, 6) water resources management for sustainable development, 7) climate variability and change, and 8) industrialisation and nexus approaches (SADC, 2016).

5.2.5 SADC Regional Infrastructure Development Master Plan – Water Sector Plan (2012)

The SADC Regional Infrastructure Development Master Plan defines the infrastructure development requirements and conditions to realize the SADC Agenda in various sectors. It is intended as a strategic framework document to guide the implementation of efficient and cost-effective infrastructure networks, integrated across sectors. The plan outlined a 3-phased approach to the water sector implementation plan. Phase 1 (2013-2017) focused on institutional reform, capacity building, project preparation and implementation. Phase 2 (2018-2022) and 3 (2023-2027) are to focus on implementation, capacity building, and monitoring and evaluation. The plan also defines possible project financing sources and implementation agencies for project profiles in the water sector (SADC, 2012).

5.2.6 SADC Climate Change Adaptation in SADC: A Strategy for the Water Sector (2011)

The Climate Change Adaptation Strategy aims to apply integrated water resources management as a critical building block for building climate resilience in the SADC region. The strategy focuses on implementing “no-regret” and “low-regret” measures over a 20-year period (SADC, 2011).

5.2.7 Guidelines for the Groundwater Development in the SADC Region Report (2001)

The guidelines represent a minimum common standard for groundwater development in the SADC Member States. The document focuses on technical elements to recommend the correct procedures and practices related to groundwater development. It covers several stages of a typical groundwater development program, from project planning and implementation to borehole monitoring and reporting. It is assumed that while the guidelines can have great implications for advancing hydrogeological science and service delivery, Member States can, and should, take steps beyond the minimum common standards in these guidelines (SADC Water Sector Coordination Unit, 2001).

5.3 Zambezi Watercourse Commission (ZAMCOM)

The Zambezi Watercourse Commission (ZAMCOM) is the river basin organisation for the Zambezi River Basin, with Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe as Member States. The Shire River Basin is a sub-catchment of the Zambezi River, so it has been considered in the development of several protocols and strategies that apply to the entire catchment.

5.3.1 Agreement on the Establishment of the Zambezi Watercourse Commission (2000)

The outcome of the Agreement on the establishment of the Zambezi Watercourse Commission was to establish ZAMCOM as the entity for governing equitable and reasonable utilisation and efficient and sustainable development of the water resources of the Zambezi watercourse. The functions of ZAMCOM,

as stated in the Agreement refers to matters of data, management, conflict resolution, sustainable development and awareness, cooperation within and beyond SADC, harmonization of policies and legislation, carrying out assigned functions, and promotion of the Agreement itself (ZAMCOM, 2000).

5.3.2 ZAMCOM Procedures for Notification of Planned Measures

The ZAMCOM procedures for notification of planned measures provides details and clarity for the “duty to notify” articulated in Article 16 of the ZAMCOM Agreement and Article 4 of the Revised SADC Protocol on Shared Watercourses. The procedures are split into two sections that include 1) Notification by a Member State and 2) Request by the Commission or one Member State to another Member State to notify. The procedures articulate the process and form of notification, the content of notification, the procedure for conducting a study and evaluation of the planned measure, and the development of a recommendation regarding the planned measure and its alignment with the principles of the ZAMCOM agreement. The procedures also address the need for consultation, negotiation and dispute resolution.

5.3.3 ZAMCOM Rules and Procedures for Sharing of Data and Information Related to the Management and Development of the Zambezi Watercourse (2016)

The ZAMCOM Rules and Procedures for Sharing of Data and Information Related to the Management and Development of the Zambezi Watercourse apply to the sharing of data and information relevant to the principles of the ZAMCOM Agreement. The Rules and Procedures are split into two parts addressing 1) the rules for sharing data and information, including data sharing, cost sharing, and institutional roles, and 2) technical procedures and specifications for specific procedures of data and information exchange (ZAMCOM, 2016). More specifically, the objectives aim to specify:

- a) The type of data and information to be shared, including the source, frequency, format, standards, quality assurance and methods of transfer.
- b) Roles and responsibilities of involved institutions.
- c) Time frames for supplying the agreed data and information.
- d) Ownership and access rights to shared data and information.

