

Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States (GMI-PLI)



Regional Gap Analysis and Action Plan Report (Final)
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This report emanates from the project Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States (GMI-PLI) commissioned by the Southern African Development Community Groundwater Management Institute (SADC-GMI), and executed by Pegasys.

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FOREWORD

The Southern African Development Community (SADC) Member States, through the support of International Cooperating Partners have gone through a series of Water Sector Reforms which varied in terms of policy, legal and institutional development. The focus of the water sector reforms has been on Integrated Water Resources Management and aimed at achieving sustainable and equitable distribution of water resources in the respective Member States. To a large extent, the water sector reforms did not comprehensively address the sustainable management of groundwater resources, yet 70% of the population in the SADC region depend on it. Climate change continues to negatively affect the availability of surface water, placing significance reliance on the use of groundwater for both urban and rural supply throughout the region. Human wellbeing, livelihoods, food security, ecosystems, natural habitats, industries and urban centres growth throughout the SADC Region are increasingly becoming more reliant on groundwater. The SADC region in general has an abundance of groundwater resources. However, due to several factors which include the lack of an enabling policy, legal and institutional environment, only an estimated 1.5% of the available renewable groundwater resources are currently being utilised.

It is estimated that there are about 30 Transboundary Aquifers (TBAs) and 15 transboundary river systems and that these systems are central to the water security of the region. There is therefore a need for Members States to establish and strengthen existing policy, legal and institutional frameworks to achieve equitable and sustainable access to water resources through joint management of the transboundary resources. It is in view of the above and in response to the need to strengthen the sustainable use of groundwater resources conjunctively with surface water at both the national and regional level, that the Southern African Development Community – Groundwater Management Institute (SADC-GMI) was established by the SADC Secretariat, on behalf of the Member States.

The vision of the SADC-GMI is, “to be a Centre of Excellence in promoting equitable and sustainable groundwater management in the SADC region”. The key focus areas of SADC-GMI are to 1) advocate, raise awareness and provide technical support in SADC around sustainable management through the dissemination of information and knowledge; 2) create an enabling environment for groundwater management through policy, legal and regulatory frameworks; 3) promote action-oriented research; 4) promote impact-oriented capacity building and training for groundwater management in the region; 5) lead and promote regional coordination for groundwater management; and 6) support infrastructure development for groundwater management.

In pursuance of the focus area of creating an enabling environment, SADC-GMI implemented the project entitled “Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States, (GMI-PLI)”. The methodology for said project included the development of the Desired Future State, conducting a baseline study of best practices, and description of policy, legal and institutional frameworks which promote sustainable groundwater management. Using an in-Country Experts model, a systematic analysis of the existing policy, legal and Institutional frameworks in comparison with the Desired Future State was conducted to identify gaps that required to be addressed in order to fulfil the SADC-GMI mandate – to achieve sustainable groundwater management in all 16 SADC Member States. The analytical assessment of the gaps identified at national level culminated in the production of 16 National Gap Analysis & Action Plan Reports and the higher-level Regional Gap Analysis Report. The latter summarises the findings across the SADC region.

This Regional Gap Analysis provides an overview of the existing gaps in policy, legislation, strategy, guidelines and the institutional frameworks within the SADC region and further suggests enablers required to unlock the identified gaps/challenges. The report also identified national trends observed in the Member States including strengths and good practices observed at a national level. The action plan provides further guidance for the SADC region to develop an implementation roadmap through a process of prioritising the Strategic Actions in close liaison and in consultations with all relevant stakeholders. It is hoped that this Regional Gap Analysis Report will ultimately advance the groundwater narrative and bring it at par with surface water in terms of policy, legal and institutional frameworks which will no doubt enhance sustainable groundwater management at a national and regional level in the SADC Region.

James Sauramba
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LIST OF ACRONYMS

ACRONYM	DEFINITION
AMCOW	African Ministers' Council on Water
CIWA	Cooperation in International Waters in Africa
CRIDF	Climate Resilient Infrastructure Development Facility
DFS	Desired Future State
DMC	Drought Monitoring Centre
DoW	Department of Water
DRC	Democratic Republic of Congo
DSDM	Dynamic Systems Development Method
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EU	European Union
GDE	Groundwater Dependant Ecosystem
GDMP	Groundwater and Drought Management Project
GDP	Gross Domestic Product
GEF	Global Environment Facility
GESI	Gender, equity and social inclusion
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GMI	Groundwater Management Institute
GMI-PLI	Groundwater Management Institute – Policy, Legal and Institutional
GW	Groundwater
GWP	Global Water Partnership
IAH	International Association of Hydrogeologists
IGRAC	International Groundwater Resources Assessment Centre
ITAS	Iullemedeen and Taoudeni / Tanezrouft Aquifer System
IWRM	Integrated Water Resources Management
LIMCOM	Limpopo Watercourse Commission

ACRONYM	DEFINITION
MAR	Managed Aquifer Recharge
MOU	Memorandum of Understanding
NAMA	Nationally Appropriate Mitigation Actions
NAPA	National Programme of Action for Adaptation to Climate Change
NDP	National Development Plan
NFG	National Focus Group
NGO	Non-Governmental Organisation
NGS	National Groundwater Strategy
NWASCO	National Water Supply and Sanitation Council
O&M	Operation and Maintenance
OKACOM	The Permanent Okavango River Basin Water Commission
ORASECOM	Orange-Senqu River Commission
PLI	Policy, Legal and Institutional
RBO	River Basin Organisation
RSAP	Regional Strategic Action Plan
RSAPIV	Regional Strategic Action Plan Four
SADC	Southern African Development Community
SADC-GMI	Southern African Development Community – Groundwater Management Institute
SAP	Strategic Action Plan
SDG	Sustainable Development Goal
TBA	Transboundary Aquifer
TDA	Transboundary Diagnostic Analysis
UFS IGS	University of Free State Institute for Groundwater Studies
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNESCO-IHP	United Nations Educational, Scientific and Cultural Organisation – International Hydrological Programme



ACRONYM	DEFINITION
WRDM	Water Resource Development and Management
WRFSA	XX
WRTC	Water Resources Technical Committee
WUA	Water User Association

1. INTRODUCTION

1.1. Background to the GMI-PLI Project

The critical role of groundwater in building the region's resilience to climate change and improving water security is reflected by the World Bank in their June 2017 online article: *People in Southern Africa are largely dependent on groundwater shared between countries and communities for health and well-being, food production, and economic growth.* As climate variability alters the amount of surface water that is available, people in the region are increasingly turning to groundwater, a resource that is already challenged by threats of depletion and pollution.

The sustainable management of groundwater is a key part of the broader water security for the region, especially in understanding transboundary aquifers. The Southern African Development Community (SADC) has established the Groundwater Management Institute (GMI) to better understand the region's needs and improve their groundwater management capabilities.

The SADC Groundwater Management Institute (SADC-GMI) is the implementing agency of the World Bank funded Sustainable Groundwater Management in SADC Member States Project. This funding is secured through the Global Environment Facility (GEF) and the Cooperation in International Waters in Africa (CIWA) trust. Part of this funding has been dedicated by the SADC-GMI to respond to gaps in the existing policy, legal and institutional (PLI) frameworks for groundwater management in the region towards fulfilling one of four main components of the project –“Enhancing institutional capacity of governments in SADC Member states and transboundary organisations”. The objective is to be met through a series of organised steps which broadly included the development of a benchmark document called the Desired Future State Document, a Gap Analysis and high-level Action plan for all SADC Member States and for the region, development of a suite of guidelines to strengthen groundwater management regionally. To inform the guideline on the development of a groundwater PLI Roadmap, Tanzania was selected as a pilot from which to draw lessons and develop the process.

This report presents the outcomes of the regional gap analysis.

1.2. Socio-economic drivers in SADC

The Southern African Development Community (SADC) consists of 16 Member States sharing the common objectives to achieve economic development, peace and security, and growth, alleviate poverty, enhance the standard and quality of life of the peoples of Southern Africa, and support the socially disadvantaged through regional integration. The region's economic outlook faces major headwinds: high unemployment, weak commodity prices, fiscal strain, increasing debt, and high inflation (AfDB, 2018). Water plays a significant role in the economy of the region and as with global trends, represents significant risk to ongoing economic development (World Economic Forum, 2018).

The total water use in SADC is approximated at 50 000 million m³/annum and sectoral water use varies from country to country (**Figure 1**), but for the SADC region as a whole, the agricultural sector is the largest

water user, using 81 per cent of total use. The domestic sector uses 15 per cent and the industrial sector (including mining) uses 4 per cent of total water use (Pietersen & Beekman, 2016).

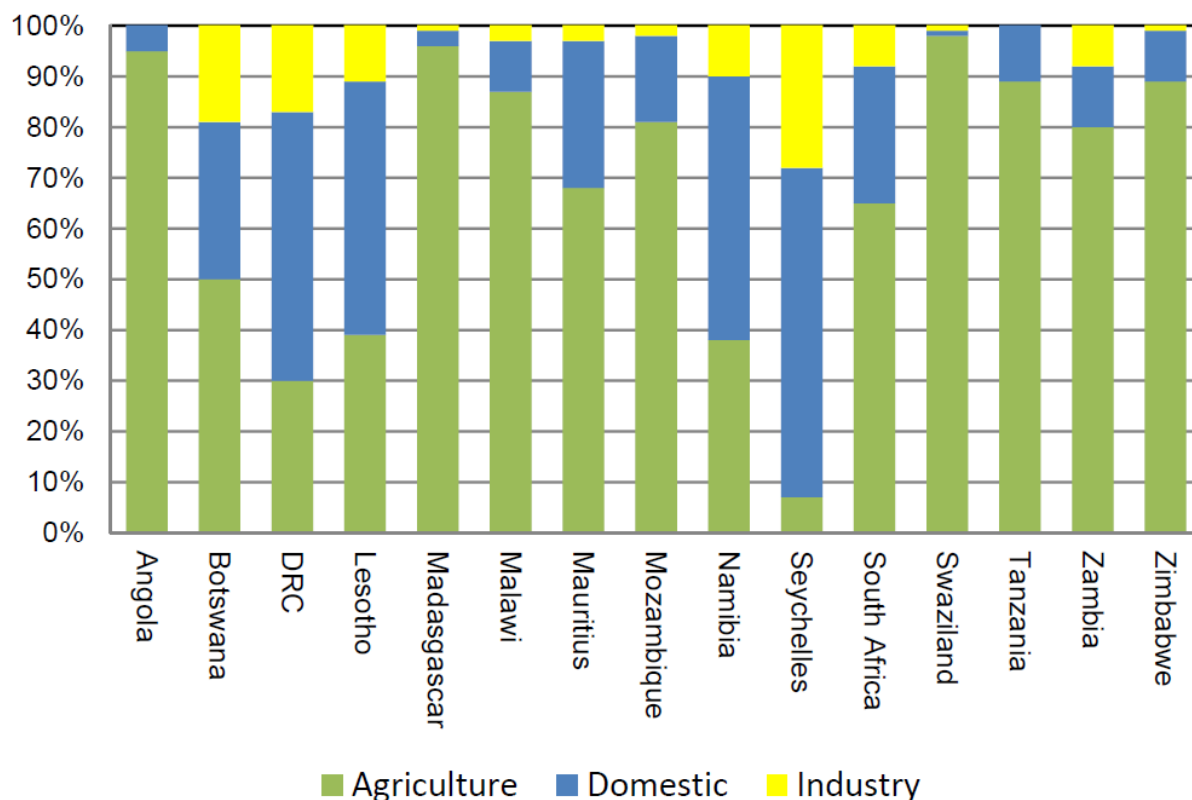


Figure 1: Water use by sector in SADC countries (data compiled from Aquastat general database) (Pietersen and Beekman, 2016)

SADC has about 280 million people of which 40 per cent of the population has no access to an adequate safe drinking water supply, whilst 60 per cent has no access to adequate sanitation services (SADC, 2016). In SADC, like the rest of Africa, the urban population growth is outpacing economic, social and institutional development (Bello-Schünemann & Aucoin, 2016). The unplanned urban population growth (**Table 1**) remains a serious threat to water security in cities and informal settlements of sub-Saharan Africa (Dos Santos, et al., 2017). Kinshasa (Democratic Republic of Congo – DRC) is already classed as a megacity with a population exceeding the 10 million mark with Johannesburg (South Africa), Dar es Salaam (Tanzania), and Luanda (Angola) emerging as megacities by 2030 (United Nations, 2016; Van Niekerk & Le Roux, 2017). The high rate of urbanisation is already putting strain on water infrastructure; pose problems for human and environmental health; result in disparate socioeconomic development and access to water; and result governance failures of water management institutions.

Table 1: Percentage of urban slum dwellers in SADC (Van Niekerk and Le Roux, 2017)

SADC country	Percentage urban dwellers living in slums
Madagascar	76
Malawi	69
Angola	66
Tanzania	64
DRC	62
Zambia	57
Lesotho	54
Namibia	34
Zimbabwe	24
South Africa	23

Despite the urbanisation trends, a significant percentage of the SADC population is rural. Most of the extreme poverty in Southern Africa are located in the rural areas and 85 per cent of all poor people in the sub-region depend on agriculture for their livelihood (UNECA - SA, 2012). The sector constitutes the primary source of subsistence, employment and income for 156 million of the sub-region's total population of 280 million (55 per cent) and accounts for close to 8 per cent of its gross domestic product (GDP) (UNECA-SA, 2012). This is the case in Zambia, where agriculture is a major socio-economic driver, employing the largest number of workers - mainly informal. Similarly, the economy of Swaziland is predominantly agriculture-based with 77 per cent of the population in rural areas who derive their livelihoods from subsistence agriculture. Although, over 90 per cent of agricultural activities [in SADC] are mainly smallholder systems and rain fed (Nhamo, et al., 2018; Nhemachena, et al., 2018) there are plans to upscale irrigated agriculture [in SADC]. There are about 50 million hectare (ha) of irrigable land available in the region, of which only 3.4 million ha (7 per cent) is currently irrigated with the target to increase land under irrigation to 20 per cent (SADC, 2016).

In most SADC countries, industrial, mining and energy developments contribute significantly to the national GDP. The potential for growth in these sectors is heavily dependent on intensive water use (SADC, 2016). Roughly half of the world's vanadium, platinum, and diamonds originate in the region, along with 36 per cent of gold and 20 per cent of cobalt (SADC, 2012). However, mining development has had negative impacts on water resources and many mining houses are engaging with various stewardship processes to address these impacts.

Along with growth comes increased demand for energy and the region has, in recent years, supported significant electrification programmes. The SADC region has enormous potential for hydropower, especially in Angola, DRC, Mozambique and Zambia (Mabhaudi, et al., 2016). The majority of power generation is from coal (75 per cent) and hydropower (Schreiner & Baleta, 2015). Most (75 per cent) of the electricity produced in the region is not sustainable from a water perspective (Mabhaudi, et al., 2016).

In countries that have undergone civil conflicts, these wars have undermined investments aggravated by water infrastructure destruction. This has resulted in the regress of water supply. Significant investments are required to rebuild the infrastructure in these countries, for example, in the DRC an estimated \$2 billion is required for water infrastructure projects (Partow, 2011).

Generally, water resources will be impacted negatively by climate change. Therefore, issues related to climate change, climate variability and climate proofing need to be continuously addressed in the SADC water sector regional plans and programmes (SADC, 2016). Namibia, for example, is expected to experience reduced rainfall of 10 to 30 per cent relative to the present situation by 2050 and 2080 (Reid, et al., 2007). Across the region there is an expectation of increased occurrence of extreme hydrological events, requiring the region to develop improved adaptive capacity to flood and drought events.

In addition to this, the region has 15 transboundary rivers shared by two or more SADC countries. This adds an important complexity to the management and development of water resources where Member States wish to enjoy shared beneficiation from these shared watercourses.

Water security is pivotal for economic growth, sustainable development and poverty reduction in SADC (Pietersen, et al., 2018). Increasing aridity and dwindling surface water supplies are resulting in new opportunities for groundwater. Drivers that have a major bearing on its unfolding role and governance [in SADC] include the widespread poverty and food insecurity in the region, the continuing need for a basic domestic water supply in both rural and informal urban areas, rapid urbanisation, and the need for drought security as part of all water provision (Braune & Adams, 2013)

1.3. Groundwater resources in SADC

1.3.1. Status of groundwater resources in SADC

Pietersen and Beekman (2016) carried out an assessment of groundwater management in SADC. Pietersen et al. (2010) compiled the SADC Hydrogeology Map (SADC HGM) which is a general map providing extent and geometry of the regional aquifer systems. The following aquifer types were identified based on the groundwater flow regime (Pietersen, et al., 2010):

- **Unconsolidated intergranular aquifers:** Examples include the Mushawe alluvial aquifer in the Limpopo River Basin, Zimbabwe or the extensive shallow aquifers of the quaternary alluvial plain in the DRC, which formed as a result of deposition of unconsolidated material in river channels, banks and flood plains and the Kalahari aquifer system which consists of undifferentiated inland

deposits of unconsolidated to semi-consolidated sediments extending across parts of the DRC, Angola, Namibia, Zambia, Botswana and South Africa.

- **Fissured aquifers:** Aquifer systems associated with Karoo formations are found extensively throughout the SADC-region. The formations normally have low permeability and are low-yielding. However, where the rocks have been subjected to deformation and intrusion of dolerites, a secondary permeability resulting in good aquifers may be found. The Cape Fold Mountains of South Africa are also associated with fractured rock aquifers. Groundwater occurrence is dependent on tectonic and structural controls resulting in higher hydraulic conductivities and transmissivities.
- **Karst aquifers:** Karst aquifers are water-bearing, soluble rock layers in which groundwater flow is concentrated along secondarily enlarged fractures, fissures, conduits, and other interconnected openings. They are formed by the chemical dissolving action of slightly acidic water on highly soluble rocks, most notably limestone and dolomite. Extensive use is made of karst aquifers in Botswana, Namibia, South Africa, Zambia and Zimbabwe.
- **Layered aquifers:** The Kalahari/Karoo aquifer system shared between Botswana, Namibia and South Africa is an example of a layered aquifer. In the “Stampriet Artesian Basin”. There are two confined regional artesian aquifers in the Karoo sediments, overlain by the Kalahari sediments that often contain an unconfined aquifer system.
- **Low permeability formations:** Low permeability formations are normally associated with basement aquifers. These formations occur extensively throughout the SADC- region.

