

SADC GROUNDWATER MANAGEMENT INSTITUTE

SUCCESS STORIES

GROUNDWATER IN THE SADC REGION

OCTOBER 2020



GROUNDWATER MANAGEMENT INSTITUTE

SADC-GMI SUCCESS STORIES



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ACKNOWLEDGEMENTS:

Developing the Southern African Development Community Groundwater Management Institute (SADC-GMI) Success Story Book was a lengthy and extensive process which required considerable amount of time from all stakeholders who were involved in the development of this profound piece of work. For the book to reach this immense success, it required contributions from various partners that worked closely and collaborated with SADC-GMI from its inception. Contributors to the book varied from SADC Member States, Cooperating partners and sub-grantees who implemented successful and impactful sub-grant projects in Member States on behalf of the SADC-GMI.

SADC-GMI would like to express a special thank you to Member States, regional and international cooperation partners for participating in the consultation process and providing invaluable contributions that resulted to success stories that are told in the book. Without your support this book would have never been accomplished.

To the SADC-GMI Team members, thank you for your vision and insightful contributions throughout the process. Through your passionate engagements, we have been able to tell rich and impactful stories to our constituencies in the SADC region. Special mention goes to Thokozani Dlamini, our Communications and Knowledge Management Specialist at SADC-GMI, for coordinating this wonderful project from its inception until completion.

A sincere thank you goes to the **frayintermedia** team for the professionalism and dedication in researching and writing of the stories culminating in this very creative book. Putting together all the pieces of the puzzle was not easy but through your never ceasing enthusiasm you managed to pull it together to the impressive finished product.

The book is inspired by the SADC-GMI work's successes and milestones over the past four years of our existence and we hope, trust and believe that readers will appreciate the huge strides that we have accomplished in building our brand as the SADC region's Centre of Excellence for sustainable groundwater management and development.

Finally, we acknowledge everyone who contributed to this body of work in any other form including those whose captivating stories populated this publication.



BY JAMES SAURAMBA SADC-GMI EXECUTIVE DIRECTOR

FORWARD

Africa is the most vulnerable continent to climate change. Flooding, hurricanes and drought have emphasised that this natural resource (water) can bring about life but can also bring about great destruction.

On the one end, excess and on the other end a lack of water: it is only at an equilibrium where life flourishes.

The Southern African Development Community Groundwater Management Institute (SADC-GMI) seeks to make a contribution to the cushioning of SADC citizens from the impacts of climate change through advocating for sustainable use of groundwater.

In 2015 the United Nations (UN) adopted 17 Sustainable Development Goals (SDGs) which is a “blueprint to achieve a better and more sustainable future for all” and is part of the 2030 Agenda. SADC-GMI’s mandate is in line with Sustainable Development Goal 6, which specifically calls for access to clean drinking water and sanitation and “ensure availability and sustainable management of water and sanitation for all.”

In this book we intend to take the reader through our journey, detailing the birth of the SADC-GMI. It explores how we have made a contribution to the national and transboundary water resources management discourse in the region through supporting national and transboundary water institutions, facilitating research and management of transboundary aquifers, institutional and individual capacity building and infrastructure interventions while reviving legacy projects and ensuring their sustainability.

The Southern African Development Community (SADC) Member States receive 2,300 km³ of renewable water resources per year. Of this only 14% is retained in water bodies of which 70% is across national boundaries. In the region, 61% of the population has access to safe drinking water and only 39% has access to adequate sanitation facilities. The onset of climate change is set to reduce access to water and sanitation for SADC inhabitants. Groundwater offers a solution for the region to build climate resilience. However to fully benefit from the climate change buffering potential offered by groundwater, we need to ensure sustainable management of groundwater.

In response to the identified need for sustainable groundwater management, SADC-GMI was established as a ‘Centre of Excellence’ for sustainable groundwater management in the SADC region to advocate for conjunctive management of surface and groundwater resources so as to build the resilience of communities and promote the sustainability of Groundwater Dependent Ecosystems. It was established to correct the historical anomaly in groundwater governance in the SADC region, where groundwater was absent in the water resources planning discourse at both regional and national level. The institution serves countries by promoting intergovernmental cooperation, facilitating funding, and policy advocacy and adaptation to ensure all structures are in place for a future in which all SADC citizens have access to clean and safe drinking water and sanitation.