5.3.4 Integrated Water Resources Management Strategy and Implementation Plan for the Zambezi River Basin (2008)

The International Water Resources Management Strategy and Implementation Plan for the Zambezi River Basin provides a joint strategy for management of the Zambezi River. It was preceded by a Rapid Assessment to investigate the biophysical and socio-economic baseline. The Shire sub-catchment is emphasized at various point throughout the strategy, including the need to reduce human-wildlife conflicts in the lower part of the Shire River basin in Malawi and Mozambique, to control aquatic weed infestation to the lower part of the Shire River basin, and to promote sustainable fisheries management in the Shire River Basin (ZAMCOM, 2008).

5.4 Implications of Transboundary Governance Mechanisms on Advancement of SAP Actions

The implications of the existence of the transboundary governance mechanisms at international, SADC, and ZAMCOM levels described on the SAP for the Shire System are as follows:

Protocols and procedures for transboundary water management: Several protocols and procedures have already been developed to address the mechanisms for coordination between countries, such as the ZAMCOM Rules and Procedures for Sharing of Data and Information Related to the Management and Development of the Zambezi watercourse. However, these protocols and procedures have not necessarily been implemented to their full extent in the Shire System. Where protocols and procedures for joint management are identified as actions within the SAP for the Shire System, it is critical to ensure that formulation of the procedures specific to the Shire System are consistent with guidance in ZAMCOM and SADC documents. Nonetheless, well-crafted joint actions on the Shire River Basin, such as those related to data exchange, should be emphasized and put principles established at ZAMCOM and SADC levels in practice.

Planned measures in the Shire River Basin and its shared aquifers: The SAP for the Shire System contains several planned measures that directly address identified transboundary issues between the countries of Malawi and Mozambique. While these actions can be prioritized and implemented according to arrangements between the two countries, potential actions fall within the framework of ZAMCOM or SADC. As such, prior to implementing joint measures within the Shire System, it will be important to seek opportunities to collaborate with, or secure endorsement from, broader ZAMCOM- or SADC-level authorities to ensure measures are appropriately nested in broader frameworks.

Principles for conjunctive, transboundary water management: Implementation of actions contained within the Shire River Basin SAP should actively contribute to the principles elaborated in overarching transboundary agreements, such as the equitable and sustainable utilisation of water described in the *Revised Protocol on Shared Watercourses* in SADC (2000) and the importance of a participatory approach to water development described in Dublin Principles. Actions in the SAP are believed to reinforce and enhance realization of regional water principles, but care should still be taken to ensure that actions in the Shire River Basin SAP do not inadvertently disrupt or counter broader principles.

6.0 Conclusion

The prevalence of Strategic Action Plans in transboundary waters in Africa reflects the importance of joint water management, but effort is urgently needed on SAP implementation. Strategic Action Plans (SAPs) are now widespread in transboundary waters in Africa, responding to the growing need to enhance the benefits that can be obtained from the numerous international watercourses on the continent. While SAPs, and the TDAs that precede them, have undoubtedly improved collaboration on the development and management of the shared resources they address, the long-term utility of SAPs must move beyond objectives of peace and international cooperation. The severity of water challenges in Africa calls for follow-up and implementation of priority actions to ensure that risks are reduced, benefits harnessed, and sustainable development and management is accelerated.

Challenges that need to be addressed in the Shire River-Aquifer System. The severity and impact of the water challenges in the Shire System are clear. Some have manifested as extreme events in the relatively short duration of this project, such as the floods that devastated Malawi and Mozambique in March of 2019. Others, including water quality challenges like salinity, are chronic in nature. Further managerial challenges, such as insufficient data and information availability and exchange, inhibit the ability to implement evidence-based solutions on-the-ground. The bottom line is that changes are needed in the status quo to improve conditions for the population relying on the shared resources of the Shire System. While change can certainly be undertaken separately by the national governments of Malawi and Mozambique, the platform of transboundary cooperation presents opportunities to implement more optimal approaches based on hydrologic boundaries and access transboundary investment opportunities that may not otherwise be available.

Time for action is overdue. The Shire SAP outlines a vision for joint management of the shared resources focused on enhancing cooperation for improved livelihoods and socioeconomic prosperity. The vision is consistent with broader development aims of the two countries, ZAMCOM and the SADC region. The Shire SAP outlines four key objectives that are also aligned with the goals of overarching institutions. Finally, actions were identified under the four objectives, resulting in a final list of 39 actions. Fourteen of these actions call for intensive cross-border engagement between the two countries, 14 are short-term in nature and relatively inexpensive, and eight were deemed to be urgent. Given the context of the Shire, now is the time to move these actions forward. A set of indicators for each objective was generated to assist countries in moving forward with M&E of the actions in the SAP.