Pietersen et al. (2010); Pietersen and Beekman (2016) documented the following beneficial uses for groundwater in the region:

- **Rural water supply:** Most rural communities in SADC are served from groundwater resources. Already, about 60 per cent of the Mozambican, population mostly rural, relies on groundwater resources (Pavelic, et al., 2012). Similarly, a significant number of rural communities in Angola are dependent on groundwater resources with groundwater being the main source of drinking water outside the larger towns. The same applies to Zambia (Pavelic, et al., 2012). In the Democratic Republic of Congo (DRC), more than 90 per cent of the rural population relies on groundwater resources (Partow, 2011). Botswana and Namibia, in rural areas, are even more reliant on groundwater resources due to the scarcity of surface water (Krugmann & Alberts, 2012; Republic of Botswana, 2016).
- **Urban water supply:** The City of Tshwane in South Africa obtains a significant portion of its water supply from boreholes and springs, which is blended with surface water within the bulk water distribution system (Dippenaar, 2013). Lusaka, the capital of Zambia, obtains about 60 per cent of its water requirements from groundwater resources (Nussbaumer, et al., 2016). Current abstraction of groundwater in Lusaka is estimated at 90 million cubic metres per annum (m³/annum) (Kang'omba & Bäumle, 2013). Dodoma, the capital city of the Tanzania, mainly

depends on groundwater (Elisante & Muzuka, 2017). Groundwater has played a crucial role during droughts in Bulawayo, the second largest city in Zimbabwe (Mukuhlani & Nyamupingidza, 2014).

- **Water security/Conjunctive use:** In the case of Windhoek, the capital of Namibia, groundwater contributes about 10 per cent to the water supply (Christelis & Struckmeier, 2011). A system of artificially recharging groundwater resources has been put in place (Murray, et al., 2018). The aim is to make available up to 8 million m³/annum of groundwater for abstraction (Tredoux, et al., 2009). The present Windhoek water demand is about 20 Mm³/annum (Christelis and Struckmeier, 2011). The town of Atlantis in South Africa has further enhanced its water supplies through artificial recharge (Bugan, et al., 2016).
- **Food security:** An important component of agricultural policies in the region is to increase incomes of the poorest groups in society through opportunities for small to medium-scale farmers. In Angola, the use of groundwater for irrigation is important in areas where the rainfall is not sufficient for crops and where rivers are unreliable. Groundwater irrigation is also important in the coastal areas and in the southwestern provinces of Angola. Shallow groundwater resources are particularly suitable for use by farmers, since access costs are relatively low. In Zimbabwe, alluvial aquifers associated with the Shashani River, a tributary of the Limpopo River, supply water to a number of irrigation schemes.
- **Environmental services:** Many ecosystem services have a direct linkage with groundwater storage, recharge and discharge. Groundwater plays an important role in maintaining ecological infrastructure such as maintaining the functioning of wetland systems and baseflow in rivers. Ecological infrastructure provides significant goods and services and as such groundwater management is an important part of ensuring that these goods and services are sustained. The groundwater and environment are further discussed in section 1.3.4.
- **Economic value:** The economic uses and value of groundwater are not yet fully realised or appreciated in SADC. As articulated earlier, groundwater plays a significant role in maintaining rural economies and localised livelihoods, but equally groundwater is playing an increasingly critical role in supporting urban settlements and industry. Understanding the economic value of groundwater is therefore complex. Over and above the value attained from groundwater use, job creation does benefit society. The protection and management of groundwater is a catalyst for job creation in both the private and public sectors. Besides jobs related to consultancy services, there is employment linked to drilling services and operators of groundwater supply systems. During the start-up phases of mining and industry operations, especially mega-scale projects, groundwater is often critical for water supply. Exploiting energy resources such as shale gas requires groundwater resources for its operations.

In the case of SADC, transboundary aquifer (TBA) is defined as a groundwater unit shared by two or more SADC nations or states (Altchenko & Villholth, 2013; Davies, et al., 2013). This definition precludes transboundary aquifers shared by non-SADC states. Nijsten et al. (2018) mapped seventy-two TBAs in Africa of which those shared by SADC States is given in Table 2.

Table 2: SADC transboundary aquifers (TBAs) and the riparian states (IGRAC & UNESCO-IHP, 2015; Nijsten, et al., 2018).

Code	Name	Countries sharing
AF1	Karoo Sedimentary Aquifer / Orange-Senqu River Basin Aquifers	Lesotho, South Africa
AF2	Coastal Sedimentary Basin V	South Africa, Namibia
AF3	Coastal Sedimentary Basin VI / Coastal Plain Sedimentary Basin Aquifer	Mozambique, South Africa
AF4	Rhyolite-Breccia Aquifer	South Africa, Swaziland, Mozambique
AF5	Stampriet Aquifer System	Botswana, Namibia, South Africa
AF6	Khakhea/Bray	Botswana, South Africa
AF7	Zeerust / Lobatse / Ramotswa Dolomite Basin Aquifer	Botswana, South Africa
AF8	Limpopo	Mozambique, South Africa, Zimbabwe
AF9	Tuli Karoo Sub-Basin	Botswana, South Africa, Zimbabwe
AF10	Northern Kalahari / Karoo Basin / Eiseb Graben Aquifer	Botswana, Namibia
AF11	Save Alluvial	Mozambique, Zimbabwe
AF12	Eastern Kalahari Karoo Basin	Botswana, Zimbabwe
AF13	Cuvelai and Etosha Basin / Ohangwena Aquifer System	Angola, Namibia
AF14	Nata Karoo Sub-basin / Caprivi deep-seated Aquifer	Angola, Botswana, Namibia, Zambia, Zimbabwe
AF15	Coastal Sedimentary Basin IV	Angola, Namibia
AF16	Medium Zambesi Aquifer	Zambia, Zimbabwe
AF17	Shire Valley Alluvial Aquifer	Mozambique, Malawi
AF18	Arangua Alluvial	Mozambique, Zambia
AF19	Sand and Gravel Aquifer	Malawi, Zambia

Code	Name	Countries sharing
AF20	Coastal Sedimentary Basin III	Mozambique, Tanzania
AF21	Karoo Sandstone Aquifer	Mozambique, Tanzania
AF22	Kalahari/Katangian Basin/Lualaba	Zambia, Democratic Republic of the Congo
AF23	Congo Intra-cratonic Basin	Democratic Republic of the Congo, Angola
AF24	Weathered basement	Tanzania, Zambia, Malawi
AF26	Tanganyika	Burundi, Democratic Republic of the Congo, Tanzania
AF27	Dolomitic Basin	Angola, Democratic Republic of the Congo, Congo
AF71	Ncojane Basin	Botswana, Namibia
AF81	Aquifere Cotier	Angola, Democratic Republic of the Congo, Congo, Gabon

Limited hydrogeological studies have been conducted in the TBAs. A diagnostic assessment of the Stampriet Aquifer System that included the collection and processing of national data (hydrogeological, socio-economic and environmental, gender, legal and institutional), and the harmonization of data across all three countries (Botswana, Namibia and South Africa) enabled a joint assessment of the transboundary resource (UNESCO, 2016). From this assessment, it was estimated that at least 20 million m³ per annum was abstracted; 66 percent of this volume is from Kalahari aquifers, 33 percent from the Auob Aquifer and 1 percent from the Nossob aquifer (UNESCO, 2015). The breakdown of water use is as follows: 47 percent for irrigation, 37.5 percent for stock watering, 16 percent for domestic use, and 0.5 percent for tourism. Lack of monitoring data (climate, groundwater abstraction, water levels, water quality) seriously hampered the systematic diagnostic analysis (UNESCO, 2015). Altchenko et al. (2017) conducted a hydrogeological assessment of the Ramotswa Transboundary Aquifer which is a karstic dolomite aquifer straddling the international border between Botswana and South Africa. Locally, groundwater has been contaminated by human activities with nitrate and coliform due to contamination from pit latrines and agricultural activities (i.e. livestock excreta) (Altchenko, et al., 2017).

In a needs analysis assessment, the transboundary groundwater issues identified by Member States include weak institutional frameworks, weak functioning of RBOs and no scientific data sharing between countries (Pietersen, et al., 2018). Pollution and over-exploitation were not seen as major issues in the context of transboundary groundwater (Pietersen, et al., 2018). Most RBOs have incipient groundwater programmes and groundwater research and consultancies are almost non-existent. The Orange-Senqu

River Commission (ORASECOM) structure makes a provision for Technical Task Teams which includes a hydrogeology committee. This structure is not replicated amongst other basins (Pietersen et al., 2018).

1.3.2. Groundwater supply and demand in SADC

Groundwater availability in SADC is estimated at 13 per cent of the total water availability of 7 199 m³/capita/annum (Pietersen and Beekman, 2016). Table 3 provides an overview of groundwater availability and use in SADC countries.

Table 3: Groundwater availability and water use *

Country	Groundwater availability (million m ³ / annum)	Groundwater used (million m ³ / annum)	% use
Angola	34 000	35	0,1
Botswana	600	76	13
DRC	154 000	47	0,03
Lesotho	120	15	13
Madagascar	34 000	No information	
Malawi	2 900	340	12
Mauritius	No information	145	1,8
Mozambique	21 700	214	1
Namibia	1 950	139	7
Seychelles	9	0,3	2,5
South Africa	10 300	2 900	28
eSwatini	405	34	8,5
Tanzania	21 200	462 ¹	2
Zambia	18 900	189	1
Zimbabwe	1 600	393	25

*This table requires verification as the Aquastat database was used.

There is, therefore, opportunity for groundwater development in many SADC Member States. The distributed nature of groundwater resources, in space and time, requires that careful groundwater

¹ Updated estimates for Tanzania (Kashaigili, 2010)

planning needs to take place for optimal use of the resource, noting the need to use these resources conjunctively with surface water resources.

1.3.3. Status of groundwater infrastructure in SADC

The failure of groundwater supply schemes is often blamed on the resource rather than on the failure of infrastructure associated with the resource. This is supported by Cobbing et al. (2015) who found that operation and maintenance (O&M) of groundwater supplies is more important to groundwater sustainability than primary or “physical” groundwater availability in several municipalities in South Africa (Cobbing, et al., 2008). Similarly, in Lesotho, poor operation and maintenance caused failures on most of the water supply systems as most of the infrastructure has out-lived their economic life of 25 years. These systems are overused and damaged. In Malawi, a survey on functionality of boreholes equipped with hand pumps undertaken in Malawi in 2016 indicated that only 74 per cent of boreholes are functional at any one point. Vandalism, lack of maintenance and inadequate capacity are some of the challenges affecting groundwater infrastructure in most SADC countries.

1.3.4. Groundwater environment and ecology in SADC

There are ecosystems that depend on groundwater. The interaction between surface water and groundwater strongly influences the structure and functioning of ecological infrastructure and as such requires the conjunctive management of both surface and groundwater. In the SADC region, iconic wetlands such as the Okavango wetland ecosystem in north-western Botswana provide an array of environmental and social goods and services. The cycling of seasonal flood water through the groundwater reservoir plays a key role in creating and maintaining the biological and habitat diversity of the wetland and inhibits the formation of saline surface water (McCarthy, 2006). In the Namib Desert, springs allow vegetation and wildlife to flourish in certain areas (Christelis and Struckmeier, 2011). Table 4 below shows organisms endemic to Namibia’s groundwater ecosystems.

Groundwater dependent ecosystems are often poorly understood, however, the role of groundwater in maintaining river baseflow can provide critically important refugia for organisms during low flow periods. Whilst there is often some form of functional dependence based on timing and magnitude of availability, these can also be opportunistic in nature (Hatton & Evans, 1998).

Table 4: Examples of organisms endemic to Namibia’s groundwater ecosystems (Christelis and Struckmeier, 2011)

Name of Organisms	Habitats
Otjikoto tilapia	sinkhole lakes
<i>Tilapia guinasana</i>	sinkhole lakes
blind cave catfish, <i>Clarias cavernicola</i>	Aigamas Cave in the Karst area

1.4. Groundwater management in SADC

In Pietersen and Beekman (2016) the overall assessment of groundwater management in most of the SADC Member States was found to be insufficient to support the sustainable management and development of groundwater resources (Pietersen & Beekman, 2016). Although there was a good understanding of aquifer systems at the regional level, information systems to manage groundwater data are disparate and institutions for managing groundwater within an environment of scarce financial and human resources. Much of the focus with regards to water resource management and development is placed upon surface water resources, often because of the limited understanding of groundwater as an essential resource to underpin socio-economic development.

Information systems for managing groundwater data hardly exist in some of the Member States, often as a result of a limited understanding of the nature, extent and importance of these resources. Regulations to protect groundwater resources are often not in place and where these are in place, often no enforcement or sanction of unlawful activities takes place. This is often exacerbated by limited coordination with other sectors such as energy and mining. Furthermore, the implementation of groundwater management action plans, where developed, is often limited and resource constrained.

2. METHODOLOGY

A literature review of regional framework documents was conducted by the specialists in the project team to establish an understanding of the regional legislative, policy and institutional frameworks for groundwater management. Discussions were also held with key regional actors to further broaden the project team's understanding of the regional status of groundwater management. In addition, in-country experts carried out a literature review of national groundwater management in each country coupled with interviews with national GW stakeholders identified across a range of categories to produce individual national gap analysis reports and action plans. These were scoping level reports developed based upon desktop review and limited stakeholder engagement and these reports, alongside the regional literature review and discussions, provided inputs into the draft regional report. The draft regional gap analysis report was presented and validated at the validation workshops by critical groundwater actors from each Member State. The draft report was then finalised, incorporating feedback received from the validation workshops.

The methodology is illustrated in the figure below.



Figure 2: Methodology Outline

As with the approach utilised in the national reports, in this regional analysis, the core actions are set out using the MoSCoW approach towards prioritisation (See Box 1 below for description of *MoSCoW* approach).

Box 1: The MoSCoW Method of Prioritisation

Upon establishment of a clear set of actions to address the gaps identified for each Member State, it was necessary to rank them in order of importance. The ranking helped to develop an understanding around the level of urgency for each action listed, effectively sequencing actions from the most important to least important. This level of prioritisation for the action plans was achieved using the MoSCoW method.

The acronym MoSCoW stands for Must, Should, Could and Would. In full, the acronym stands for:

M	=	Must have this action(s) to significantly address existing gaps,
S	=	Should have this action(s) if possible, but success does not rely on it,
C	=	Could have this action,
W	=	Would like to have this action item, but it is not terribly urgent.

The method is a useful tool to help assess and decide on which actions to come first, and which ones may come later. *The MoSCoW method was developed by Dai Clegg of Oracle UK in 1994 and has been made popular by exponents of the Dynamic Systems Development Method (DSDM).*

Source: <https://www.projectsmart.co.uk/moscow-method.php>

3. REGIONAL FRAMEWORK FOR GROUNDWATER MANAGEMENT

SADC, through the Water Division, provides the regional framework for water and provides ongoing guidance to support the various Member States in collectively supporting and attaining the objectives within this regional framework (**Figure 3**). This regional framework consists of the SADC Regional Water Policy (2005), SADC Regional Water Strategy (2006), SADC Regional Strategic Action Plan (through various phases of development) and SADC Revised Protocol on the Shared Watercourses (2000) (SADC, 2005; SADC, 2006; SADC, 2016; SADC, 2000).

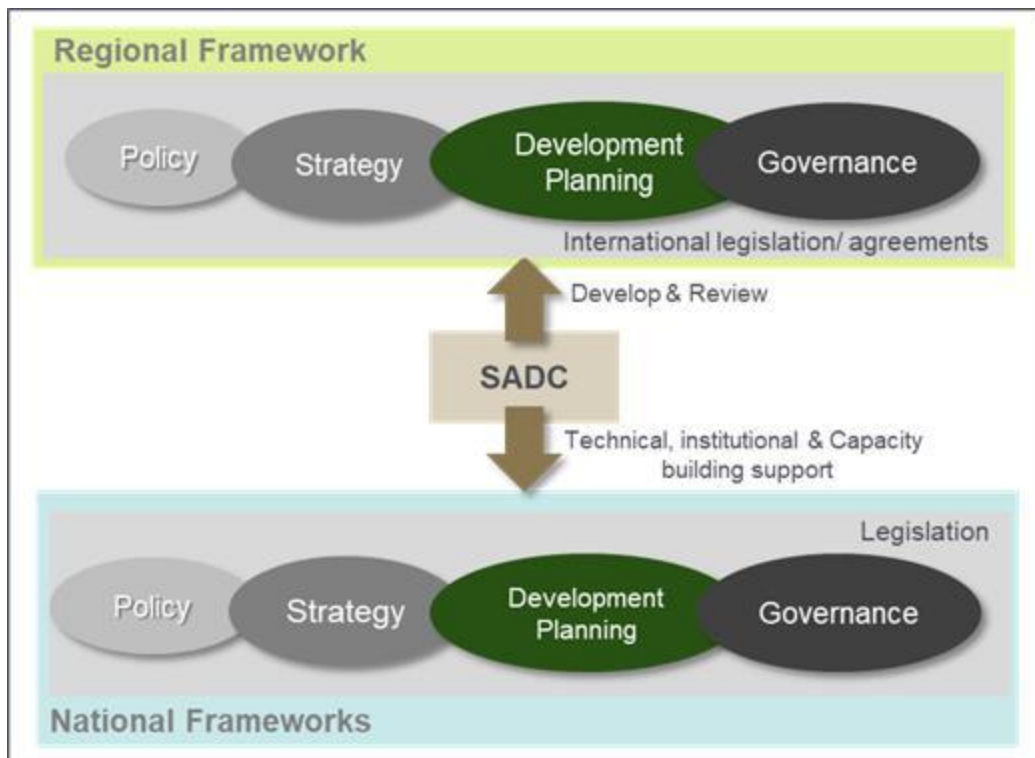


Figure 3: Regional water framework supported by national water frameworks with the guidance for SADC

Together, these provide the key pillars of the framework, namely, legal, policy, strategy, planning instruments to support development and governance, noting that the latter element under the regional framework provides for managing water in transboundary contexts.

These pillars are mirrored at the national level with SADC supporting interventions to harmonise approaches to manage water resources and provide support in technical aspects, institutional development, exchange knowledge and building capacity. SADC also has a key role to further develop and review the regional framework based upon lessons learned and experience from across the region and the various SADC states. In this regard, SADC Water Division and SADC GMI have a central role to play.

3.1. Regional Legislation

3.1.1. Review of existing regional legal framework and gaps identified

The overarching legal framework governing transboundary water in SADC is the Revised Protocol on Shared Watercourses in the Southern African Development Community (2000).² The scope of the Protocol includes shared “watercourses,” which are defined as systems of “surface and ground waters consisting by virtue of their physical relationship a unitary whole normally flowing into a common terminus such as the sea, lake or aquifer.” (Art. 1(1)). While this phrasing, which closely mirrors that of the 1997 United Nations Watercourses Convention, does include groundwater and accepts the hydrological relationship between surface and groundwater, it also imposes limitations on the ways in which internationally shared aquifers and aquifer systems can be regulated. In focusing on “systems” of surface and ground waters, the Protocol effectively restricts consideration to aquifers that are hydrologically connected to surface water – such as a river or lake. This is supported by the language “by virtue of their physical relationship a unitary whole.” This potentially excludes solitary, non-recharging and fossil transboundary aquifers from consideration. The Protocol also focuses heavily on surface waters for most of the body of the text and raises further questions about whether aquifers, in order to qualify as transboundary, must be connected to international rivers or lakes, or whether an entirely domestic surface body of water connected to a transboundary aquifer is covered by the Protocol.