In December 2020, SADC-GMI will conclude the implementation of its first flagship, World Bank funded project, ‘Sustainable Groundwater Management in SADC Member States’ implemented from 2016. In a bid to capture some of the successes, milestones and challenges we have overcome, we decided to capture these as stories in this coffee table book.

The stories in this book aim to convey the importance of groundwater and interventions implemented by the SADC-GMI from the period 2016-2020. We aim to capture a wide readership - non-specialists as well as the general water resources management stakeholders.

We will also talk about the journey of bringing leading experts from SADC and across the globe together at the SADC Annual Groundwater Conference to share knowledge, new discoveries, challenges and accomplishments, and to strategise about the future of groundwater in the region.

We share our successes, projects and initiatives from every Member State and how in the past five years we have navigated the region to build partnerships and networks in every Member State.

We realise that it cannot ever just be a handful of individuals and organisations alone who wish to grow this sector in the region. As a result, we have invested resources into citizens, communities, local leadership all the way up to international organisations to ensure we have a groundwater army equipped with the skills and knowledge to work together for a shared objective.

Within this specialised profession, we are ensuring the vision we have for the future of groundwater will be upheld by the young professionals we endorse and train throughout prestigious programmes.

We hope you enjoy these stories and we look forward to the next five years of SADC-GMI as we continue to pave the way for groundwater and ensure sustainable, clean, drinking water and sanitation for all of SADC’s citizens.





ABBREVIATIONS

CIWA: *Cooperation in International Waters in Africa Trust Fund*

CUVECOM: *Cuvelai Watercourse Commission*

DWA: *Department of Water Affairs*

DWS: *Department of Water and Sanitation*

EKK TBA: *Eastern Kalahari-Karoo Basin Transboundary Aquifer*

GEF: *Global Environmental Facility*

GIP: *Groundwater Information Portal*

GIS: *Geoscience Information system*

GIZ: *Deutsche Gesellschaft für Internationale Zusammenarbeit*

GMI-PLI: *Policy, legal and Institutional Development for Groundwater Management in SADC Member States*

HGA: *HydroGeo Analyst*

IGRAC: *International Groundwater Resources Assessment Centre*

IGS: *Institute for Groundwater Studies*

KCS: *Kalahari Conservation Society*

LIMCOM: *Limpopo Watercourse Commission*

LWSC: *Lusaka Water and Sewerage Company*

NIGIS: *National Integrated Geoscience Information system*

OKACOM: *Okavango River Basin Water Commission*

ORASECOM: *Orange-Senqu River Commission*

RBO: *River Basin Organisation*

SADC: *Southern African Development Community*

SADC-GMI: *Southern African Development Community Groundwater Management Institute*

SDG: *Sustainable Development Goal*

ShireConWat: *Conjunctive Transboundary Water Resources Management in the Shire River Aquifer System project*

TBA: *Transboundary Aquifer*

TDA/JSAP: *Transboundary Diagnostic Analysis/Joint Strategic Action Planning*

UN: *United Nations*

ZAMCOM: *Zambezi Watercourse Commission*

SADC-GMI INSTITUTIONAL ARRANGEMENTS

THE FOUNDATION AND STRUCTURE OF SADC-GMI

Before the establishment of SADC-GMI there was no organisation looking at the bigger picture in managing groundwater, especially not so across borders. To ensure that an organisation could be formed and be held accountable, the structure of the organisation was key. SADC-GMI's structure is composed of a Board of Directors from representatives from the SADC Member States, the University of the Free State, an Executive Director and SADC Secretariat's Water Division as the Chair. The SADC Sub-committee on Hydrogeology was selected as the steering committee for the project.

It was established that the organisation will be hosted by the University of the Free State's Institute for Groundwater Studies in Bloemfontein, South Africa on behalf of, and under the strategic guidance of the SADC Secretariat, Directorate of Infrastructure's Water Division, in Gaborone, Botswana. As SADC-GMI is a subdivision of SADC, its mandate was shaped by the fourth phase of the Regional Strategic Action Plan for Integrated Water Resources Management.