The next step is to use the momentum from the development of the SAP to make tangible interventions in water management institutions and on the ground. Completion of the SAP process should trigger the start of a larger effort to implement joint actions in the Shire System. Moving forward, focus can be equally placed on i) institutionalization of the SAP under an appropriate existing transboundary body (e.g., ZAMCOM) and/or a newly created joint committee, and ii) implementation of actions as soon as possible, taking advantage of information about low-cost, short-term actions and those that are most urgent. The most critical element of joint management of the Shire System is the will and capacity of actors to implement actions and improve long-term water management.

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Annex I: Attendance Lists

National Consultation 1: October 30, 2018 – Tete, Mozambique

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Girma Ebrahim, IWMI
Noimia Godinho, ARA-Zambeze
Jonathan Lautze, IWMI
Anita Lazurko, IWMI
Francisco Macaringue, ARA-Zambeze
Inocência Marsingue, ARA-Zambeze
Nelson Miranda, ARA-Zambeze
Claudio Pacachegue, ARA-Zambeze
Pedrito Soquir, ARA-Zambeze
Custodio Vicente, ARA-Zambeze

National Consultation 1: November 1, 2018 – Lilongwe, Malawi

Patrick Chintengo, MoAIWD
Emmanuel Chiundira, MoAIWD
Girma Ebrahim, IWMI
Solomon Kalima, MoAIWD
Sydney Kamtukule, SRBMP, MoAIWD
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Anita Lazurko, IWMI
Hastings Mbale, MoAIWD
Kamoza Msonda, MoAIWD
Faides Mwale, Malawi Polytechnic
Macpherson Nkhata, MoAIWD
Peaches Phiri, MoAIWD
Zione Uka, MoAIWD

National Consultation 2: December 11, 2018 – Tete, Mozambique

Mima Davidola, ARA-Zambeze
Nélio Julio, ARA-Zambeze
Anita Lazurko, IWMI
Moisés Macambaeo, ARA-Zambeze
Inocência Marsingue, ARA-Zambeze
Claudio Pacachegue, ARA-Zambeze

National Consultation 2: December 13, 2018 – Lilongwe, Malawi

Stanley Chabvunguma, DCCMS
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Zione Uka, MoAIWD

National Consultation 3: February 5, 2019 – Tete, Mozambique

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National Consultation 3: February 7, 2019 – Lilongwe, Malawi

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Joint Workshop: March 7 and 8, 2019 – Blantyre, Malawi

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Knowledge Management Workshop: April 16 and 17, 2019 – Tete, Mozambique

Malawi

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Annex II: Developing objectives

Draft objectives from National Consultation 2

The six draft objectives generated from National Consultation 2 are as follows. These objectives were reviewed during National Consultation 3, with review comments summarized in Table 6.

Objective 1: To enhance strategies for the management and conjunctive use of natural infrastructure (e.g., aquifers and wetlands) and early warning systems to reduce the adverse impacts (i.e. floods and droughts) to vulnerability and change.

Objective 2: To ensure the joint planning, monitoring and assessment of both surface water and groundwater quality, including action to preserve the ecosystem and reduce water quality challenges for the benefit of the basin.

Objective 3: To institute a joint monitoring system for data collection, validation and quality control in order to capture relevant data to be incorporated in decision making.

Objective 4: To enhance coordinated development, management and utilisation of groundwater and surface water in order to harness all potential benefits from the Shire basin for sustainable development and integrated management.

Objective 5: To strengthen national and transboundary institutional coordination to standardize information, improve responses to challenges and ensure better management in order to realise the full potential for sustainable development of the Shire River basin and its shared aquifers.

Objective 6: To promote best practices of catchment management for sustenance of groundwater and surface water in both riparian states.

Comments on draft objectives from Malawi and Mozambique – National Consultation 3

Draft objectives	Comments	
	Mozambique	Malawi
1 To enhance strategies for the management and conjunctive use of natural infrastructure (e.g., aquifers and wetlands) and early warning systems to reduce the adverse impacts (i.e. floods and droughts) to vulnerability and change.	<ul style="list-style-type: none"> Objective could be combined with objective 2 (water quality) 	<ul style="list-style-type: none"> Objective overlaps with objective 6 (catchment management)
2 To ensure the joint planning, monitoring and assessment of both surface water and groundwater quality, including action to preserve the ecosystem and reduce water quality challenges for the benefit of the basin.	<ul style="list-style-type: none"> Objective could be combined with objective 1 (climate variability and change) 	<ul style="list-style-type: none"> Objective overlaps with objective 6 (catchment management)
3 To institute a joint monitoring system for data collection, validation and quality control in order to capture relevant data to be incorporated in decision making.	<ul style="list-style-type: none"> Objective is one of the most critical Remove the word “validation” 	