The issues related to the scope of the Protocol are exacerbated by the fact that groundwater also has a number of unique physical characteristics that need to be considered when creating a transboundary regulatory framework (Eckstein, 2017).³ Thus, while many of the core principles that have evolved to govern internationally shared surface waters also apply to shared aquifers, there are additional and unique considerations that must guide the creation of any effective international legal regime governing shared aquifers and aquifer systems. For example: aquifers are often more vulnerable to surface pollution and other forms of contamination as they generally flow more slowly and this slow flow can result in contamination (and other problems) manifesting at equally slower rates and a reduced ability of the resource to recover from contamination; reclamation of a polluted aquifer is extremely difficult and can take years and come at great expense due to the underground location and difficulty in gaining access; some aquifers are non-recharging and require specific protections; and monitoring of groundwater is particularly costly and difficult (Eckstein, 2017). These considerations require specific regulatory interventions tailored to the context of groundwater that represent major gaps in current international, regional and basin-specific legislation governing shared watercourses.

The SADC Protocol was drafted as a framework agreement, meant to provide guidance to Member States in concluding basin-specific agreements and creating joint institutions to govern their shared watercourses. A number of such agreements (both pre- and post-dating the Protocol) exist throughout

² Revised Protocol on Shared Watercourses in the Southern African Development Community (2000), *available at*

³ G. Eckstein (2017). The International Law of Transboundary Groundwater Resources. Earthscan, London.

the region, covering bilateral and multilateral arrangements. While a comprehensive study of all of these treaties was not possible, a survey of over a dozen bi- and multilateral agreements from throughout the region revealed that **only one** specifically mentions groundwater as part of the scope of the agreement (the 2003 *Agreement on the Establishment of the Limpopo Watercourse Commission*). This is not surprising, given the fact that groundwater has long been overlooked in international water law. However, the lack of specific focus on groundwater will be an important factor for SADC to consider in providing guidance to Member States on how to effectively address transboundary groundwater management concerns within the context of existing legal frameworks. Fortunately, for the most part, these agreements formulate the scope of their agreement in such a way as to enable the inclusion of groundwater without amendment, often referring to “waters (or water resources) of common interest” or including reference to “all water resources in the system.” However, effective governance of shared aquifers and aquifer systems will require specific attention to the unique physical characteristics of those bodies, as well, as noted above.

Despite the increasing awareness of the critical role of groundwater in sustainable development, aquifers and aquifer systems have long been neglected, not just in the SADC region, but in international water law more broadly. Unlike surface water, there is no internationally agreed, global instrument or even set of customary norms that can be said to represent the rules governing States’ conduct on shared aquifers (Eckstein, 2017). However, there is a growing interest and understanding of the need for such rules, as well as a number of emerging formal agreements between States that can be used as evidence of practice or custom in governing transboundary aquifers. In addition, legal scholars and practitioners have developed guidance in the form of Draft Articles and regional Model Provisions that can provide further evidence of an emerging consensus on the essential norms that should be considered in governing transboundary aquifers. A brief overview of these instruments is provided in the section below to shed some light on the key issues that SADC will need to focus on in order to broaden the scope of its transboundary water management to effectively govern its shared groundwater resources.

3.1.2. Opportunities/Enablers to strengthen the legal framework

As noted above, while no global instrument or set of customary norms exist to guide SADC in creating a legal framework for governing transboundary aquifer regulation, there is an emerging set of work by legal scholars, technical experts and practitioners that has taken the form of guidance and draft and model provisions, which can offer SADC an understanding of the core norms to consider as it moves forward. These are briefly described below.

UN Draft Articles on the Law of Transboundary Aquifers (2008)

From 2002 to 2008, an interdisciplinary team of experts, supported by the International Hydrological Programme of the UN Educational, Scientific and Cultural Organization (UNESCO-IHP) developed three reports and three addenda that culminated in the drafting of 19 Articles that were adopted by Resolution 63/124 by the UN General Assembly and commended to governments to take them “into account” in

making “appropriate bilateral and multilateral arrangements for the proper management of their transboundary aquifers.” The Articles are divided into four sections: (1) scope and definitions; (2) general principles on States’ rights and obligations; (3) specific obligations on protection, preservation and management; and (4) miscellaneous provisions on emergencies, armed conflict and other matters.

It is notable in this context that Article 1 on Scope includes “the utilization of transboundary aquifers and aquifer systems,” as well as “other activities that are likely to have an impact” on those aquifers/systems. This expansive definition includes all aspects of transboundary aquifers and their systems, whether or not connected to surface waters, and includes the range of activities above and below ground that could have an impact on them, thus addressing the fragility and unique characteristics of the resources and the types of issues that may face them (Eckstein, 2017). The definitions of aquifer and aquifer system also clarify that all aspects of transboundary aquifers are covered, and further definitions are provided for key terms including: recharging aquifer; recharge zone; and discharge zone. These are not necessarily the only formulation of such terms but point to the necessity of having a clear legal understanding of these concepts for regulating shared aquifers.

The Draft Articles also include a number of principles to guide States in their implementation of shared aquifer governance. Most of these reflect customary international water law principles that are already embedded in the SADC Protocol, including: equitable and reasonable utilization of shared water resources (and the factors that are relevant to weighing such utilization); the obligation not to cause significant harm; a general obligation to cooperate in good faith; an obligation to conclude basin/aquifer-specific treaties/institutional management mechanisms; and regular exchange of data/information. Notably missing from the Draft Articles is any provision on public participation in the management of shared aquifers, or on the need for gender equity in their management. Additionally, while the major principles outlined are already present in the SADC Protocol, many would require further elaboration to meet the needs of a sound shared groundwater governance regime. For example, the obligation not to cause significant harm may require a different threshold for “significance” with respect to an aquifer’s pollution than for surface waters and this could require guidance for States. There may also be specific factors to consider in balancing equitable and reasonable utilization, such as those highlighted in the Draft Articles: “the natural characteristics of the aquifer or aquifer system” (Article 5(1)(c)), “the contribution to the formation and recharge of the aquifer or aquifer system,” (Article 5(1)(d)), and “the role of the aquifer or aquifer system in the related ecosystem” (Article 5(1)(i)) (Eckstein, 2017). Information and data exchange are also more complex and costlier in relation to aquifers, resulting in the Draft Articles’ formulation of requiring States to use “best efforts” to collect and disseminate such data/information. Ideally, however, this data will be harmonized across aquifer States and specific guidance for bilateral and multilateral agreements must be considered.

The third section of the Draft Articles includes provisions that address the substantive needs for protection, preservation and management of shared aquifers and aquifer systems. These include: protection and preservation of ecosystems (including measures to protect water quality and quantity); identification and

measure to prevent and minimize detrimental impacts on recharge and discharge zones/processes; cooperation on recharge and discharge protection; prevention, reduction and control of pollution, including the precautionary approach; monitoring (including, wherever possible, joint monitoring using harmonized standards and methodologies); creation and implementation of aquifer management plans and establishment of joint management mechanisms; notification of planned activities with potentially adverse impacts and consultations/mitigation of impacts.

Broadly speaking, the Draft Articles provide guidance on how to tailor and supplement SADC's current provisions to more effectively govern shared aquifers in the region. However, it is important to note that the Draft Articles do not represent the state of international law of transboundary aquifers but remain a codification of proposed concepts and principles that have not yet been vetted by the international community (Eckstein, 2017). They would have to be assessed critically for their regional application.

UNECE Model Provisions (2012)

Another instrument that could provide guidance grew out of the framework water treaty in the United Nations Economic Commission for Europe: The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (2002), or the "Helsinki Convention" (UNECE, 1992). In order to address groundwater more comprehensively in the context of this treaty, the Model Provisions on Transboundary Groundwaters were developed to "reflect the current state of international law" and provide practice mechanisms for its applications by UNECE Member States (UNECE, 2012). The Provisions build on the Draft Articles and is specifically contextualized for EU Member States and signatories to the Helsinki Convention. Nonetheless, the provisions reflect a further consensus on key principles and obligations of States related to shared groundwater resources:

- States must take all appropriate measures to prevent, control and reduce transboundary impact (including pollution, particularly of drinking water) of their shared aquifers;
- Use shall be equitable and reasonable, taking into account all relevant factors;
- Use shall be sustainable with a view to maximizing benefits and preserving groundwater dependent ecosystems;
- Making arrangements for exchange of information and available data, cooperation in joint information/data gathering and management, as well as joint monitoring using harmonized standards and methodologies;
- Parties shall cooperate on management of transboundary aquifers, including establishing and implementing joint management plans;
- Prior notification (and consultations where necessary) of planned activities with likely significant impacts on transboundary groundwater;
- Establishment of joint bodies to coordinate cooperation.

The Provisions also set forth additional guidance on specific measures to take to avoid and control pollution, including the establishment of protection zones in critical recharge areas, regulation of land uses, adoption of pollutant discharge limitations, and groundwater quality objectives (Provision 5).

Again, the Provisions are specifically tailored to the context of the Helsinki Convention. However, the similarities with the Draft Articles highlight the types of issues and key provisions that SADC should be considering as it moves forward in tailoring the SADC Protocol to more effectively address transboundary groundwater governance in the region.

Bilateral and Multilateral Agreements on Shared Aquifers

In addition to the international development of guidance in the form of the Draft Articles and the UNECE Provisions, there are emerging State practices that can also be gleaned from the conclusion of various types of legal agreements between States cooperating over specific aquifer resources. These are very few to date and include⁴:

- The 1977 Agreement between France and Switzerland on the Genevese Aquifer (re-negotiated in 2007);
- Three agreements on the Nubian Sandstone Aquifer between Chad, Egypt, Libya and Sudan (1992-2000);
- The North-West Sahara Aquifer System consultative arrangement between Algeria, Libya and Tunisia (2002-2008);
- The Memorandum of Understanding between Algerian, Benin, Burkina Faso, Mali, Mauritania, Niger and Nigeria on the Iullemedeen and Taoudeni/Tanezrouft Aquifer System (ITAS) to establish a Consultative Mechanism (2014, replacing an original MoU in 2009);
- The Guarani Aquifer Agreement (2010) between Argentina, Brazil, Uruguay and Paraguay; and
- The 2015 Al Sag/Al Disi Aquifer Agreement between Jordan and Saudi Arabia.

⁴ Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-Swiss Genevois Aquifer, made by the Community of the Annemassienne Region, the Community of the Genevois Rural Districts, and the Rural District of Viry, on one part, and the Republic and Canton of Geneva on the other, at Geneva, 18 December 2007 (available at <https://www.internationalwaterlaw.org/documents/europe.html>); Guarani Aquifer Agreement, made by Argentina, Brazil, Paraguay and Uruguay at San Juan (Argentina), 2 August 2010 (available at <https://www.internationalwaterlaw.org/documents/s-america.html>); Memorandum of Understanding for the Establishment of a Consultation Mechanism for the Integrated Management of the Water Resources of the Iullemedeen. Taoudeni/Tanezrouft Aquifer Systems (ITAS) (Algeria, Benin, Burkina Faso, Mali, Mauritania, Niger, Nigeria), 2nd Council of Ministers of GICRESAIT Project, Abuja (Nigeria) 28 March 2014 (available at <https://www.internationalwaterlaw.org/documents/africa.html>); Agreement between Jordan and Saudi Arabia for the Management and Utilization of the Groundwaters in the Al Sag-Al Disi Aquifer, made at Riyadh, 30 April 2015 (available at <https://www.internationalwaterlaw.org/documents/asia.html>); Programme for the Development of a Regional Strategy for the Utilization of the Nubian Sandstone Aquifer System (NSAS) – Terms of Reference for the Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System (Chad, Egypt, Libya, Sudan) – Agreement No.1 – Terms of Reference for the Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System – Agreement No.2 – Terms of Reference for Monitoring and Data Sharing. Made at Tripoli, 5 October 2000 (available at <https://www.internationalwaterlaw.org/documents/africa.html>).

These agreements range from the establishment of complex standards for groundwater abstractions, recharge operations, pollution control and apportionment of costs (Genevese Aquifer), to cooperative mechanisms to collect and compile information on the aquifer, promote cooperation and develop common policies (Nubian Sandstone Aquifer), to establishment of a Consultative Mechanism to identify risks to the aquifer and facilitate cooperative management of those risks and sustainable development of the shared resources (Iullemedeen Aquifer, not yet in force). The Al-Sag/Al-Disi, the most recent of the agreements, establishes a Joint Technical Committee and places a moratorium on all abstractions of groundwater in a protected zone on both sides of the border, as well as restrictions on pollution (Burchi, 2018). Looking at these agreements and their context in more detail could provide SADC with further understanding of the available mechanisms for implementing the concepts, principles and requirements set forth in the Draft Articles and other international guidance described above in a manner tailored to the specific needs of the Basin States.

Moving Forward: Procedural Options for SADC

Ultimately, the only mechanism for changing the regional legal framework to more effectively govern SADC's shared aquifers and aquifer systems is to amend the existing Protocol on Shared Watercourses. The SADC Treaty provides only one channel for binding legal agreements in areas of cooperation and integration and that is Protocols. Protocols are further only binding on those Member States that parties to the Protocol in question (Art. 22(9)). Legal amendments to any Protocol that has entered into force requires a decision of three-quarters of the Member States that are parties to the Protocol. Thus, if provisions related to transboundary aquifers are to have full legal effect, they must be passed as amendments to the Water Protocol.

However, there are additional options for promoting good practices among Member States that do not require amendment to the Protocol but would provide practical guidance that could, in turn, result in lessons that could guide a longer-term process towards amending the Protocol. These include guidance documents, such as the UNECE's Model Provisions, which could be specifically tailored to the SADC Protocol and the SADC context. Additionally, SADC has undertaken Memoranda of Understanding on specific issues, which could include agreements on data sharing, joint monitoring and standards, or other specific and priority mechanisms for shared groundwater governance that should be implemented on a shorter-term basis and could then be folded into a larger package of legal reforms over time. Legal reform is often a long-term process, so such a multi-stage approach would enable SADC to prioritize areas of reform, learn from implementation and from the experience of other regions and international practitioners, provide ongoing guidance to Member States, and build the political will and momentum necessary to forge agreement on an ultimate set of appropriate amendments to the Protocol that would support sustainable and equitable transboundary groundwater management throughout SADC.

3.2. Regional Water Policy

3.2.1. Review of existing regional policy framework

In its preamble, under water resources development and management, the SADC Regional Water Policy (2005) states that the planning, development and management of watercourses, particularly in shared watercourses will consider the integrated use of surface and ground water resources, the reuse of water, proper pollution management and the provision of environmental requirements (SADC, 2005: xiii). The policy promotes a river basin approach for WRDM, and states clearly that “The planning, development and management of shared watercourses will consider the integrated use of surface and ground water resources, the reuse of water, proper pollution management and the provision of environmental requirements” (SADC, 2005:37). The policy takes a broader consideration and definition of key terms such as river basin and watercourse to be inclusive of both surface and groundwater. For example, regarding river basins, the policy defines it as ‘an area drained by a system of surface and ground waters consisting by virtue of their physical relationship a unitary whole normally flowing into a common terminus such as the sea, lake or aquifer’ (SADC, 2005:59). The policy reflects the interlinkages between land and water use, surface and groundwater integration and the possibility of conjunctive use as part of IWRM and importantly, recognises the role groundwater can play in rural development and improved livelihoods. This unitary and holistic understanding and appreciation of surface and groundwater systems is key and further reinforced by the definition of a watercourse (SADC, 2005:59).

3.2.2. Gaps identified

While the definition of a watercourse is inclusive of both surface and groundwater, and issues of groundwater management and development can, therefore, be read into the regional policy, in fact, the document is strongly focused on surface water, with considerable gaps pertaining to groundwater management and development. Thus, for example, the Policy includes statements such as:

- “Water Resources Development and Management: including policy provisions on a river basin approach; integrated planning of shared watercourses; dams and dam management; water conservation and water demand management; and alternative sources of water”
- “Policy: Water resources development for irrigation in commercial agriculture should be planned in coordination with other sectors in the interest of IWRM. Commercial irrigated agriculture is the largest single user of water in the region, presently accounting for about 70% of all water use. In the past, commercial irrigation developments were not planned in an integrated manner in collaboration with other sectors. This has led to single purpose dams and inefficient allocation of water resources. The Policy on future dam development, based on IWRM principles is elaborated in Section 8.”

In both these examples, and in numerous other cases in the Policy, there is direct reference to dams and dam development, yet groundwater is often a critical resource in localised development and in support of surface water use when there is drought. The policy is clear in stating the importance of the conjunctive

use of surface water and ground water and the design of management regimes to support this, but the policy does not provide the more explicit policy guidance on the development or co-management of groundwater resources. Linked to this, the policy provides little guidance regarding the interconnectivity between groundwater and ecological infrastructure and the importance of this. The policy also does not provide direction with regards to the need for groundwater protection zones or the need to develop approaches towards aquifer recharge and also does not provide guidance with regards to the linkages between groundwater and sanitation and the resultant water quality impacts.

In addition, noting that the understanding of climate change and the importance of this in terms of socio-economic development, the policy provides little direction in this regard. Climate change is only really discussed in terms of floods and droughts and the recently developed Sustainable Development Goals (SDGs) and the importance of such international targets is not reflected.

Whilst the Policy refers to managing water according to basin boundaries, it makes limited reference to aquifer boundaries or the situation where aquifers boundaries cross basin boundaries. These results in an array of institutional challenges that can result in poor aquifer management. Equally, the Policy makes no reference to the specific institutional arrangements for groundwater management where localised management is generally more important than basin level management. Yet there is a need to provide some very clear guidance on the management of transboundary aquifers.

Lastly, whilst the policy recognises the importance of knowledge and data, and the concomitant need to effectively manage and share this, there is no recognition of the value of indigenous knowledge and the use of approaches to utilise this.

3.2.3. Opportunities/Enablers to strengthen policy framework

Ideally, the policy should be reviewed with a conscious focus on addressing its limitations in relation to groundwater management and development. More generally, the policy is dated in that it does not reflect the more recent developments in understanding of such issues as climate change, the importance of international development goals, the importance of groundwater in terms of socio-economic development, the role of groundwater in sustaining ecosystems and the importance of transboundary aquifers. The amendment of regional policy is understood to be longer-term process and as such should be a longer-term objective of the SADC-GMI, in conjunction with the SADC Water Division. However, in recognition of the challenges involved in revising regional policy, it may be possible to address some of the shortcomings of the Policy through, for example, a policy addendum/interpretation in the shape of a document that unpacks the groundwater elements of the nine thematic areas of the Policy as follows:

- 1) Regional Cooperation in Water Resources Management: this theme needs to specifically address the issue of transboundary aquifers, as well as aquifer management in transboundary basins in relation to the concept of conjunctive use and impacts on base flow in particular;

- 2) Water for Development and Poverty Reduction: this theme should give recognition to the importance of groundwater in the region in meeting people's needs for domestic water and water for irrigation (large and small)
- 3) Water for Environmental Sustainability: this theme needs to recognise the role of groundwater in meeting base flow requirements for environmental flows, and in supporting terrestrial ecosystems;
- 4) Security from Water-related Disasters: this section should deal with issues pertaining to protecting groundwater quality, subsidence from over-abstraction from groundwater, and the role of groundwater in drought management.
- 5) Water Resources Information and Management: this section needs to deal specifically with issues of groundwater information and management;
- 6) Water Resources Development and Management: this section needs to refer specifically to options pertaining to groundwater development and artificial recharge;
- 7) Regional Water Resources Institutional Framework: this section needs to deal with the institutional arrangements for groundwater management, particularly in transboundary basins;
- 8) Stakeholder Participation and Capacity Building: this section needs to deal with issues of participation and awareness creation; capacity building and training; gender mainstreaming; and research, technology development and transfer in relation to groundwater
- 9) Financing integrated water resources development in the region: this section needs to refer to financing of groundwater development and management.