The structure of the organisation has ensured that buy-in from all Member States are achieved as well as to create an environment which encourages transparency and accountability throughout the implementation of the project. SADC-GMI has achieved to bring governments together to work towards a shared goal of managing transboundary water resources.

SADC Member States

*Committee of Water Ministers
Committee of Water Sr Officials
Water Resources Technical Senior
Committee SADC Sub-committee on
Hydrogeology & National Focal Points/
Groups*

SADC Secretariat

Directorate for infrastructure &
Services - Water Division

Botswana - Gaborone

University of the Free State

Institute for Groundwater
Studies

Bloemfontein - South Africa

SADC-GMI Board of Directors

*(SADC, UFS, Member States repress)
Sub-Grant Committee*

SADC Groundwater Management Institute

SADC-GMI

SADC-GMI Beneficiaries

*Member States representatives in the SADC
Sub-committee on HG with Project Steering
Committee function*

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GENESIS

THE GENESIS OF SADC-GMI

Since SADC-GMI's inception, there have been challenges but the institution managed to forge a way forward in managing and ensuring the sustainability of groundwater in SADC.

The Southern African Development Community (SADC) is an inter-governmental organisation headquartered in Gaborone, Botswana. Its goal is to promote socio-economic cooperation and integration as well as political and security cooperation among 16 SADC Member States. The SADC also endeavours to foster regional integration through cooperation in water resources management, through various policies and protocols.

The SADC acknowledges the role of groundwater in food and water security of the region. However, historically groundwater has not been addressed in a holistic and strategic way in the SADC region. While some groundwater projects were implemented successfully, there was no overarching body to ensure the ongoing advocacy for sustainable management and development of groundwater.

The need for a regional body tasked with groundwater management in the region became necessary in the period 2005 to 2011 when the SADC Secretariat was implementing the Global Environmental Facility (GEF) funded SADC Groundwater Drought Management Project.

One of the components of this project entailed undertaking a strategic institutional review to establish a groundwater management institute that would exist beyond the implementation of individual projects and ensure the long term sustainability of these projects coming together for a shared objective.

In 2008 the SADC Secretariat working through the Sub-committee on Hydrogeology which is a Sub-committee of the Water Resources Technical Committee of SADC through an open tendering process identified the University of the Free State's Institute for Groundwater Studies as the host institute of the SADC-GMI. The University of the Free State took over the responsibility to explore what type of institute SADC-GMI would be. On the 6th of May 2011, SADC-GMI was registered with Companies Intellectual Property Commission (CIPC) as a not-for-profit company under the South African Companies Act No. 71 of 2008 as amended.

Initially SADC-GMI was composed of three Board Members who were at the time Mr Simon Kangomba from the Government of Zambia, Professor Danie Vermeulen from the University of the Free State and Mr Phera Ramoeli who was the Senior Programme Officer for Water at the SADC Secretariat.

In 2014 the World Bank with funding from the Global Environment Facility (GEF) and Cooperation in International Waters in Africa Trust Fund (CIWA) availed funding to the SADC Secretariat's Water Division to implement the 'Sustainable Groundwater Management in SADC Member States' project with the objective of promoting the sustainable management of groundwater at national and transboundary levels across the SADC Member States.

In September 2016 the project was officially launched and the organisation started to grow. In February 2017 Mr James Sauramba officially became the first employee of SADC-GMI as the Executive Director. "We started implementing this specific project in terms of its objectives, implementing the

activities foreseen in the project appraisal document and therefore operationalising SADC-GMI in its entirety," says Mr Sauramba.

In 2017 the organisation took on more key staff members. Mr Sauramba further states that, "we were at risk of losing the funding because we did not have enough capacity and progress was slow", consequently in mid-2017 the SADC-GMI recruited an additional five core staff Members to expedite operationalisation of the SADC-GMI. In August 2018 SADC-GMI was accepted formally as a subsidiary of the SADC Secretariat through another resolution of the SADC council.

"I think one exciting part of our history is that we operate in a niche area; an area that had not been very much traded before and one of our strengths is that our mandate is clearly documented in the Regional Strategic Action Plans where our work is well cut out for us," says Mr Sauramba.

I think one exciting part of our history is that we operate in a niche area; an area that has not been very much traded before and one of our strengths is that our mandate is clearly documented in the Regional Strategic Action Plans where our work is well cut out for us.