4	To enhance coordinated development, management and utilisation of groundwater and surface water in order to harness all potential benefits from the Shire basin for sustainable development and integrated management.	<ul style="list-style-type: none"> Objective overlaps with all others Objective may be rewritten as <i>“to identify all the potential benefits on the Shire basin of both countries for sustainable development and integrated management”</i> 	<ul style="list-style-type: none"> Objective overlaps with all others Language of “coordination” is similar to objective 5; may merge objectives 4 and 5
5	To strengthen national and transboundary institutional coordination to standardize information, improve responses to challenges and ensure better management in order to realise full potential for sustainable development of the Shire River basin and its shared aquifers.	<ul style="list-style-type: none"> Language of “cooperation” is better than “coordination” 	<ul style="list-style-type: none"> Objective is compatible with objective 4; may merge objectives 4 and 5
6	To promote best practices of catchment management (land and water use practices that protect and improve the quality of the water and other natural resources) or sustenance of groundwater and surface water in both riparian states.	<ul style="list-style-type: none"> Objective overlaps with others 	<ul style="list-style-type: none"> Objective partially overlaps with objective 1 (climate change) and 2 (water quality)

5.2.2 Revised objectives from National Consultation 3

The review comments from Table 6 resulted in a consolidated list of objectives in each country as below.

Revised Objectives, Mozambique

Objective 1: To reduce the adverse impacts of climate variability and change (i.e., floods and droughts), preserve the ecosystem, and address water quality challenges by enhancing joint conjunctive management of surface water and groundwater, including the use of natural infrastructure (e.g., aquifers and wetlands), and early warning systems.

Objective 2: To institute a joint monitoring system for data collection and quality control in order to capture and incorporate relevant data in decision making.

Objective 3: To promote best practices of catchment management (land and water use practices that protect and improve the quality of the water and other natural resources) and identify and harness all the potential benefits in the Shire Basin for sustenance of groundwater and surface water in both riparian states.

Objective 4: To strengthen national and transboundary institutional cooperation to standardize information and ensure better management in order to realise full potential for sustainable development of the Shire River basin and its shared aquifers.

Revised Objectives, Malawi

Objective 1: To reduce adverse impacts of climate variability and change (i.e. floods and droughts) by enhancing conjunctive management of natural infrastructure (e.g., aquifers and wetlands) and early warning systems.

Objective 2: To reduce water quality challenges and sustain ground and surface water resources by promoting best practices of joint planning and catchment management in within and across riparian states.

Objective 3: To capture relevant data for decision making by instituting a joint monitoring system for data collection, sharing and standardization.

Objective 4: To strengthen national and transboundary institutional coordination to ensure better management in order to harness all potential benefits for sustainable development of the Shire Basin and its shared aquifers.

Synthesizing to final objectives

The objectives for the Shire System aim to address key issues identified in the TDA and achieve the shared vision. Upon review of the original 6 objectives and consolidation into 4 separate sets of objectives in each country, synthesis of the separate objectives from Malawi and Mozambique was straightforward due to key points of alignment. However, Mozambique placed water quality issues alongside climate risk, while Malawi placed water quality issues alongside catchment management. The final list of objectives placed water quality challenges alongside catchment management due to the strong linkages between water quality and environmental standards.

Annex III: Urgency of actions climate, population growth and economic growth risks

Actions categorized according to special urgency under high climate risk, high population growth and rapid economic growth