If such a document were to be developed, it would be important for it to be done in a thoroughly consultative manner, and through the appropriate channels to ensure that it has the necessary buy-in and levels of approval to be accepted as a SADC document.

3.3. Regional Water Strategy

3.3.1. Review of existing regional strategic framework

The SADC Regional Water Strategy (2006) describes the strategies for achieving development and poverty reduction within SADC, through integrated planning, development and management of water (SADC, 2006). Amongst the strategies outlined are two key specific strategies directly related to groundwater, with both focussing on ensuring livelihoods and food security. The first is aimed at '*promoting construction of multi-purpose storage facilities that will benefit irrigation and ground water recharge to enhance food security*' (SADC, 2006). This recognises the importance of groundwater resources to rural communities that are not supported by reticulated water supply systems. The second is to '*attain Regional Food Security through sustainable irrigated agriculture, rainfed agriculture, aquaculture and livestock production, through optimal use of both surface and ground water with the ultimate goal of poverty reduction*' (ibid:35). The overall strategy recognises and attempts to address the historical practice where there has

been a tendency to compartmentalise the surface water and groundwater resources instead of viewing and managing them as an inter-linked hydrological unit under the rubric water and environment (ibid:45).

The SADC strategy recognises the critical importance of information management to enable effective water resource management as well as that water resource development policies and strategies cannot be realised without understanding the availability of surface and groundwater and the related occurrence of floods and droughts. These require systematic updated and thorough information collection and dissemination.

The establishment and operationalisation of the SADC-GMI, is understood as a key element of the regional response to these policy and strategy directions. (section 3.4).

3.3.2. Gaps identified

The Regional Water Strategy was developed before the role and importance of TBAs were fully understood. Most of the TBAs are in areas that has low groundwater development stress indicating exploitation opportunities. Our current understanding does not take into consideration the vertical dimension of aquifers, that is the existence and thickness of multi-layered systems and deep-seated aquifers, the quantity of these still unexploited reserves becomes very large (UNESCO-IHP and UNEP, 2016). However, TBA hotspots are projected in the future for TBAs located in the more arid areas of SADC e.g. Stampriet Artesian Aquifer, Khakhea / Bray Dolomite System, Tuli Karoo Sub-Basin Eastern Kalahari Karoo Basin (Davies, et al., 2013; UNESCO-IHP and UNEP, 2016). Strategies are required to deal with aquifer connectivity, in such aquifers, to prioritise local-scale interventions. The groundwater governance and institutional frameworks to deal with TBAs (UNESCO-IHP and UNEP, 2016) are absent in SADC and require consideration in the Regional Water Strategy. TBAs are diverse in size, climate, hydrogeology, human pressure and present levels of management, and therefore require in-depth studies (Nijsten, et al., 2018). Although the RSAPs has included TBAs, an updated Regional Water Strategy is required that take cognisance of the future role of TBAs. This is in line with the Sustainable Development Goals (SDG 6.5) which requires implementation of integrated water resource management at all levels including transboundary cooperation as appropriate (UN Water, 2018).

The Island States needs for groundwater resources are not explicitly incorporated in the Regional Water Strategy. The degradation of groundwater quality [in Island States] and growing demands are posing short-medium term threats to human health, and impairing the provision of ecosystem services of great economic importance (UNESCO-IHP and UNEP, 2016).

Several large cities across SADC are coastal and have a number of water management challenges resulting from rapid population growth and associated rapid economic development. In addition, sea-level rise due to climate change will lead to sea water intrusion leading to groundwater salinisation and dwindling freshwater supplies.

Future strategies for groundwater management include optimized groundwater abstraction, demand control, enhanced aquifer recharge and engineering approaches (Post, et al., 2018). Fresh groundwater is often limited to thin freshwater lenses/layers requiring a large number of shallow wells with low abstraction rates (Comte, et al., 2016). An updated strategy is required to deal with water supply in urban areas but also consider the unique aspects of coastal cities.

Whilst the need for groundwater monitoring has been identified in the SADC Regional Water Strategy its practical implementation has not taken place. The general lack of technical cooperation, data sharing, training and research between the riparian states on hydrogeology hampers a mutual understanding of the resources hindering regional assessments (Cobbing, et al., 2015; Nijsten, et al., 2018). The Regional Water Strategy will need to incorporate a groundwater monitoring infrastructure to manage both national and transboundary aquifers. Monitoring systems need to consider early warning and trigger thresholds.

There is limited understanding of groundwater dependent ecosystems (GDEs) and its role in environmental functioning. Modifications of the groundwater regimes and water quality can negatively impact on GDEs influencing the sustainability of the groundwater system. Protection of ecosystems contribute to reliability of groundwater supply and require incorporation.

The role of groundwater in drought alleviation has not been fully incorporated into the Regional Water Strategy. The high residence times of groundwater add value to these transboundary resources because of their capacity to mitigate the effects of prolonged climatic extremes (UNESCO-IHP and UNEP, 2016). This means groundwater may be an alternative or supplemental source of water during periods of surface-water drought as experienced frequently in the region. Whilst, groundwater may provide a critical buffer in the early phases of a drought certain vulnerable groundwater systems may themselves become subject to desiccation and failing access during, and after, prolonged drought (Villholth, et al., 2013). This requires pro-active warning systems.

Comprehensive scientific and technical assessment and plan for groundwater resources in SADC needs to be completed as identified in previous RSAPS which include for the Karoo aquifers, Precambrian basement aquifers and Limpopo/Save Basin.

An updated Regional Water Strategy will need to incorporate emerging groundwater issues. These include:

- Alignment of political and catchment boundaries – dealing with jurisdictional complexity and water rights
- Emerging pollutants (e.g. pharmaceuticals) and vulnerability of the aquifers
- The use of data analytics in TBA management
- Groundwater use and renewable energy options which includes the promotion of the nexus approach

3.3.3. Opportunities/Enablers to strengthen framework

The focus of an updated regional water strategy dealing with groundwater management needs to be problem focused. The argument that transboundary groundwater issues manifest locally in the border

area, in zones of transboundary impact, at a scale smaller than the whole aquifer, and potentially only require involvement of a subset of aquifer states and stakeholders must be further explored (Nijsten et al., 2018). Such nesting or zoning, based on sound hydrogeological and scientific methods, will justify the allocation of limited resources for groundwater- related activities, while making them more efficient and effective (Nijsten et al., 2018). Groundwater science has progressed, and the opportunity exists to inform new groundwater management implementation measures. Bridges between science on the one hand and law and policy on the other can be built in many ways: institutional arrangements that connect individuals across disciplines; “integrative science” that connects economics and other social sciences with the physical sciences, like the concept of valuing ecosystem services; and “integrators” – individuals who are specialists in their discipline, but who can effectively communicate with others from other disciplines (Nelson & Casey, 2013). Water scarcity necessitates the diversification of the water supply mix. Innovative mechanisms for conjunctive use, such as water banking, requires implementation. Cities like Windhoek have taken water banking from concept to implementation (Murray, et al., 2018). Water banking provides a means to recycle underutilised urban storm water and treated wastewater to maximize their water resource potential and to minimize any detrimental effects associated with their disposal (Page, et al., 2018). Such innovative mechanisms must be taken forward in a Regional Water Strategy.

The understanding of groundwater sustainability has progressed since 2008. The recent drought in California has advanced provided rich experience in the implementation of sustainability measures for groundwater management (Christian-Smith & Abhold, 2015; California Department of Water Resources, 2017). These new lessons and knowledge can provide opportunities for updating the Regional Water Strategy.

There are groundwater networks and partnerships that has been established in the region to implement water strategy. The opportunity exists for the SADC-GMI to build a coherent knowledge infrastructure that includes the involvement of National Governments, Universities and the Private sector (Pietersen et al., 2018). Further opportunities exist for the public sector, private sector and civil society to finance groundwater development and management programmes and projects in their mutual interest and benefit e.g. the GIZ International Water Stewardship Programme (Pietersen et al., 2018). Projects are required that link knowledge production (e.g. WaterNet) with knowledge application in government line departments and municipalities

An updated Regional Water Strategy needs to consider groundwater resilience options and infrastructure to adapt to climate change water-related implications such as drought. Technological progress coupled with better understanding of aquifer systems make it conceivable to implement a raft of measures that allow sustainable utilisation of groundwater resources.

3.4. Regional institutional framework

3.4.1. Review of existing regional institutional framework

The SADC institutional landscape is characterised by layered and inter-twined relationships as illustrated in the **Figure 4**, and provides for policy and strategic guidance, operational water resource management and development, as well as oversight in terms of implementation of policies, strategies and programmes. The SADC Council of Ministers provides policy direction and oversight regarding the implementation of SADC programmes, with the sectoral ministers responsible for water providing an important linkage between SADC and the African Ministers Council on Water (AMCOW), which functions at a continental level. The SADC water sector ministers are tasked with the following responsibilities through the Protocol on Shared Watercourses:

- Oversight on the implementation of the Regional Strategic Action Plan;
- Resolution of potential conflicts in transboundary watercourses; and
- Advising the SADC Council regarding matters of policy.

Within the SADC secretariat, the Water Division falls under the Directorate for Infrastructure and Services and is responsible for coordinating, monitoring and facilitating regional water-related initiatives in collaboration with Member States under the guidance of the Revised Protocol on Shared Watercourses. The Regional Water Policy provides the outline for the SADC Secretariat and the Water Division that has the role to promote, coordinate and monitor the implementation of the Revised Protocol for Shared Watercourses. Importantly, this role includes the promotion and guidance of Member States towards regional harmonisation of national policy and legislation. In this regard, the achievement of SADC's goals, objectives, strategies and programmes require monitoring and evaluation and as such, this falls to the SADC Secretariat and Water Division to assess.

Water Resources Technical Committee (WRTC) is established as part of the Water Sector Organs in the Revised Protocol and provides technical oversight and guidance for the SADC Water Sector. The respective groundwater focal persons, who also serve as part of the Sub-committee on Hydrogeology, report to the WRTC. The WRTC has the responsibilities to:

- Provide strategic guidance to the Regional Strategic Action Plan;
- Assess and approve projects under the RSAP banner;
- Advise with regards to RSAP project governance; and
- Oversee RSAP operational activities and projects.⁵

⁵ SADC, Regional Strategic Action Plan on Integrated Water Resources Development and Management Phase IV, RSAP IV, Gaborone, Botswana, 2016

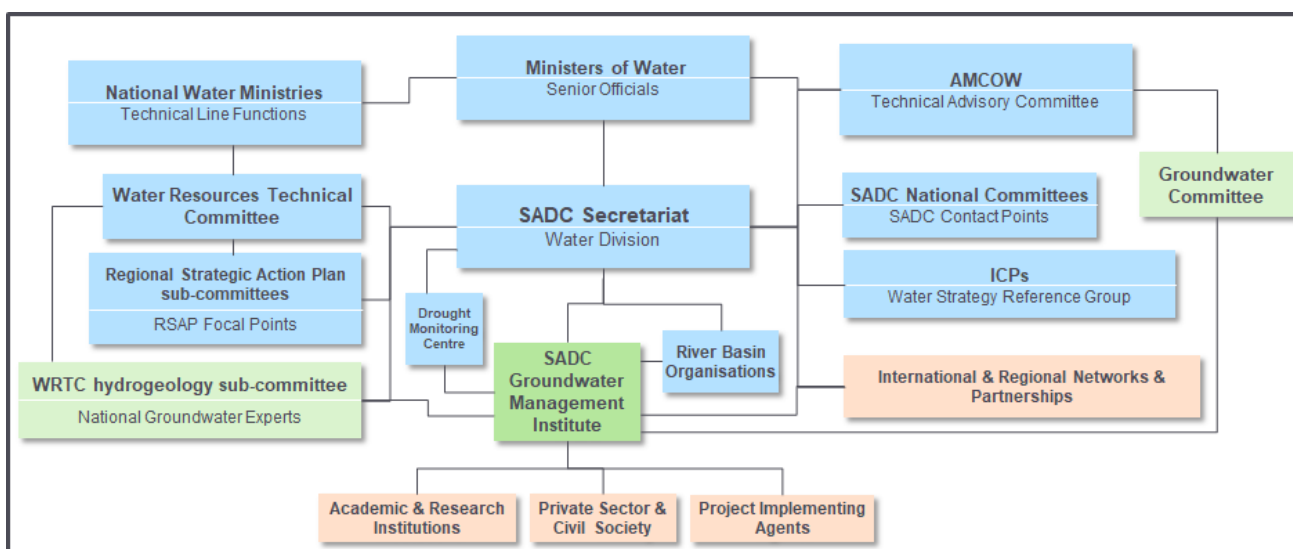


Figure 4: SADC water sector institutional framework (adapted from SADC RSAP IV)

The SADC-GMI beneficiaries are represented by Member State representatives in the SADC sub-committee on hydrogeology with project steering committee functions and reports to the SADC Water Resources Technical Committee.

Importantly, the Regional Water Policy provides for the “negotiation” of shared watercourse institutions in all shared watercourses, between the watercourse states. As noted earlier, the legal definition of watercourse does include groundwater, but is restrictive to those aquifers hydrologically connected to surface water systems. Whilst, the SADC region currently consists of 15 major shared river basins and 29 transboundary aquifers (see Table 2), there are currently only nine River Basin Organisations (RBOs) and none established specifically for the management of a transboundary aquifer. These RBOs are established to advise and coordinate the sustainable development and equitable utilisation of the relevant water resources, to enable mutual benefit and integration. The specific roles and organisational arrangements are negotiated and specified within each agreement.

The regional institutional framework does allow for the establishment of bi-lateral or multi-lateral water institutions in order to support specific purposes. These have been utilised in a significant number of shared river basins to support the development and operation of joint water projects. In many instances these have taken the form of Joint Water Commissions and technical committees. Broadly, at the transboundary scale, there are typically four distinct, but not mutually exclusive, types of institution that practically reflect the types of transboundary agreements that are observed:

- Water (basin) infrastructure authorities: Typically established under treaty between the parties for the development, financing and/or operation of joint water resources infrastructure between two or more countries.
- Bi-lateral issue-based bodies: Established under agreement between two countries to engage water issues of common concern, such as water sharing, infrastructure planning, aquifer management, hydropower, water quality and/or flooding.

- Multi-lateral basin committees: Established under agreement to advise the parties on a range of transboundary water management issues and priorities, including the development of a basin agreement/plan concerning the allocation of water, transboundary objectives and institutions to be established to foster cooperation in the basin.
- Multi-lateral basin organisations: Established with a permanent secretariat by transboundary agreement, in order to advise the parties on water resources related issues of common concern at a transboundary level.

The SADC-GMI

Noting that the regional institutional framework is constructed around the concept of an integrated water resource, the establishment of the SADC Groundwater Management Institute (SADC-GMI) has been important in recognising the critical role that groundwater plays. The SADC-GMI was established as a regional centre of excellence for groundwater management under the strategic guidance of the SADC Secretariat, Directorate of Infrastructure and Services – Water Division. SADC-GMI's core mandate is to promote sustainable groundwater management and providing solutions to groundwater challenges in the SADC region through creating an enabling policy, legal and regulatory environment, capacity building, advancing research, supporting infrastructure development, and enabling dialogue and accessibility of groundwater information (SADC-GMI, 2017).

The current key strategic objectives of the SADC-GMI are reflected in **Figure 5**.



Figure 5: SADC- GMI Strategic Objectives

Valuably, the SADC-GMI is supported by a range of organisations and institutions (see **Figure 4**) that provide a range of useful research, thought leadership, advocacy and capacity development roles.

3.4.2. Gaps identified

The institutional frameworks across the SADC Region provide a useful balance of regional policy and strategy guidance, supported by capacity development. At the transboundary basin levels there are a range of institutional forms that support basin and aquifer management and development. Whilst, these institutions have an integrated view of water resource management, they have largely recognised the

importance of groundwater through their planning instruments and supporting technical studies. However, there are only limited groundwater specific programmes and studies that emerge from these, as a result, our understanding of transboundary aquifers is only limited (Pietersen et al., 2018). The institutional framework for research across the region is not well established and the introduction of SADC-GMI will be important in supporting a more coordinated approach to groundwater management across the region.

There are no groundwater focused institutions (other than SADC-GMI which has a specific mandate) that look to the direct management and development of transboundary aquifers. It is a moot point as to whether such an institution would provide a more integrated management regime than those based upon surface water basins. There is a need at these scales to manage and develop water resources conjunctively and this creates the possibility to create a range of institutional scenarios, with increasing levels of complexity. Nonetheless, there is still more focus upon the management of surface water resources in terms of supporting regional development, although generally there is a broad recognition of the importance of groundwater in terms of rural supply. In essence, this indicates that there is insufficient effort applied to the management of groundwater resources.

In addition, the institutional framework provides only limited clarity as to the various reporting frameworks at regional and national levels, and between the various regional institutions. This results in a lack of clarity and coordination regarding ongoing programmes and projects.

A key element of this dilemma is that most institutions across the region have very significant challenges in terms of ensuring appropriate capacity to manage groundwater (and surface water) resources effectively. This has been experienced within the SADC Water Division as well as the various RBOs. This takes the form of insufficient staff compliments, insufficient groundwater technical skills, inadequate information management systems, and financial constraints. These challenges are not about the structure of the regional institutional framework, but rather about how implementation of the framework is supported. Efforts to develop capacity are required and includes not only the appointment of staff with the appropriate technical skills, but this needs to be underpinned by a range of technical guidelines, standard operating procedures, and knowledge products.

There have been challenges quite specifically around the exchange of data and information across institutions and between shared watercourse Member States. This exchange is critical in ensuring shared understanding and, where there is conflict, to build trust between states. More needs to be done to assist in this exchange of information.

The engagement with stakeholders and civil society takes various forms during various water resource management interventions, but these are often perceived to be poorly coordinated, insufficiently funded and with a lack of clarity as to the role that these important actors can play. There is limited guidance in this regard and this needs to be strengthened.

Lastly, there is no real institutional platform for the exchange of knowledge and technical experience across the region. Such a technical network would not only be useful in providing access to technical expertise, it will also provide the basis for the ongoing development and improvement of skills of individual groundwater technicians and experts.

3.4.3. Opportunities/Enablers to strengthen the institutional framework

The support and direction of the SADC Water Division and the WRTC is indeed useful in providing technical guidance across an array of water resource management challenges. Noting the nature of these challenges (i.e. insufficient groundwater management and a range of capacity constraints) the establishment of the SADC-GMI has been significant in bringing in an institution that will support the development of strengthened groundwater management approaches through the exchange of knowledge, the development of capacity and the improvement of coordination (see **Figure 5**). This is a significant step forward towards improved groundwater management.

Whilst it will be important to strengthen and support SADC-GMI, there are core capacity constraints across most, if not all, transboundary institutions that require redress and the appointment of groundwater advisors within the various institutions would be a critically important step in strengthening the approach of these institutions. Generally, there is a dearth of expertise in groundwater sciences and on-the-ground practical experience that needs to be developed, with the various institutions developing this capacity. SADC-GMI will play an important role in supporting this, but equally Member States will collectively need to support this drive.

However, this is needed to develop a range of capacity development tools including an array of guidelines and knowledge products. This needs to be underpinned by regular and structured training interventions. Connectivity between academic institutions, SADC-GMI, SADC Water Division and other actors such as the various international and regional partners will prove essentially in the development of this capacity. This strengthened capacity needs to be harnessed and the undertaking of more groundwater management and development programmes and projects will be essential. This will require drive from the various water sector institutions across the region, and especially in transboundary contexts.

Equally critical will be new initiatives to strengthen the financing of the water sector across SADC. This will need to look at innovative and more sustainable financing mechanisms that enable institutions to develop and embed the sustained capacity that is required to ensure consistent and effective groundwater management.

The establishment of a SADC regional groundwater association will also be important in ensuring consistency in skills for groundwater practitioners as well as enabling a network for the exchange of skills and experience, for the development of standard operating procedures and the roll-out of training programmes.

In addition, more efforts are needed to strengthen the interactions between the various institutions to develop improved approaches towards groundwater management. The establishment of the SADC sub-committee for hydrogeology provides a groundwater network to support the exchange of information and experience would provide support to institutions in dealing with the various water resource management dilemmas. In the first instance, this is about making connections between people to drive shared learning, but this should also be supported by improved systems to enable exchange of data and information. This also supports in developing a more harmonised approach towards groundwater management, as a key precept of the Regional Water Policy. It would be useful to explore ways to strengthen this sub-committee in terms of its functioning, but also in finding strategic ways to enable that SADC-GMI provides on-point technical and knowledge development support to this committee. As with many committees, there is a need to develop the tools that enable the members to take information and knowledge back to their relevant institutions and Member States, and as such the development of a knowledge management strategy, knowledge products and guidelines, as well as awareness raising materials to support this will be important. Again, SADC-GMI has a key role to play in supporting this.

Lastly, it will be essential to improve the various engagement interventions that support ground water management. This means there needs to be better guidance on the engagement of stakeholders and the provision of sufficient funding to effectively support these initiatives.

3.5. Regional Development

3.5.1. Review of existing regional development framework

The Regional Strategic Action Plan (Phase Four) (RSAPIV) has the key objective to unlock the potential for water (and related resources) to play its role as an engine and catalyst for socio-economic development. To do this, the RSAPIV recognises the importance of both ecological infrastructure and built infrastructure in providing the basis for water supply and sanitation, for energy security, for industrial development, for food security and for protection from water-related disasters (**Figure 6**). Groundwater resources not only provides support in maintaining ecological infrastructure, but also as a key source of supply. RSAPIV states that seventy percent of SADC's rural population relies on groundwater supplies (SADC, 2016:1).

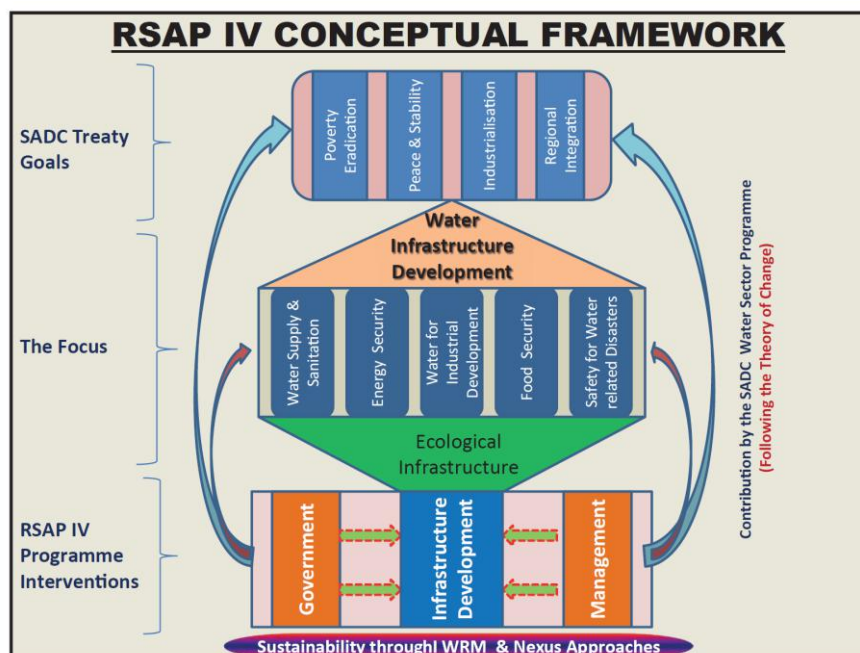


Figure 6: Theory of Change for RSAPIV (SADC, 2016)

Through RSAPIV, the operationalisation of the SADC-GMI starts to become increasingly important in developing improvements in the way that groundwater is managed. Guidance and objectives regarding groundwater development and management are structured on the following key themes:

- Institutionalising the SADC Groundwater Management Institute
- Strengthening Institutional Capacity for the Sustainable Management of Groundwater in SADC
- Advancing Knowledge on Transboundary Water and National Groundwater
- Promoting Groundwater Infrastructure Management and Development
- Management and Use of Groundwater in Island States

RSAPIV recognises SADC-GMI as a centre of excellence for groundwater in the region whilst recognising the need to modernize and harmonize legal, policy and regulatory frameworks to address gaps in prevailing institutional groundwater management tools at national and transboundary levels, including in Island States. Key to this is the advancement of transboundary and national groundwater knowledge through various initiatives and studies.

Institutionalising the SADC Groundwater Management Institute

- a) mobilising and soliciting finance for SADC-GMI including designing small grants schemes for Member States;
- b) coordinating and administering the SADC-GMI;
- c) developing a project implementation manual, and a monitoring and evaluation framework;
- d) raising awareness, enhancing knowledge management and communication, including setting up a project website.
- e) developing a research programme; and

- f) supporting National Focus Groups (NFGs).

Strengthening Institutional Capacity for the Sustainable Management of Groundwater in SADC

- a) providing assistance to Member States to modernise and harmonise laws, policies and regulatory tools through technical assistance to Member States;
- b) developing guidelines, standards and management tools to access and compare up-to-date management tools;
- c) strengthening groundwater monitoring and data management systems to support Member States;
- d) facilitating the integration of groundwater in shared watercourse commissions and agreements through transboundary cooperation;
- e) organising awareness-raising initiatives on draft UN articles on groundwater among Member States; and
- f) facilitating consultation on whether and how to incorporate the draft articles in to the existing regional and basin institutional arrangements.

Advancing Knowledge on Transboundary Water and National Groundwater

- a) assisting Member States to identify finance for transboundary aquifer management in Member States in collaboration with RBOs/OSIC through Transboundary Diagnostic Analysis (TDAs) and Strategic Action Plans (SAP);
- b) undertaking demonstration projects on emergent and priority ground water management challenges such as climate change, pollution, etc.; and
- c) building a knowledge-sharing platform for an integrated data management system interlinked to a GIS platform and website, through information and communication technologies.

The role of infrastructure to develop opportunities for more sustainable management of groundwater is clearly outlined and promoted to address groundwater related challenges. Hence, RSAPIV provides the following:

Promoting Groundwater Infrastructure Management and Development

- a) facilitating the development of infrastructure for improved groundwater utilization, management and protection. This will be achieved through assessment, mapping, operation and maintenance of infrastructure at Member States level;
- b) evaluating impact and learning from groundwater infrastructure investments to help report on results;
- c) providing operational support for groundwater infrastructure development, including disseminating manuals on infrastructure solutions; and
- d) providing support to partnership developments and securing funding from among governments, private sector parties and bi/multilateral partners and others, for scaling-up successful solutions for infrastructure development.

The same applies to the recognition of the need to develop strategies for the safe and sustainable use of groundwater to promote water security of Island States which are heavily reliant on groundwater sources. The key themes and activities envisaged for groundwater within the RSAPIV regarding the Island States are:

Management and Use of Groundwater in Island States

- a) conducting assessments on groundwater availability and current and future use in Island States;
- b) identifying the vulnerability of groundwater to sea water intrusions, over abstraction, pollution, climate change, and reduction in recharge zones; and
- c) facilitating the formulation of master plans for sustainable use, management and development of groundwater, including innovative approaches such as artificial recharge and conjunctive use.

Importantly, the RSAPIV has reflected the importance of groundwater to not only the rural economy, but also in ensuring that socio-economic development is sustainable. In order to underpin development, RSAPIV has provided the first critical step to note the importance of groundwater, to recognise the need to improve our knowledge and capacity, and to take some institutional steps in this regard.

3.5.2. Regional Programmes

There have been numerous efforts to understand and manage groundwater in a SADC context (Pietersen and Beekman, 2016):

- **Development of a code for good practice of groundwater development in the SADC Region:** This study reviewed and assessed existing standards and practices in the region to develop minimum common standards for groundwater development in SADC Member States. For each of the 14 Member States described:
 - Groundwater occurrence including natural water quality;
 - Institutional framework;
 - Status of groundwater development and standards including public and private capacity and training; and
 - Status of groundwater management including database and information systems and groundwater monitoring.
- **Groundwater and Drought Management Project (GDMP):** SADC developed a Groundwater and Drought Management Project (GDMP) in 2009 with support from the World Bank in recognition of Member States' increasing dependence on groundwater for both domestic and commercial water needs. The GDMP comprised four main components:
 - testing of practical local groundwater drought management strategies at pilot level;
 - the development of groundwater drought management tools and guidelines;
 - research into Groundwater Dependent Ecosystems (GDEs), their occurrence, vulnerability, value, protection and monitoring; and

- establishment of a SADC-GMI to continue long-term groundwater and drought monitoring and the promotion of better management and awareness in the SADC region and at national levels.
- **SADC hydrogeology map:** SADC compiled a SADC hydrogeology map providing information on the extent and geometry of regional aquifer systems at a scale of 1: 2 500 000.
- **SADC Groundwater Grey Literature Archive:** Regional studies form the basis of the current knowledge of regional aquifers systems. An important initiative of SADC was to set up the “SADC Groundwater Grey Literature Archive” website to make available books, reports, maps, notes and datasets that were unpublished or published in limited quantities. The Grey Data Project focused on making part of the large body of useful information on African groundwater held by the British Geological Survey more accessible. Whilst this is an important and useful repository of information, it has not been updated with recent information.

3.5.3. Gaps identified

The role of groundwater in terms of supporting regional development is understood and articulated at a strategic level, but there is much to be done in understanding this in a detailed manner. Whilst there have been several studies that have reflected upon the role of water in the economy, there is still much to do to understand this within a regional context. This particularly within the transboundary basin and aquifer regimes where, in accordance with regional policy, Member States should be looking to shared beneficiation from shared watercourses.

To date, development has largely focused upon the utilisation and effective management of surface waters. Nonetheless, it is understood where there are challenges with infrastructure to ensure supply of surface water, that groundwater plays a pivotal role. Hence, in many rural contexts, groundwater supports these social economies. In improving our understanding of the role of water in supporting economies, there is a need to explore the urban and rural contexts and the societal shifts that we are seeing between these.

Noting the pressures that water resources are generally facing due to increased socio-economic development and the impacts of climate variability and climate change, there is a need to improve upon the conjunctive water resource management regimes. Currently, surface and groundwater resources are still effectively managed as two separate resources and the development of more integrated approaches are not yet prevalent enough.

3.5.4. Opportunities/Enablers to strengthen framework

The mid-term review of RSAPIV provides a key opportunity to influence the next tranche of work to be undertaken as well as starting to influence the strategic intent of RSAPV. In addition, there are opportunities to strategically link an array of regional support programmes such as CRIDF2 and CIWA.

Through these initiatives there is the opportunity to strengthen the strategic approaches towards conjunctive water resource development.

SADC-GMI and the WRTC sub-committee on hydrogeology will provide the opportunity to leverage improved levels of knowledge and capacity towards more focused studies that support our understanding of the role of groundwater in the economy. This will be important in providing support in the development of more strategic approaches to the conjunctive management and development of water resources.

3.6. Key considerations

There are a number of considerations in developing a suite of options to strengthen the regional approaches to the management and development of groundwater.

- **SADC Regional Framework Review:** There is no clarity as to when and how often the key elements of the SADC Regional Framework for water resources (inclusive of groundwater) such as the Revised Protocol on Shared Watercourses, the Regional Water Policy and Regional Water Strategy should be reviewed and updated. Noting that there are increasing pressures upon water resources to support socio-economic development that will only be further compounded by the risk of climate change, there is a need to look for improved approaches that will enable effective and efficient conjunctive use of surface water and groundwater. It is understood, however, that the brevity of this task should not be underestimated and would require considerable commitment from the regional water sector. However, there are useful and progressive first steps that can be taken to strengthen the framework that exists. Thus, the use of MOUs and Policy Addendums can provide pragmatic steps to improve the approach to the management and development of groundwater. Gleaning lessons from the broader international arena will prove extremely valuable.
- **Institutional Frameworks:** There is often a tendency to restructure institutions to solve what are often systemic issues. The regional institutional frameworks provide a useful platform to manage and develop water resources. However, there are very significant internal and systemic issues that require resolution towards improving the management and development of groundwater. This includes a drive to build capacity (staff and skills), to develop monitoring and information management programmes and to provide funding for groundwater studies. These issues are not quickly resolved, but the development of a longer-term programme towards this end will be a key first step.
- **Data and Information Exchange:** Part of the process to develop capacity is ensuring that water resource experts have access to data and information. It is equally essential, in terms of supporting transboundary discourse, to have shared and agreed-upon data sets and information. Whilst the SADC-GMI website is excellent and a number of the transboundary commissions have established information portals there is still much to be done to strengthen the collation, updating and exchange of data and information to support management decision making. In addition, the need to utilise other media as a means for information exchange is critical, especially to support the regional network of experts.

- **Groundwater focal points:** These key resources exist as part of the SADC structures and provide an important network towards strengthening regional capacity and developing harmonised approaches to groundwater management. There are resource constraints that inhibit the functioning of this network, but within these constraints there is a need to develop a programme to enable their ongoing development and the exchange of information and knowledge between them. Whilst the strategic regional issues may take time to resolve, there is opportunity for these focal points to start assisting in shifting national thinking about groundwater management and development. The development of regional knowledge products to support this will be invaluable.
- **Regional Strategic Action Plan:** The mid-term review of the RSAP IV is about to be undertaken and the development of RSAP V will start to be developed in the next few years. Whilst this will take some time, this provides a meaningful opportunity to strengthen the approach to conjunctive surface and ground water management and development, whilst developing programmes that strengthen the governance of groundwater resources.

4. NATIONAL LESSONS INFORMING REGIONAL FRAMEWORK

The Desired Future State (Appendix A) has been contextualised for the SADC region, taking into account:

- The high levels of groundwater dependency in many SADC countries, in rural areas in particular;
- The variety of geohydrological contexts;
- High levels of poverty, gender disparities, social exclusion and pollution; and
- Relatively low levels of state capacity – skills, infrastructure and finance.

It sets out the *minimum* requirements for policy, legislation and Institutional frameworks to support the delivery of national, regional and international developmental goals, including the Sustainable Development Goals, meeting basic human needs to water, energy and food (the WEF nexus), and the protection of ecosystems that are dependent on groundwater.

The sections below reflect the gaps in Policy, Legislation, Institutional framework and Strategy to support groundwater management. One commonality worth noting were issues around communication, information availability and awareness.

4.1. National Trends: Addressing Gaps in Policy

4.1.1. Key strengths identified

The following key trends highlight the strengths in the groundwater management policy:

- **Recognition of the human right to water.** The human right to water is generally widely recognised at the policy level and drinking water/basic human needs are prioritised in the water policy. There is also generally control over the entitlement to use groundwater based on land-based rights, although this is often through permit systems that are poorly implemented. The role of groundwater in meeting basic human needs for food security is less well recognised.
- **Recognition of the role of groundwater in poverty alleviation.** Groundwater is generally recognised as an important source of domestic and agricultural water supply and a key resource for poverty alleviation, food security, and the sustainable economic development of rural areas.
- **Recognition of the social, economic and environmental value of groundwater.** The social, economic and environmental values of groundwater are generally recognised in water policy, although possibly through generic recognition of these values in relation to all water, rather than specifically in relation to groundwater.
- **Recognition of principles around polluter-pays and subsidiarity.** The issue of polluter-pays is common in the policy, as is the principle of subsidiarity.

4.1.2. Good practice

Several aspects emerged as good practice with regards to policy:

- **National Integrated Water Resource Management (IWRM) policy.** Many countries have amended and improved their national policies to reflect the core concepts of integrated water resource management, and in so doing have recognised the importance of the connectivity between groundwater and surface water and understand the importance of groundwater in maintaining important ecological infrastructure.
- **Groundwater Protection.** Some of the policies reflect that whilst groundwater is indeed underutilised and an important source of water supply for both urban and rural settings, there is still the need to protect the resource and ensure that use remains sustainable. In the regard, the concept of a groundwater reserve is considered good practice. Likewise, several countries recognise the importance of recharge as a key policy position.
- **Wetland Policies.** Both Namibia and South Africa are in the process of developing national wetland policies. These are important in recognising the importance of groundwater in maintaining wetlands that place a crucial role in regulating surface water hydrology as well as in supporting rural livelihoods. Wetland degradation over the last 25 years has been prolific and the introduction of policies to ensure improved management is significant.
- **Mine-water Management Policy** South Africa has introduced a mine-water management policy that recognises the importance of managing the impacts of mining both on surface and groundwaters, particularly with regards to the impacts upon water quality.
- **Catchment based institutions:** Most policies call for the establishment of catchment-based institutions. The area of jurisdiction is most often based upon surface water hydrological boundaries, but these have in some instances been adjusted to consider aquifers. Whilst, in many instances the establishment of these institutions has been slow and fraught with challenges, those established have shown significant impact upon the management of water resources. Localised water user associations can play a significant role in the management of groundwater.