Action	Total increased urgency	High climate risk	High population growth	Rapid economic growth
1.1.1 Establish a joint Shire River Basin Committee for coordination and cooperation in conjunctive water management over the Shire River Basin and its shared aquifers.	✓✓✓	✓	✓	✓
1.1.2 Create a local committee in each country for coordinating efforts to manage the Shire River Basin, ensuring that all districts are well represented.	✓✓✓	✓	✓	✓
1.1.3 Ensure priority issues of transboundary surface and groundwater management are clearly articulated and agreed upon.				
1.1.4 Make comparative analysis of relevant laws, policies and regulations for joint water resources management to develop recommendations for possible harmonization.	✓			✓
1.2.1 Identify areas for joint training in e.g. IWRM using appropriate technology and indigenous knowledge.	✓✓		✓	✓
1.2.2 Identify areas for joint studies and research				
1.3.1 Analyze investment plans in respective countries that apply to the Shire river Basin and its shared aquifers to promote joint investments (joint project implementation).	✓✓✓	✓	✓	✓
1.3.2 Provide resources that will promote advancement in institutions, use of relevant equipment, and capacitation and training of personnel.	✓		✓	
2.1.1 Develop an MoU on data sharing between the two Member States, taking into account the existing ZAMCOM protocol on data sharing.	✓✓	✓		✓
2.1.2 Conduct a comprehensive research study to establish the hydrological/ hydrogeological (e.g. quantity and quality) status of water resources in the Shire River Basin and aquifers contained within, particularly in light of climate change scenarios and the need for hydrogeological information (e.g. recharge zone maps, water quality maps and geological cross-sections that include soil type).	✓✓✓	✓	✓	✓
2.2.1 Conduct research to investigate linkages between land and water tenure and aquifer use in order to develop recommendations.	✓✓		✓	✓
2.2.2 Conduct spatial mapping exercise on linkages between sanitation issues and groundwater and surface water pollution in order to develop a subsequent action plan to be addressed.	✓		✓	

2.2.3 Implement training programmes on data collection, analysis and reporting.	✓✓		✓	✓
2.2.4 Conduct exchange visits to countries or shared watercourses that have successfully implemented similar transboundary data programs.				
2.3.1 Promote mobilization of resources for the implementation of the joint monitoring system for quantity, quality, use and abstraction (including acquisition of monitoring equipment).	✓✓		✓	✓
2.3.2 Develop a data sharing portal between Malawi and Mozambique that facilitates a joint information system in consultation with Zambezi Water Resources Information System (ZAMWIS) developed under ZAMCOM.	✓	✓		
3.1.1 Integrate issues of climate variability and change into the decision-making responsibilities of the Shire River Basin Committee (1.1.1).	✓✓	✓	✓	
3.1.2 Integrate issues of climate variability and change into the local committees of each country (1.1.2).	✓✓	✓	✓	
3.2.1 Train personnel involved in collecting and analysing information related to surface and ground water about climate variability and change.	✓	✓		
3.2.2 Undertake research and monitor issues of climate variability and change in the basin.	✓	✓		
3.2.3 Develop an integrated decision support system for predicting and responding to climate variability and change.	✓✓	✓	✓	
3.2.4 Conduct research to map flood prone areas in light of climate change.	✓✓	✓	✓	
3.3.1 Develop a joint model for monitoring and early warning for floods and droughts.	✓✓	✓	✓	
3.3.2 Construct water harvesting structures or dams for multipurpose use (hydro-power, irrigation, flood control).	✓✓✓	✓	✓	✓
4.1.1 Develop a joint catchment management plan and guidelines for the Shire River Basin.	✓✓	✓	✓	
4.1.2 Sign a joint accord or agreement regarding commitments to address catchment management in the basin at the relevant level(s) of government.	✓✓	✓	✓	
4.1.3 Implement measures to better enforce legislation and policy relevant to catchment management.	✓✓		✓	✓
4.1.4 Promote good practices for the exploration and preservation of water quality in the basin according to national and international guidance (e.g., Malawi and Mozambique standards, World Health Organization guidelines).				
4.1.5 Set water extraction standards in alignment with SADC policy.	✓✓		✓	✓
4.1.6 Promote joint proposals to mobilise funds for specific projects within the Shire River Basin for activities related to sustainable catchment and natural resources management.	✓✓✓	✓	✓	✓

4.2.1	Capacitate village-level natural resource management through Catchment Management Committees by forming proper structures and training in Integrated Catchment Management.	✓✓	✓	✓	
4.2.2	Train personnel involved in collecting and researching information related to surface water, groundwater, water quality and catchment management.	✓		✓	
4.2.3	Conduct assessment of the quality and quantity of water resources in the Shire River Basin, including land use and land/forest cover.	✓		✓	
4.2.4	Enhance capacity building and public awareness about catchment management, including addressing the links between student enrollment and education quality to the future health of the catchment.	✓✓	✓	✓	
4.2.5	Promote the utilization of water resources for rural households and other uses in the catchment.			✓	
4.2.6	Promote research on groundwater recharge (natural and managed) within the basin for their proper water resources management and protection.	✓✓✓	✓	✓	✓
4.3.1	Promote development of sustainable infrastructure in the basin to address effective management challenges in agriculture, water storage, wastewater, solid waste, afforestation and forest fires, and energy by adopting both grey and green solutions.	✓✓✓	✓	✓	✓
4.3.2	Extend and modernize the monitoring network for both surface water and groundwater in terms of quality, quantity, and other parameters relevant for catchment degradation.	✓✓✓	✓	✓	✓
4.3.3	Promote investment of public-private partnerships in the Shire River-Aquifer System (e.g. wildlife protection) and PES schemes.	✓			✓

Annex IV: Elaborated Priority Actions

Action 1.1.1: Establish a joint Shire River Basin Committee for coordination and cooperation in conjunctive water management over the Shire River Basin and its shared aquifers (and Action 1.1.2).

Activities:

- Identify third party to facilitate formation of the committee and facilitate formulation of the ToRs/Agreement
- Formation of transboundary committee
- Formation of local committees

Institutions and Expertise:

- Ministry responsible for water affairs in each country, ARA-Zambeze
- Ministry responsible for natural resources, energy and mining in each country
- Ministry responsible for public works
- SADC
- ZAMCOM

Budget:

- Shire River Basin Committee (transboundary committee): \$60,000 USD
- Local committees in Malawi and Mozambique: \$17,000 USD (each)

Foreseen Challenges:

- Approvals for committees and agreements
- Funds mobilisation

Action 1.2.2: Identify areas for joint study and research.

Activities:

- Joint meetings to identify potential areas
- Prepare joint proposals for research
- Identify researchers

Institutions and Expertise:

- Shire River Basin Committee
- Universities
- Institutions responsible for the areas of research (e.g. Department of Meteorology for climate change research)

Foreseen Challenges:

- Funding for conducting research studies and joint meetings

Action 2.1.1: Develop a memorandum of understanding on data sharing between the two member states, taking into account the existing ZAMCOM protocol on data sharing.

Activities:

- Conduct stakeholder meeting to draft MoU
- Submit draft MoU to decision makers
- Incorporate all comments from the decision makers
- Conduct stakeholder workshop
- Signing of the MoU
- Implementation of the MoU

Institutions and Expertise:

- Ministry (responsible for water affairs) – Water Resource Managers
- Ministry of Justice – Lawyers
- Ministry of Foreign Affairs – Lawyers
- Ministry of Lands – Land Planners
- Ministry of Environmental Affairs – Environmentalists
- Ministry of Forestry – Engineers
- Ministry of Agriculture and Fisheries – Engineers and soil scientists
- Ministry of Home Affairs – Administrators

Foreseen Challenges:

- Political will
- Human resources (experts)
- Finances
- Legislation (different in each country)
- Different interests

Action 2.3.2: Develop a data sharing portal between Malawi and Mozambique that facilitates a joint information system in consultation with Zambezi Water Resources Information System (ZAMWIS) developed under ZAMCOM.

Activities:

- Conduct a meeting with ZAMCOM
- Conduct stakeholder meeting to agree on desired information
- Review ZAMWIS data platform to accommodate the information related to groundwater and water quality
- Training of personnel in data collection, storage and reporting

Institutions and Expertise:

- Ministry (responsible for water affairs) - Water Resources Managers, Information Technology (IT) specialists
- ZAMCOM - Administrative and IT specialists
- SADC-GMI - Groundwater and Water Quality Experts
- Academic - IT Specialists and Modelers
- Shire River Basin Committee - IT Specialists and Water Resources Experts

Foreseen Challenges:

- Finances

- Lack of expertise
- Lack of infrastructure (e.g., computers)

Action 4.1.6: Promote joint proposals to mobilise funds for specific projects within the Shire River Basin for activities related to sustainable catchment and natural resources management.

Activities:

- Conduct consultations in both countries
- Engage with stakeholders and technical committees
- Prioritization/ranking of catchment management issues

Institutions and Expertise:

- ARA-Zambeze
- Water sector
- Fisheries, land management, forestry, climate change, agriculture, watershed management experts
- Gender
- Engineers

Foreseen Challenges:

- Financial constraints
- Finding the right individuals in human resources and technical expertise
- Language barrier between two countries
- Exchange rates
- Differences in process, culture and bureaucracy

Action 4.2.2: Train personnel involved in collecting and researching information related to surface and ground water and water quality issues.

Activities:

- Conduct gap analysis for training
- Identify suitable individuals or institutions to design and conduct the trainings
- Agree on training schedules
- Conduct trainings

Institutions and Expertise:

- Water-related government institutions
- Fisheries
- Agriculture
- Land management
- Forestry

Foreseen Challenges:

- Financial constraints
- Bureaucracy
- Human resources
- Training materials

- Translation