4.1.3. Key gaps identified

The following trends highlight the gaps and areas for improvement in groundwater management policy:

- **Limited specific reference to groundwater in national water policies.** The importance of groundwater is recognised in some national water policies, however, often in relation to provision of water to rural communities. Generally, it is dealt with by default, subsumed into the concept of 'water resource'. This means that the specific issues pertaining to groundwater management are often not well addressed. Some countries do not appear to have a national water policy (e.g. DRC, Madagascar, Swaziland (has a 2017 draft) Mauritius). The necessity of a policy in these countries will need to be clarified.
- **Limited cross-sectoral policy positions and alignment.** Across all the countries, there are a number of other policies that have implications for groundwater, such as those on mining, land, environment, water supply and sanitation. Whilst some of their policies actually refer to groundwater, there is little cross-sectoral collaboration that ensures the alignment of policy positions or drives integrated

implementation of groundwater-related policy. In some cases, it appears that there is conflict between sectoral policy positions which might lead to unsustainable use of groundwater e.g. between water and agricultural/land use policy. The groundwater resource management links to other groundwater-dependent sectors like agriculture, health and environment, are insufficiently addressed in policy.

- **Limited recognition of the biophysical and ecological linkages between ground and surface water.** Since there is generally little specific reference to groundwater in the policies, the biophysical and ecological linkages between ground and surface water for their use, protection and management are insufficiently recognised. There are a few policies that do refer to issues of groundwater protection and recharge and conjunctive use, but there are very limited reference made to biophysical and ecological linkages.
- **Limited recognition of the role of groundwater management in wetland protection.** While some policies refer to the need to protect wetlands, the specific connection between this and groundwater management is not recognised.
- **Limited policy related to transboundary aquifers.** The issue of transboundary aquifers and its management is missing from national water policy. This presents a significant challenge noting the large number of transboundary aquifers in the region.
- **Limited policy guidance to support transboundary aquifers that cross administrative boundaries.** Most of the policies being based on the concept of IWRM refer to the need to manage water according to catchment boundaries; however, do not reflect the challenge that aquifers may cross catchment boundaries and may need other administrative boundaries to be drawn for the sustainable management of groundwater.
- **Limited recognition of customary rights.** There is little or no recognition in the policy of customary rights in the groundwater sector. Generally, the policy approach that is taken is that water use permits must be used to control and regulate groundwater use, despite the growing evidence that states in SADC do not have sufficient capacity to implement water permit systems. The recognition of customary rights, as well as other water use authorisation tools (such as general authorisations in South Africa), would enable the state to regulate groundwater use more effectively with limited state resources.
- **Limited translation of policy into implementation instruments.** Even where policy is in place, and does address groundwater to some extent, there are major challenges in implementation across the region. This highlights the issue of how to ensure that policy positions are implementable within the limited human, financial and information resources of SADC countries
- **Limited recognition for intersectoral collaboration.** There is generally little, if any, reference to intersectoral collaboration in relation to groundwater.
- **Limited stakeholder engagement specific to groundwater management.** The roles of various stakeholders and water users is recognised and the participation of stakeholders in decision-making and water management is promoted and facilitated, but generally in relation to water as a whole, not specifically in relation to groundwater, and there is little reference to the specific institutional

arrangements required for participation in and management of aquifers and community-level groundwater management.

- **Limited policy positions of groundwater data, monitoring and information.** The issue of public access to geohydrological data held by the state is poorly articulated at the policy level. The critical need for adaptive management is referred to in some of the policies, but it is insufficiently dealt with and the critical links with effective monitoring and data collection and analysis is poorly made.
- **Pricing mechanisms need to be strengthened.** In most cases, there are generally provisions for pricing mechanisms for the use of water. There is little reference, however, to the specific need for such mechanisms to be pro-poor. It is not clear whether the implementation of these mechanisms incentivizes equitable distribution of rights to access and use of groundwater (gender-sensitive), and the prioritization of small-scale users' livelihoods and food security needs, especially youth and women.

4.1.4. Enablers required to unlock these gaps at a regional level

In resolving the challenges identified, the following responses at a regional level are noted:

- **Advocacy:** Strengthened and innovative approaches to advocacy and raising the awareness of the critical role of groundwater for national development in the SADC region would assist in drawing attention to the current weaknesses in policy and the need for countries to respond.
- **Core policy positions:** A document setting out the core policy positions for groundwater, drawing on regional and international best practice, would enable countries to respond more easily to policy revision processes. These could be included into general water policy or used to inform specific policy for groundwater.
- **Sectoral policy positions:** In addition to the document referred to above, core policy positions pertaining to groundwater management in relation to critical sectors (agriculture, mining, wetland protection, etc) could be developed either to be included in national water policy, or to be used as the starting point for policy engagement with the relevant sectors at the national level.
- **Development of instruments to support policy implementation:** Translation of policy into appropriate instruments to support implementation is required.
- **Transboundary and trans-catchment aquifers:** The SADC-GMI could greatly assist the region through the development of best practice policy positions on the management and institutional arrangements for transboundary aquifers as well as how to manage aquifers that cross watershed/catchment boundaries.
- **Adaptive management awareness creation:** SADC-GMI, with the support of the SADC Water Division, can assist in raising awareness on the critical need for adaptive management for groundwater in the face of changing conditions on the ground, including climate change. This awareness raising should assist in clarifying the critical links between monitoring, assessment and adaptive management.
- **Capacity building and training:** SADC-GMI collaboration with key regional academic and research institutions (e.g. Waternet) would support broadened capacity building and promote advocacy.

- **Customary rights and hybrid water rights systems:** There is significant work to be done in the region on understanding customary water rights in relation to groundwater, the practical opportunities and implications of recognising customary rights, and the opportunities for developing practical hybrid water rights systems that will meet the needs of both the state and water users. SADC-GMI, in conjunction with other organisations working on these issues in the region, could take the lead on developing innovative, African-specific approaches to effective water rights systems for groundwater.
- **Gender and social inclusion:** Although several of the policies refer to the important issue of groundwater as a source for meeting basic human needs, and this addresses the issue of equity to some extent in this regard, very little attention is paid to the issue of gender in access to groundwater for productive purposes. In the light of the challenges that female farmers face in Africa, and the recognised enhanced role that they could play in food security and nutrition should they be given equal access to resources as men, it is critical that groundwater policy deals specifically and clearly with gender and with the issue of equal access to groundwater for women and men. Regular liaison with the SADC Gender Unit and Focal Points would support this.

4.2. National Trends: Addressing Gaps in Legislation

4.2.1. Key strengths identified

The following key trends highlight the strengths in the groundwater management legislation:

- **States are legally recognizing the status groundwater at the national level.** The majority of the laws reviewed recognize that all water, surface and ground, has a consistent status in law, irrespective of where it occurs. Many recognize the need for integrated water resource management, and some make explicit reference to the need for conjunctive management of surface and groundwater. There are few standalone groundwater laws, but this is a policy choice in many countries to integrate surface and groundwater regulation in one legal framework.
- **Water use authorizations include provisions for groundwater (with a system that does not discriminate, especially against the rural poor).** Water licensing or permitting is consistently used as the administrative tool of choice to regulate groundwater use. In most, if not all, cases, permitting requirements provide exemptions for digging of shallow wells/boreholes and/or abstraction of groundwater for domestic use purposes. Domestic (or primary) uses are defined differently across countries, but mainly include water for drinking, bathing, sanitation and often for watering of livestock. Any other water uses (and, in some countries, even domestic water uses above a certain daily abstraction rate set by regulation) are required to obtain a license/permit.
- **Groundwater use is not exclusively tied to land rights/groundwater is a public resource.** Across almost all (if not all) countries, some form of the public trust doctrine has been articulated in the national water legislation, vesting water resources in the State or the people to be managed for the good of the citizens. As such, groundwater rights that were previously appurtenant to land and therefore only available to landowners are now limited to those exempted from permit requirements. All other abstraction and use rights require permits. In some cases, water permits (or exempted water uses) are only available when land ownership, occupancy or a certification from the land owner or occupant is made available (or where a person has “legal access” to land on which water is located). In many of these cases, legal provision is made for easements to enable necessary access. Such administrative burdens can be onerous, particularly for rural poor communities.
- **National water legislation is regulating drillers/drilling of boreholes.** For the majority of the countries, provisions are made to license both drillers of boreholes and the drilling/construction process itself in addition to abstraction and use. Some countries have developed detailed regulatory requirements outlining very specific requirements related to notices of intention; information requirements for drillers; qualifications/certification of drillers; records to be kept during the construction process; factors the government must consider in granting or denying permits; and installation of meters for ongoing monitoring and data collection.
- **Water control areas.** The use of groundwater control areas or protection zones is apparent in a number of the laws. However, the tools available are often limited to restricting permitting and new

drilling or reallocation of existing rights. More planning and stakeholder engagement in planning, data collection and targeted enforcement in these areas are among the tools that could enhance the scope of protections available.

4.2.2. Good practice

Certain practices and innovations have emerged from different countries, although it is important to understand how well these are being implemented in practice.

- **Mauritius Groundwater Regulations (2011):** requires every licensee to set up, at his/her own cost, a meter and use it to measure the volume of groundwater abstracted. The meter must be kept in good working order and a daily record of abstraction kept and reported monthly to the Water Authority. The regulations specify how and where the meter is to be installed and calibrated annually. Renewals of licenses depend on payment of outstanding fees, a certificate that the meter is in working order, and historical adherence to permit requirements.
- **Malawi's Water Resources Act (2013):** provides a comprehensive set of considerations for the permitting authority to consider when issuing a groundwater use or abstraction permit, including:
 - **Consistency with policy and the national water resource management plan;**
 - Impacts on water users and the resource
 - The safe yield of the aquifer impacted
 - Conformity with efficient water resource management practices
 - Likely water quality impacts
 - International obligations
 - Traditional communities and customary rights and practices dependent on the resource.

The same Act enables the Water Authority to establish Groundwater Conservation Areas where it is convinced that it is necessary for the conservation of groundwater or the protection of water supplies. Once established, the Authority has broad powers within a Conservation Area to “impose such requirements, regulate or prohibit such conduct or activities, in or in relation to a groundwater conservation area as the Authority may think necessary to impose, regulate or prohibit for the protection of the area and its groundwater.” (Malawi Water Resources Act, Art. 66(2)).

- **Zambia's Water Resources Title on Management (Groundwater and Boreholes) Regulations (2018):** requires notice of intention to drill a borehole; an application and payment of prescribed fee; technical specifications to ensure safety and sanitary standards are met; and specific distances that must be met between boreholes and between boreholes and various types of pollution sources.

4.2.3. Key gaps identified

The following trends highlight the gaps and areas for improvement in groundwater management legislation:

- **Limited legal recognition of the human right to water.** While there is generally wide recognition of the right to water at the policy level, very few of the laws have actually enshrined the human right to water as an enforceable right. This has implications for the enforcement of provisions prioritizing domestic water uses in times of conflict or drought, as well as for basic administrative decisions allocating groundwater resource rights.
- **Limited legal tools to facilitate access to groundwater for livelihoods/small-scale productive uses.** While, as noted above, most countries exempt domestic or “primary” groundwater uses from a permitting requirement. However, few countries (Zambia is a notable exception that also exempts “non-commercial uses”) allow for enough water to be exempted to allocate for livelihoods or small-scale productive uses (uses that do not reach the level of commercial scale uses). This administrative burden can, and often does, limit the ability of many communities and people to use groundwater in a way that supports food security, poverty alleviation and overall resilience.
- **Limited legal recognition of customary groundwater rights and practices.** While there are examples of laws that do provide legal recognition of customary rights and practices (e.g., Botswana, Namibia, Tanzania), these are not in the majority. Further, the ones that do recognize customary rights often fail to clarify the status of those rights in the face of potentially conflictive legislative rights or simply provide that they must be “considered”. This places communities (almost all customary resource rights are practiced on a collective basis) at a legal disadvantage in securing their groundwater rights. It also de-emphasizes the possibility of affordable, small-scale and indigenous solutions to groundwater challenges.
- **Limited provisions for effective groundwater monitoring.** Most provisions related to data collection pertain to data collected by users/drillers or enabling the establishment of a broader monitoring system. Detailed requirements related to groundwater-specific monitoring programs are conspicuously absent.
- **Lack of provisions for inter-sectoral coordination/harmonization.** Almost every country noted failure of inter-sectoral coordination as one of the key challenges to effective groundwater management. While this is partially an institutional issue, it must also be addressed at a regulatory level, by providing groundwater management institutions the mandate and authority to consult and require feedback from relevant sectors, for example. Additional provisions should relate to integrating data collection and management across relevant sectors; establishment of inter-sectoral institutional coordination mechanisms (including stakeholders); and harmonization of various sectoral laws and permitting requirements and processes (e.g., mining, irrigation, land use zoning and planning).
- **Limited stakeholder engagement in groundwater decision-making and management.** Very few of the laws reviewed for the national assessments provided meaningful provisions for stakeholder engagement in groundwater management and decision-making. While some of the legislation contains broad provisions for access to information on groundwater resources (where data is collected by the government is it made publicly available), or through consultation in planning procedures, the main mechanism for stakeholder engagement more broadly is via the creation of water user

associations or catchment management institutions at the local level. Very few of the countries specifically refer to groundwater management as the basis for these associations/committees, and even those that do, provide no specific provisions about groundwater management practices for these stakeholder/community groups. Legal provision for the establishment of groundwater user associations, particularly in water stressed aquifers, should be a priority for including stakeholders in decision-making and management as well as for improving monitoring, enforcement and compliance at the local level.

- **Gender.** No provisions are made for inclusion of women in groundwater decision-making and management or for ensuring that there is no gender discrimination in allocation of groundwater use rights.
- **Non-point source regulation.** While many of the countries appear to have point source pollution (including wastewater effluent) permitting systems in place, provisions for non-point source pollution control are conspicuously absent.
- **Incentives for conservation/efficient use.** Provisions for economic incentives or requirements for technologies for conservation, demand management and efficient use are largely absent.
- **Compliance and enforcement.** While most laws provide inspections and sampling authority, as well as sanctions for permit violations, there are many additional provisions for compliance incentives and enforcement that could improve groundwater management immensely that are largely absent from the laws reviewed.
- **Conflict resolution measures.** Again, the absence of groundwater user associations/committees from most jurisdictions undermines the ability of local users to solve their own conflicts. Other mechanisms are also largely absent from the existing laws.

4.2.4. Enablers required to unlock these gaps at a regional level

In resolving the challenges identified, the following responses from the SADC Water Division and SADC-GMI would assist:

- Many countries indicated that a standalone groundwater law or regulation would be appropriate to ensure that all legal issues can be addressed comprehensively. A **model groundwater law** could be provided to provide guidance on the types of provisions that should be included in such legislation.
- **Model regulations and guidance** on various aspects of groundwater management, including:
 - Model regulations on exploration, drilling and construction of boreholes/wells;
 - Model regulations on groundwater use permitting;
 - Certification of professionals;
 - Guidance on compliance and enforcement provisions.
- **Training** on specific issues to raise awareness, e.g.:
 - Permitting;
 - Groundwater information systems;
 - Human right to water, customary water rights, gender and social inclusion;

- Compliance and enforcement.
- **Legal recognition of customary groundwater rights/laws and harmonization of water, land and resource tenure laws:** As indicated in the Policy section, there is significant work to be done in the region on understanding customary water rights in relation to groundwater, the practical opportunities and implications of providing clear legal recognition of customary rights and harmonizing those rights with land and other resource tenure rights. SADC-GMI, in conjunction with other organisations working on these issues in the region, could take the lead on developing innovative, African-specific approaches to effective water rights systems for groundwater.
- **Gender and social inclusion:** As indicated in the Policy section, very little attention is paid to the issue of gender in legislation related to groundwater use and management. Specific provisions should be developed to proactively engage women in groundwater decision-making at both the national and regional level, both through institutional mechanisms and also by prohibiting discrimination in the application of laws, ensuring allocation of water rights proactively consider the needs of women, and other innovative legal mechanisms.
- **Transboundary aquifer agreements/institutions:** building on the SADC Water Protocol, SADC-GMI could play a critical role in creating a Groundwater Protocol to guide basin-specific agreements on shared groundwater resources and facilitate Member State cooperation and strategic management decisions related to these aquifers.

4.3. National Trends: Addressing Gaps in Strategies and Guidelines

4.3.1. Key strengths identified

The following key trends highlight the strengths in the groundwater strategies and guidelines

- **Subsidiary legislation or regulations:** Water quality standards have been codified into regulations in a number of countries.
- **Community management of groundwater:** There exist a number of guidelines for community management of groundwater

4.3.2. Good practice

A number of countries have developed regulations, guidelines and standards for use, protection including on-site sanitation; borehole drilling and regulation of drillers; appropriate financial and economic regulatory tools e.g. water pricing (Zambia is the only case) and water quality standards. Several countries have protocols and standards on data collection and storage and but there are limited examples of templates for municipal by-laws. Community management guidelines have also been developed by a number of SADC Member States.

- **Groundwater strategies:** South Africa is the only example of a country that has developed an explicit National Groundwater Strategy (NGS) in 2010 and updated in 2016 (Department of Water Affairs, 2010; Department of Water and Sanitation, 2016). The NGS 2016 update has a number of strategic themes of which each one has been developed in terms of Objectives, Principles, Situation Assessment, Current challenges, and Strategic Actions for the following themes:
 - ✚ Stakeholder-driven development and implementation
 - ✚ National Groundwater Leadership
 - ✚ Responsive groundwater regulatory framework
 - ✚ Groundwater resource protection
 - ✚ Sustainable groundwater resource utilization
 - ✚ Appropriate institutional development
 - ✚ Water sector awareness, skills and capacity
 - ✚ Redirecting Finances
 - ✚ Groundwater resource planning and development
 - ✚ Information management
 - ✚ Regional and international partnerships
 - ✚ Local Action
- **Conjunctive use / Managed Aquifer Recharge (MAR):** An Artificial Recharge Strategy (or MAR) for South Africa was developed in 2007 (Department of Water Affairs and Forestry, 2007). The strategy identified the following themes to support implementation: (a) Knowledge (b) Legislation and

Regulation (c) Planning (d) Implementation (e) Management (f) Research Theme, and (g) Strategy Implementation. The DWAF, at the time, intended to incorporate artificial recharge as part of water resource planning - both at the Water Resource Level and at the Water Services Level (Department of Water Affairs and Forestry, 2007). At the Water Resource Level, this meant incorporating artificial recharge within Catchment Management Strategies and the National Water Resource Strategy and at the Water Services Level, it will mean including artificial recharge in Integrated Development Plans, in Water Services Development Plans and in the various Water Conservation and Water Demand Management Strategies (Department of Water Affairs and Forestry, 2007). The City of Windhoek has taken this concept to application as discussed in section 1.3.1.

- **Water resource regulations and standards:** Malawi has developed water resource regulations which amongst others deal with groundwater management, development and administration (Government of Malawi, 2018). The regulations require a drilling permit to be obtained by a person who wishes to engage a driller to construct a borehole on his land for the purpose of using water; recharging an aquifer; or monitoring and research; fitting a motorised pump to a borehole, and exploration. Regulation of groundwater development requires an allocation plan and test pumping. The following standards, known as ZWS 678:2013 standards have been developed and are currently in use in Zimbabwe.
- **Municipal by-laws:** The dependence of Windhoek, Namibia on groundwater resources for its water security necessitated the Windhoek City Council to pass new town-planning regulations aimed at preventing over-abstraction and pollution of the Windhoek Aquifer. The regulations include prohibition of hazardous material and land use zoning to protect recharge areas of the aquifer. The Zambian government has introduced fees on groundwater use (Government of Zambia, 2018). The fees include:
 - ✚ Registration of a borehole
 - ✚ Application for a permit to drill domestic and commercial boreholes
 - ✚ Drillers licenses for Zambian and non-Zambian companies to operate

4.3.3. Key gaps identified

The following trends highlight the gaps and areas for improvement in groundwater strategies and guidelines

- **Subsidiary legislation or regulations:** There are guidelines in place, in several countries that deal with groundwater use; protection including on-site sanitation; borehole drilling and construction standards; and aquifer tests. There are also guidelines for groundwater licensing e.g. Namibia. There are no guidelines for appropriate financial and economic regulatory tools e.g. water pricing. The guidelines that were developed were also not gazetted becoming voluntary rather than statutory resulting in uncontrolled drilling and groundwater use. At SADC level Guidelines for the groundwater development in the SADC Region was compiled (Bee Pee (Pty) Ltd, 2001).

- **Clear protocols and standards on data collection and storage:** There is disparate monitoring and information systems at national level with no clear protocols and standards on data collection and storage.
- **Template for municipal by-laws:** There are limited government commitment to implement strategies and guidelines for groundwater management at local level.

4.3.4. Enablers required to unlock these gaps at a regional level

In resolving the challenges identified, the following responses from the SADC Water Division and SADC-GMI would assist:

- **Advocacy:** Implement advocacy programmes highlighting the social and economic values of groundwater resources and its role in conjunctive use
- **Strategies:** Develop regional groundwater strategy with specific actions for countries. This includes groundwater exploration and assessment of priority aquifers in SADC
- **Components of the strategy:** Encourage conjunctive use, water reuse and recycling through Managed Aquifer Recharge and also groundwater pricing
- **Regional database:** Facilitate a regional groundwater database with clear protocols and standards on data collection and storage
- **Regulations, standards and guidelines:** Develop model groundwater regulations for implementation in Member States and update guidelines for groundwater exploration, drilling and construction, test pumping and operation & maintenance
- **Capacity development:** Implement the capacity development roadmap (Pietersen et al., 2018) which includes tasks for: advocacy and awareness creation; training and education; facilitation and mentoring; networking, collaborative research programmes; supporting RBOs; feedback, to promote learning from experience; regional groundwater monitoring and information system; and funding
- **Local groundwater management:** Facilitate institutional models for both rural and urban groundwater supply
- **Financing arrangements:** Consider cost-recovery financial models to implement (ground)water strategy e.g. Water Fund, Tariffs

4.4. National Trends: Addressing Gaps in Institutional Frameworks

4.4.1. Key strengths identified

Whilst, there are potentially some specific institutional outcomes that could be considered for specific aspects in the management of groundwater resources, it is generally accepted that there is a need for institutional arrangements that understand and support the integrated nature of surface water and groundwater resources and, therefore, enables the sustainable management and development of groundwater resources.

The development of institutional arrangements to support ongoing water resource management and development has taken place at differing rates across the region and is closely connected to the shifts in policy and legislative environments. It is clear that institutional development requires iterative adjustment over time and through these processes find workable solutions towards an improved management, development and regulatory regime.

In this regard, key institutional trends that demonstrate the strengths in existing institutional frameworks include:

- **Nationally responsible Ministry:** All states have a nationally responsible governmental Ministry and/ or Department of water affairs that recognises the importance of managing water as a strategic asset. In most instances, these Departments are responsible as custodian of the national asset and provide the policy frameworks for resource management, with a strongly connectivity to national development agendas.
- **Water resources authorities:** In several instances, states have established, or are in the process of establishing water resource management authorities. These nationally focused authorities have varying resource management and development agendas and sometimes have a strong regulatory responsibility.
- **Catchment based institutions:** Most policy directives provide for the establishment of catchment-based water resource management institutions. These are largely focused on providing water resource management with areas of operation that are, in the majority of instances, based on surface water hydrological boundaries.
- **Transboundary institutions:** Whilst, the development of transboundary water resource management institutions (commissions and supporting secretariats) has been slow, most states are engaging with fellow Member States with regards to shared water courses. These arrangements vary in terms of being both bilateral and multi-lateral in nature.
- **Localised institutions:** In most instances the establishment of water user associations (WUAs) is provided for by the existing policy and legislative frameworks. The establishment of these more localised institutions focused upon the coordination of water use has taken place in many states.
- **Split of regulatory functions:** Most institutional frameworks recognise the need to institutionally split the responsibilities for water resource management and regulation from that of water resource development.

4.4.2. Good practice

A number of aspects start to emerge as good practice with regards to institutional arrangements:

- **Functional differentiation:** The need to ensure effective management of water resources is supported by differentiating those functions that provide policy intent from the more operational functions that support water resource use and development. This is then overseen by a regulatory function that may be institutionally close to the setting of policy but could equally reside within a

separate institution. There is a growing trend towards the establishment of more independent regulators (see Zambia's NWASCO for example), but more important is that there is a clear differentiation from those that are responsible for the setting of policy frameworks and those that develop resources.

- **Catchment-based institutions:** The need to devolve the more operational management and catchment-based oversight to institutions within catchments is generally recognised as best practice. These institutions not only enable an improved level of planning and coordination by supporting engagement across a range of sectors and levels of government, but also by enabling better engagement with stakeholders (See Tanzania for the Basin Water Offices and Zimbabwe for the Catchment Councils).
- **Establishment of Water Users Associations:** Whilst there are a range of challenges with regards to ensuring that these institutions are effectively functioning, they are generally recognised as being important in terms of ensuring localised management and operations of water use management and in supporting effective compliance monitoring. There are quite significant capacity and financial challenges at these levels that do require support, but some states, such as Tanzania, has driven hard to get these established and are now working to build their capacity towards improved functioning.
- **Redefining areas of operation:** Noting the importance of groundwater across the region it is particularly important that the areas of operation, of differing institutions, takes into consideration geohydrological boundaries wherever possible and necessary. This has been undertaken in a number of instances and enables more effective groundwater management at the local scale.
- **Improved financing:** Many policies allow for a range of financial instruments to support ongoing water resource management. Most of these are based upon abstractive use, whilst in many instances the policy frameworks support the concept of "polluter pays" little has been done to take this into implementation. The South African Waste Discharge Charge System development has taken this to implementation readiness and can provide a useful platform for catchment-based institutions to engage with issues of water quality in surface and ground water.
- **Stakeholder engagement:** Nearly all states reflect the value-add that is gained from stakeholder engagement processes, with many reflecting significant rooms for improvement. Developing appropriate institutional platforms to enable effective engagement is important. In some instances, the establishment of water user associations is seen as one of the platforms for this, however, a few countries have taken the step to more actively establish stakeholder engagement forums that meet on a regular basis and are open to attendance by a wide range of interested and effected parties. There are undoubtedly challenges in ensuring that these platforms are sustainable, but the use of such 'institutions' is immensely powerful in harnessing the collective wisdom of a range of stakeholders.
- **Research institutions:** The need for improved research is recognised as a key issue for strengthening our ongoing management of groundwater resources, but also, in so doing, to train

and develop our skills and capacity with regards to the various aspects of groundwater management. Whilst some states have established some form of council for geoscience, which is powerful in furthering geohydrological sciences, the establishment of the Water Research Commission in South Africa has to be seen as best practice in terms of supporting and coordinating integrated water research.

4.4.3. Key gaps identified

The following trends highlight the gaps and areas for improvement in institutional frameworks:

- **Limited progress in institutional development:** Whilst, there are in nearly all states policies to develop the institutional frameworks responsible for water resource management and development, progress has indeed been slow. This finds many countries in a state of institutional flux that creates an array of challenges including uncertainty in roles and responsibilities, poor planning and an inability to develop appropriate capacity.
- **Limited and ineffective intergovernmental relations:** Whilst there is an apex Ministry responsible for water and groundwater management, there are a range of other Ministries and Departments that have very significant impact upon water resources and groundwater resources, specifically. This includes sectors such as agriculture, minerals and mining, human settlements, trade and industry and energy. Whilst there are often challenges in ensuring effective coordination and collaboration horizontally between sectors, there are also significant challenges when trying to ensure effective cooperation vertically across the different spheres/tiers of government. Noting the importance of local government in terms of driving local socio-economic development, and the importance of groundwater resources at that level, the interface with municipalities is particularly important, yet complex.
- **Instability in policy frameworks:** There has been a tendency to adjust and amend the policy and legislative frameworks regarding institutional establishment and development. This has been the case in some countries more than others, but generally this has been a factor in the slow progress in institutional processes.
- **Water management areas:** In many instances, institutional arrangements are based around areas developed using hydrological boundaries. These are most often surface water catchment-based areas and only limited cognisance of groundwater aquifers is taken. This creates some institutional challenges when trying to manage groundwater across an array of natural, administrative and political boundaries.
- **Limitations in the coordination of planning:** The complexity of joined-up planning across sectors, spatial scales and various boundaries is noted in many states, with most recognising the need for institutions to find ways to strengthen and improve the way in which this planning takes place. Noting the general vulnerability of water resources and the relative importance of groundwater resources, institutions need to find methods and approaches that can serve to strengthen what is currently poor planning.

- **Split in surface and ground water responsibilities:** Whilst many countries have a groundwater “division” within the national department of water, in many instances’ groundwater falls under some form of department of rural water supply. This creates a disjuncture in the effective management of groundwater resources and that of surface water, but also enables poor regulation of groundwater abstraction and use.
- **Limited groundwater capacity:** There are generally shortages of staff focused upon groundwater management, with many of the divisions responsible for groundwater management being under-capacitated. This is exacerbated by the fact that there are only limited skilled and trained people that have suitable groundwater qualifications.
- **Limited training offerings:** Many states have a well-developed network of tertiary institutions that provide training, but there are only a few institutions (across SADC) that provide training with regards to groundwater management and development. Most often this is a subset of a broader training in integrated water resource management. The WATERNET offering is typical in this regard. The limited availability of these training offerings is a key dimension of the limitations in capacity across the region and requires strengthening.
- **Financial constraints:** A key factor in enabling the implementation of institutional frameworks has been the ability to ensure there are sufficient and sustainable financial resources to support the institutional development processes required to ensure effective management of water resources.
- **Poorly integrated data and information management systems:** In order to support effective and efficient decision making, access to data and information through decision support systems becomes increasingly important. Most states have recognised the importance of these information management systems but have noted that the development of these systems is lacking. This is particularly the case for systems that are required to connect different government departments or institutions. This has created significant challenges for effective management and regulation, in particular.
- **Varying institutional capacity at local levels:** The establishment of water user associations and other such localised institutions has been recognised across SADC as being a critical dimension of ensuring efficient water use through localised compliance monitoring and enforcement. The establishment of water user associations has been undertaken in different ways, but there are concerns about technical capacity within these institutions and whilst some are well capacitated, others are poorly so, particularly with regards to groundwater management.
- **Insufficient Stakeholder engagement:** Most policy frameworks adhere to the core concepts of integrated water resource management, which are underscored by the principles of stakeholder engagement. However, in most states there are concerns that the efforts to engage stakeholders have not been sufficient, noting the importance of water resources. This has resulted in a poor awareness regarding the complexities of both surface water and groundwater management. This has been exacerbated by relatively poor use of social media and the internet to distribute materials

and information that can be used to create better awareness of water resource management and development.

- **Limited institutions supporting research:** There is a need to improve the level of research into groundwater resources across the entire SADC region. Whilst certain universities do undertake research with regards to groundwater management, these are few across the region with sufficient in-depth technical abilities. In addition, there are only a few institutions that have a core research mandate such as the Water Research Commission (in South Africa) or Councils for Geoscience. These institutions form a critically important role in both furthering the understanding of groundwater management as well as supporting academic training.
- **Few professional Bodies:** Groundwater resources are critical in supplying water to rural and marginalised communities and have been increasingly mined by communities where insufficient infrastructure development has occurred. It is becoming increasingly important to ensure that there is consistency and quality in approach to drilling and siting of boreholes. In this regard, there is very little taking place to establish and develop professional bodies that provide oversight and training to ensure that drillers use appropriate and sustainable techniques. These bodies need to be supported by an effective regulatory environment, which is currently lacking.

4.4.4. Enablers required to unlock these gaps at a regional level

In resolving the challenges identified, the following responses from the SADC Water Division and SADC-GMI would assist:

- **Advocacy:** Strengthening the understanding of the importance of not only establishing and developing appropriate institutions, but also providing key tools and instruments that can support these institutions in terms of the operational business of groundwater management. The development of guidelines could prove useful in this regard.
- **Transboundary aquifer management:** Support in developing approaches to strengthen the management of transboundary aquifers would prove useful to basin commissions/ RBOs. These may have institutional impacts and require the establishment of groundwater focused task teams, but also have impact upon how information exchange between Member States takes place.
- **Coordinated ground water training:** Whilst there are a number of institutions that provide training and development with regards to groundwater management this does appear to be disjointed. Engagement with key tertiary institutions and programmes such as WATERNET would prove valuable in developing more integrated learning opportunities.
- **Coordinated groundwater research:** The South African Water Research Commission, the various Councils for Geoscience as well as the Universities (across the region) could be better coordinated to ensure more integrated and effective research. Sharing of this research across the region is immensely powerful and would enable more in-depth discovery and discourse with regards to groundwater management.

- **Network of professionals:** There has been discussion in most states that there is a need for some form of professional body for geohydrological experts, there is a need for someone to champion this approach. Likewise, the development of a network of geohydrological experts would encourage improved levels of knowledge exchange that can only benefit geohydrological practice and research.
- **Creating awareness:** There is an ongoing need for awareness creation materials that support states in developing an improved level of awareness with regards to groundwater resources and their effective management. These will support broader awareness and engagement through stakeholder processes.

5. OPPORTUNITIES TO STRENGTHEN THE REGIONAL FRAMEWORK

There are a range of opportunities to strengthen the regional framework for water resource management with specific attention on aspects relating to groundwater management. As has been often noted during the review process, the frameworks (whether national or regional) are only as good as the ability to implement and realise impact. It must be understood that there are significant resource constraints across the SADC region that impact upon the ability to ensure effective implementation of policy, legislation, and strategy. As such, it is essential to be pragmatic noting that some processes will have significant time and effort requirements.

Noting the importance of water to the regional and national development agendas, there is a need to strengthen the institutional frameworks, to build capacity across a range of technical and strategic groundwater and surface water resource management areas, to improve the policy, legislative and strategic frameworks and to ensure that there are the financial resources to ensure the ongoing development. To this end, there are a range of activities required across the domains of institutions, information and investments (see **Figure 7**).

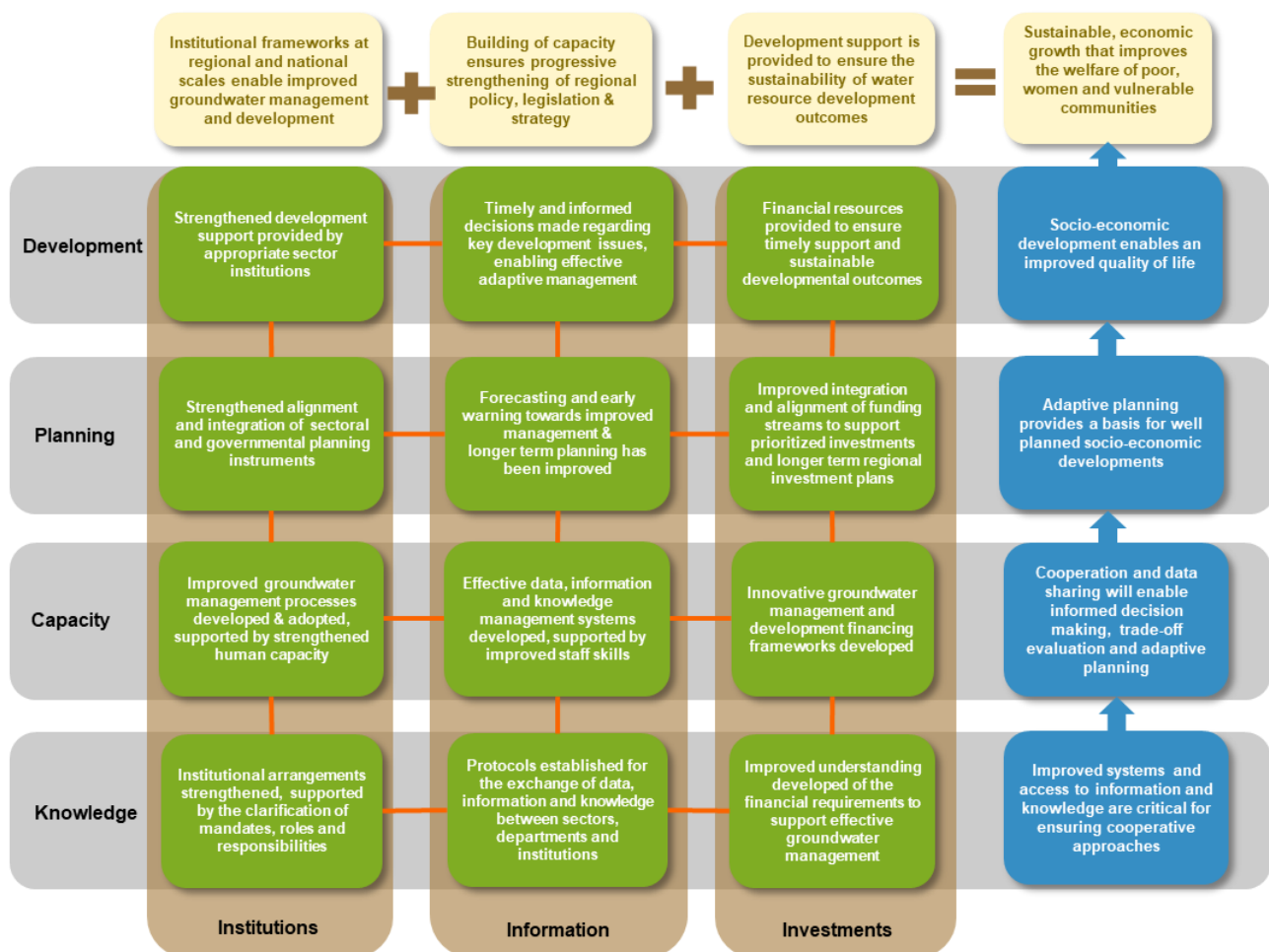


Figure 7: A Theory of Change towards strengthening groundwater management

From the review, a number of possibilities emerge in terms of strengthening the legislative, policy, strategy and institutional frameworks towards improving groundwater management.

Legislation

- Review and strengthen the SADC Revised Protocol on Shared Watercourses using the UN draft articles on the law of transboundary aquifers (2008), the UNECE model provisions as well as using lessons gleaned from several bilateral and multilateral agreements that have been developed specifically for the management and development of groundwater. This review would require a critical assessment of the applicability of the various of the various aspects of these various instruments.
- Develop guidelines for promoting good practices among Member States that do not require amendment to the Protocol, to provide practical guidance that could result in lessons towards a longer-term process towards amending the Protocol. These could be developed from such tools as the UNECE's Model Provisions and be tailored to the SADC Protocol and the SADC context.
- Make use of the development of Memoranda of Understanding on specific issues to strengthen groundwater management and development, specifically within transboundary contexts, which could include agreements on data sharing, joint monitoring and standards, or other specific and priority mechanisms for shared groundwater governance. These would enable implementation on a shorter-term basis and could then be encapsulated into a larger suite of legal reforms over time.

Policy

- The Regional Water Policy should be reviewed with a conscious focus on addressing its limitations in relation to groundwater management and development. This should be a longer-term objective of the SADC-GMI, in conjunction with the SADC Water Division.
- In addition to the groundwater dimensions of the Regional Water Policy a review of the policy would enable the incorporation of improvements to strengthen the approaches to conjunctive use of water resources, incorporate improved approaches to climate change and related disasters as well as strengthen the various gender dimensions.
- It may be possible to address some of the shortcomings of the Policy through the development of a policy addendum that unpacks the groundwater elements of the nine thematic area of the Policy as follows:
 - ✚ Regional Cooperation in Water Resources Management;
 - ✚ Water for Development and Poverty Reduction;
 - ✚ Water for Environmental Sustainability;
 - ✚ Security from Water-related Disasters;
 - ✚ Water Resources Information and Management;
 - ✚ Water Resources Development and Management;
 - ✚ Regional Water Resources Institutional Framework;
 - ✚ Stakeholder Participation and Capacity Building; and

- ✚ Financing integrated water resources development in the region.

Strategy

- Update the Regional Water Strategy to address specific transboundary aquifer challenges, noting that many of the management issues with regard to transboundary aquifers actually manifest locally.
- An updated Regional Water Strategy would also need to consider groundwater resilience options and infrastructure. Technological progress coupled with better understanding of aquifer systems make it conceivable to implement a raft of measures that allow sustainable utilisation of groundwater resources.
- Strategically support the diversification of the water supply mix and develop innovative mechanism for conjunctive use of groundwater and surface water.
- Support the development of partnerships to strengthen governance towards improved and more integrated management and development of groundwater. This should incorporate mechanisms for the financing of projects.
- Strengthening of institutions would become increasingly important to give effect to improved strategy approaches.

Institutions

- Provide support to further strengthen and capacitate regional institutions such as SADC Water Division and SADC GMI.
- Strengthen the competencies with regards to groundwater management and development across transboundary institutions with special focus upon the basin commissions such as ORASECOM, LIMCOM and OKACOM which typically only have sufficient funding for one water resources technical advisor.
- Strengthen the network of groundwater specialists through such structures as the sub-committee for hydrogeology.
- Undertake initiatives towards obtaining improved harmonisation in approaches towards the management and development of groundwater approaches. The joined-up support of SADC Water Division, SADC GMI, the sub-committee for hydrogeology and the various transboundary commissions would be essential.
- Establishment of a SADC regional groundwater association to support the development of capacity and the exchange of knowledge and experience.
- Development of a range of knowledge products and guidelines that support managers and technical staff engaged in the various dimensions of groundwater management and development. These would also start to support harmonisation in approaches.
- Provide improvements to the data and information management and exchange protocols in order to support improved understanding of groundwater resources across the region.

- Strengthen the regional approach to groundwater research to enable improvements in knowledge and understanding of transboundary aquifers.

Regional Development

- SADC GMI and the WRTC sub-committee on hydrogeology to support the strengthening of knowledge and information sharing across the SADC region.
- Engage and interact with a number of transboundary programmes such as CRIDF and CIWA to find opportunities to strengthen the approaches towards conjunctive water use.
- Support the RSAP IV review and strengthen the various strategic dimensions of groundwater management and development, linked to regional development goals, in the development of RSAP V.

6. ACTION PLAN

The MoSCoW method of prioritisation has been used to develop the action plan. This method identifies the *Must have*, *Should have*, *Could have*, and *Won't have* elements for the Groundwater Management Regulatory Framework.

Table 5: Action Plan – “Must Haves”

Policy <ul style="list-style-type: none"> ▪Development of a regional water policy addendum to strengthen groundwater management, conjunctive use and transboundary aquifer management.
Legislative <ul style="list-style-type: none"> ▪Development of Memoranda of Understanding on specific issues to strengthen groundwater management and development.
Institutional <ul style="list-style-type: none"> ▪Provision of support to further strengthen and capacitate regional institutions such as SADC Water Division and SADC-GMI. ▪Strengthening of the network of groundwater specialists. ▪Development of a range of groundwater knowledge products towards the harmonisation in approaches, such as groundwater best practice. ▪Develop approaches to institutionalise groundwater management in existing structures, such as regional and transboundary institutions.
Strategy/Guidelines <ul style="list-style-type: none"> ▪Participate in the review of the RSAP IV, and ensure RSAP V includes provisions to strengthen groundwater management and conjunctive use. ▪Develop innovative funding/financing mechanism to support groundwater management initiatives. ▪Develop a guide for operation and maintenance of groundwater infrastructure. ▪Support the diversification of the water supply mix ▪Development of innovative mechanism for conjunctive use of groundwater and surface water. ▪Strengthening of knowledge application and information sharing across the SADC region.

Table 6: Action Plan – “Should Haves”

Policy	<ul style="list-style-type: none"> ▪Review of the Regional Water Policy to strengthen the approaches to groundwater management and development.
Legislative	<ul style="list-style-type: none"> ▪Development of guidelines for promoting good practices to provide practical guidance that could result in lessons towards a longer-term process towards amending the Protocol.
Institutional	<ul style="list-style-type: none"> ▪Strengthening of competencies with regards to groundwater management and development across transboundary institutions and RBOs.
Strategy/Guidelines	<ul style="list-style-type: none"> ▪Updating of the Regional Water Strategy to address specific transboundary aquifer challenges and climate change issues. ▪Support the development of partnerships/stewardships to strengthen governance and financing. ▪Identify the priority aquifers in the RSAPs. ▪Engagement with transboundary development programmes to strengthen the approaches towards conjunctive water use and equitable water allocation. ▪Developing guidelines for compliance monitoring and enforcement ▪Support and strengthening of the linkages between groundwater management and development to regional development goals which includes energy options.

Table 7: Action Plan – “Could Haves”

Policy	<ul style="list-style-type: none"> ▪Strengthening of policy harmonisation across SADC.
Legislative	<ul style="list-style-type: none"> ▪Review and strengthening of the SADC Revised Protocol on Shared Watercourses.
Institutional	<ul style="list-style-type: none"> ▪Implementation of support initiatives towards harmonised approaches for the management and development of groundwater resources.
Strategy/Guidelines	<ul style="list-style-type: none"> ▪Strengthening of institutional capacity towards driving improved and effective strategy approaches

Table 8: Action Plan – “Won’t Haves”

Policy

- Regional water policy that does not effectively provide for the management and development of groundwater.

Legislative

- Inadequate representation of the necessary legal requirements to manage transboundary aquifers in the Revised Protocol for Shared Watercourses.

Institutional

- Under capacitated institutions at various spatial scales.

Strategy/Guidelines

- Strategically disintegrated approaches to the development and use of water resources, in support of regional development.

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APPENDIX A: DESIRED FUTURE STATE

Introduction

This document sets out the desired future state for policy, legislation and the general regulatory framework for effective groundwater management in SADC Member States. It sets out the **minimum** requirements that support the delivery of national, regional and international developmental goals, including the Sustainable Development Goals, meeting basic human needs to water, energy and food (the WEF nexus), and the protection of ecosystems that are dependent on groundwater.

This desired future state has been contextualised for the SADC region, taking into account:

- The high levels of groundwater dependency in many SADC countries, in rural areas in particular;
- The variety of geohydrological contexts;
- High levels of poverty, gender disparities, social exclusion and pollution; and
- Relatively low levels of state capacity – skills, infrastructure and finance.

Our approach has drawn on the four aspects of groundwater governance identified in the Global Diagnostic on Groundwater Governance undertaken by the FAO in 2016 and recognises that there is no “one-size-fits-all” governance arrangement, but that general principles and good practices need to be tailored to suit the specific socio-economic and geohydrological conditions of each Member State.

TABLE 1 Groundwater dependency in SADC Member States

Member State	Rural	Urban	Agriculture	Industry	Overall dependency
Angola	**	**	**	*	**
Botswana	***	**	***	***	***
DR Congo	*	*	*	*	*
Lesotho	**	**	*	*	*
Malawi	***	*	**	*	**
Mauritius	*	**	**	**	**
Mozambique	**	**	*	*	**
Namibia	***	***	***	***	***
Seychelles	**	**	*	*	*
South Africa	***	**	**	**	**
Swaziland	**	*	*	*	*
Tanzania	***	**	**	*	**
Zambia	**	**	*	**	**
Zimbabwe	***	**	***	**	***

Scale *** major, ** moderate, * minor

Figure 1: Source: J L FARR, R GUMIREMHETE, J DAVIES and N S ROBINS (20005). Groundwater dependence and drought within the Southern African Development Community

The pillars of sound groundwater governance

The sections below describe what is considered to be the minimum best practice for policy, legislation and subsidiary legislation, regulations and standards for effective groundwater management.

Policy

As a minimum, these requirements should be in place:

- A long-term policy to protect groundwater by preventing pollution and overuse. This policy is comprehensive, implemented at all appropriate levels, consistent with other water management policies and be duly taken into account in other sectoral policies;
- The social, economic and environmental values of groundwater are all recognised;
- The human right to water is recognized and a rights-based approach to groundwater management is taken, *inter alia*, through:
 - Prioritization of drinking water/basic human needs in water legislation;
 - Ensuring that land-based rights cannot entitle unlimited access/use of freshwater, including groundwater;
 - Ensuring groundwater is legally recognized as a public good;
 - Recognising the role of groundwater in meeting basic human needs for food security;
 - Legal recognition of customary rights to freshwater, including groundwater;
 - Legal mechanisms to ensure gender equity in access, use and management of freshwater, including groundwater;
 - Provision of pricing mechanisms that incentivize equitable distribution of rights to access and use of groundwater, as well as prioritization of small-scale users' livelihoods and food security needs, especially youth and women.
- Groundwater is recognised as a highly important source of domestic and agricultural water supply and a key resource for poverty alleviation, food security, and the sustainable economic development of rural areas;
- The biophysical and ecological linkages between ground and surface water for their use, protection and management are recognised, including land use zoning for groundwater protection and recharge (conjunctive use);
- The importance of the maintenance of the ecological integrity of wetlands in groundwater management is recognised (recharge zones);
- Intersectoral collaboration is promoted and facilitated so that the needs and impacts of different sectors (e.g., land, agriculture, mining, municipal, and environment) are taken into account in groundwater management and the impacts of developments in those sectors on groundwater are accounted for;
- The need for adaptive management is recognised due to the inherent limitations in the nature of scientific information in conjunction with the widely occurring dynamic processes of climate, social and institutional change;
- The roles of various stakeholders and water users in groundwater management is recognised and participation of stakeholders in decision-making and groundwater management is promoted and facilitated;
- An apex body that is responsible explicitly for GW management and playing the role of custodian/trustee on the part of the state is clearly defined;
- Effective institutional arrangements are coordinated at transboundary, national and local levels;

- Public access to geohydrological data held by the state is promoted and facilitated
- Additional environmental principles necessary to protect and sustain groundwater are mandated, including: the precautionary principle, the principle of gender equity and social inclusion (GESI), the principle of subsidiarity, and the principle of intergenerational equity.

Legislation

At the national level, legislation should be in place that explicitly addresses the use, management, and protection of groundwater and provides the necessary tools for the state to regulate, manage, control, protect and develop groundwater resources in conjunction with surface water resources. At a minimum, legislation and/or subsidiary regulations should:

I. Provide Status of Groundwater

- a. All water has a consistent status in law, irrespective of where it occurs
- b. Explicit reference to groundwater and conjunctive use management in catchment/water management and development plans and drought/emergency management plans
- c. Human right to water recognized in groundwater legislation, facilitating prioritization of drinking water and basic human needs, as well as small-scale users

II. Regulate Groundwater Quantity

a. Provide conditions for accessing groundwater

- i. Water use authorizations:
 1. Legislation must enable the authorisation of groundwater use (with a system that does not discriminate, especially against the rural poor);
 2. The permitting of groundwater use should not be tied exclusively to land tenure;
 3. Legislation should allow for the categorisation of water users;
 4. Groundwater should be declared a public asset and/or authority vested in government to restrict, in the public interest, the rights accruing from its private ownership to prevent over-abstraction or inequitable access/use by landowners;
 5. New legislation should strive towards changing ownership rights to use (usufruct) rights, subject to a government-controlled, permit system for large scale users with appropriate non-permit systems for addressing the needs of small-scale users
 6. The legislation recognises and legalises affordable, small-scale and indigenous solutions;
 7. The legislation should enable the regulation of borehole drillers, regulation for drilling, control of drillers, information from drillers and standards for borehole drilling;

8. Legislation should give water inspectors the right to enter land with the offenses and associated penalties noted in the legislation (this includes appropriate fines and jail time that needs to be adjusted annually);
9. The legislation should enable the regulation of exploration;
10. The legislation should allow for zoning for overused/fragile aquifers;
11. Groundwater use organizations should be integrated into existing institutional frameworks (e.g., catchment management, customary institutions)

III. Groundwater Protection Mechanisms

a. Regulating Pollution (Point source and non-point source)

- i. Water quality targets;
- ii. Regulation of emissions/wastewater discharge/waste storage including the impact of mines on groundwater quality:
 1. Permits can be used to regulate the discharge, disposal and possibly the storage of waste should specifically take into account the vulnerability of the aquifer concerned and the provisions necessary for its protection;
- iii. Classification of water bodies; and
- iv. Reducing and regulating abstraction.
- v. Powers of compliance monitoring and enforcement

b. Regulating Depletion

- i. Regulation of abstraction and recharge (usually via permitting);
- ii. Sustaining wetlands;
- iii. Land use zoning – prohibition of abstraction in certain zones; cropping or irrigation practices; protection zones for recharge areas; no surfacing/drainage requirements; and
- iv. Legislation must make it mandatory for installation of monitoring equipment of boreholes especially for large-scale users (the information must then be supplied to the state).
- v. Powers of compliance monitoring and enforcement

IV. Planning

- a. The legislation should specify the need for long term plans to ensure the sustainable use of groundwater, including drought management plans and cross-sectoral coordination;
- b. Where water legislation provides for catchment level or basin level planning, groundwater should be integrated into those plans (for example through impact assessment requirements);
- c. The legislation should specify that groundwater management planning should take into account and be integrated into land use and environmental planning; and
- d. Planning should be cyclical and based on continuous learning from data and stakeholder feedback to ensure adaptive management and effective responses to changing climatic, social, political and institutional contexts/drivers.

V. Institutional Arrangements

- a. Legislation should contain provision for its effective implementation, including the mandate, competence and power of the relevant authorities in accordance with uniform governance principles;
- b. Water authorities or coordinating bodies should have the competence to integrate all aspects of water management and should be rendered competent to arbitrate among various competing demands, and diverging interests regarding groundwater abstraction and use, both in the short-term and in the long-term;
- c. The authority or body should collaborate with other authorities, competent for public health, land-use planning, soils management, waste management; and
- d. Water user associations and other appropriate forums (such as municipalities) should be utilized to strengthen the user advocacy role and achieve new partnerships and a joint management of the common resource.

VI. Stakeholder engagement

- a. The legislation should specify when and how stakeholders, the public and/or other water users are to be engaged in planning, decision making and self-management with regard to groundwater;
- b. There should be specific mechanisms for directly involving stakeholders in the development of laws and regulations related to groundwater and decisions that may impact the use or quality of groundwater on which they depend for drinking, livelihoods, food security, economic or cultural well-being; and
- c. The legislation should specifically address the issue of the involvement of women and youth in decision-making and the implementation of groundwater supply schemes.

VII. Monitoring and data collection to support regulation

- a. The legislation should specify the need and parameters for a sustainable system for data collection, management and dissemination, including standardization and harmonization of data. This entails a national monitoring and information system which captures quantity and quality data from key aquifers;
- b. The legislation should specify the need for drought monitoring systems which extend beyond rainfall, surface water and food security indicators to groundwater and groundwater supply status, including the appropriate prediction of future hydrogeological conditions;
- c. In transboundary basins, legislation should address the need for standardization and exchange of data as well as the establishment of joint inventories; and
- d. The legislation should enable access by the public to geohydrological data held by the state.

VIII. Water conservation and efficiency of use

- a. Legislation should enable regulation to ensure the efficient use of groundwater, such as the use of economic incentives and imposition of technologies.

IX. Compliance and Enforcement

- a. Clear mechanisms for promoting compliance with groundwater regulations should be included in the legislation
- b. Enforcement provisions should include, *inter alia*, inspections authority for groundwater management institutions, the ability to impose fines and/or additional administrative penalties and adjust those as necessary, and enumerate criminal offenses associated with failure to comply with the law.

X. Conflict resolution mechanisms and/or the right to appeal

XI. Regulatory measures

- a. The legislation must enable the relevant authority (Minister) to make regulations on any relevant matter in the legislation
- b. Legislation should provide a clear ability for the government to pass regulatory measures, such as abstraction fees and waste disposal charges, to provide revenue to water management institutions and to incentivise appropriate use of groundwater

Subsidiary legislation, regulations and standards

The actual requirements for subsidiary regulation will differ from country to country, according to their own National Legislation. However, it is important to understand the extent to which critical issues around groundwater management have been translated into regulations. Below are some examples of how this could look.

I. Subsidiary legislation or regulations pertaining to

- a. use,
- b. protection including on-site sanitation,
- c. borehole drilling, and
- d. appropriate financial and economic regulatory tools e.g. water pricing.

II. Clear protocols and standards on data collection and storage

III. Template for municipal by-laws. Municipality bylaws should be the preferred solution and advocacy should be with the municipalities. **(Is the focus on both rural and urban municipalities, authorities, councils?)**

IV. Community management of groundwater and community participation in groundwater management

Actors/Role-players

This section seeks to look at the content of the policy, legislation and possibly whether regulations exist. It is not an assessment of actors.

Groundwater, like broader water resource management, cannot be managed in isolation, and have a number of actors/role-players that contribute to its effective and sustainable management. Regarding actors in groundwater management, there should be, as a minimum:

- An apex body responsible explicitly for Groundwater management and playing the role of custodian/trustee on the part of the state.
- Some degree of stakeholder engagement so that water users, in particular, can engage with government on issues of groundwater management
- Intersectoral collaboration so that the needs and impacts of different sectors e.g. agriculture, mining and industrial, domestic, ecosystems, are taken into account in groundwater management.

SADC Protocol and Transboundary Agreements

Groundwater is mentioned explicitly in the SADC Protocol and in all transboundary agreements, with appropriate institutional and other mechanisms in place for managing shared aquifers.



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