- Mr James Sauramba, SADC-GMI Executive Director

As part of SADC-GMI's mandate 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," they believe that by the end of 2020 they would have integrated groundwater into River Basin Organisations (RBOs).

Until now Mr Sauramba says that "by way of their [RBOs] history and establishment, they have basically been talking about everything else except Groundwater," but adds that "we have grown through it. We have also grown a lot more relevant... and as much as groundwater is coming to the surface, so are we as the Centre of Excellence in promoting equitable and sustainable groundwater management in the SADC Region."

SADC-GMI's core mandate is to promote sustainable groundwater management and providing solutions to groundwater challenges in the SADC region.

ANNUAL CONFERENCE

CONVENING GROUNDWATER'S LEADERS FOR FUTURE GROWTH

The annual SADC Groundwater Conference is a platform where experts can come together to advance sustainable groundwater management in the region.

When like-minded people gather for a common cause such as advancing sustainable groundwater management, they can foster understanding and cooperation in the sector.

The Southern African Development Community Groundwater Management Institute (SADC-GMI) annual conference offers groundwater experts a platform to convene, supporting SADC-GMI's core mandate of promoting sustainable groundwater management and providing solutions to groundwater challenges in the region.

A challenge the SADC region currently faces is that of climate change. Africa has not been spared from the burning effects of climate change, propelling SADC to ensure water security for its people who are largely dependent on groundwater.

"Studies suggest that the climate of Southern Africa changed during the 20th century: mean annual temperature rose by approximately 0.5°C; inter-annual rainfall variability increased since the 1970s," according to the UNDP Climate Change Adaptation. That inspired the theme of the inaugural SADC groundwater conference held in 2018, held under the theme 'Adapting to Climate Change in the SADC Region through Water Security - A Focus on Groundwater'.

At the very first conference, we had in excess of 40 papers coming of very good quality. And the second one was also in excess of 40 papers coming through from a very wide cross-section of practitioners and experts.

- Mr James Sauramba, SADC-GMI Executive Director

"In 2018, we had approximately 123 participants," said Mr James Sauramba, SADC-GMI Executive Director.

The inaugural conference pulled groundwater leaders and experts from across SADC Member States and attracted stakeholders from other parts of the world including Germany, Netherlands and the United States of America to deliberate on the SADC region's groundwater issues.

"Groundwater is not only a resource that we need to be concerned and worried about — to see as a problem — but also very much a big opportunity to solve some of our issues in terms of water supply, security, and resilience," said

Dr Karen G. Villholth, presenting her keynote paper at the first conference.

Mr Sauramba said the quality of papers presented at SADC conferences were of a high standard.

"At the very first conference, we had in excess of 40 papers of very good quality. While the second conference also had in excess of 40 papers coming through from a very wide cross-section of practitioners and experts. I think that was a very big highlight," he said.

While the SADC-GMI provides groundwater leaders a platform to share knowledge, it also amplifies the voices of young professionals to participate in the conversation.

Capacity building is also at the heart of SADC-GMI's mandate.

"SADC-GMI deliberately tries to encourage and provide support for young people to attend the conference and there are awards given," said Dr Kawawa Banda, an academic at the University of Zambia's Department of Geology and Chief Rapporteur of the second SADC Groundwater conference.

"The young people are the future and we need to keep passing on the baton."

Held in 2019, the second SADC Groundwater conference was under the theme 'Groundwater's Contribution to the achievement of Sustainable Development Goals in the SADC Region'.

"Water is central to the development agenda of SDGs and how they can be actualised. Last year's theme was trying to tap into how groundwater has contributed towards SDGs," Dr Banda said.

Groundwater links to SDG 6 which speaks about water and sanitation, SDG 12 which focuses on responsible consumption and production and SDG 13 that speaks on climate action.

"We're seeing an intimate link between water resources and the achievements around SDGs," Dr Banda said.

"The networking aspects allow different experts and organisations to arrive at a sort of thesis where energies should be focused on," Dr Banda said.

He added that it gives the opportunity for collaboration on joint projects and that outcomes have cascaded from the conferences.

"At the moment we have a project that is looking at operational and maintenance of groundwater infrastructure in the region and because of the conference, the lead consultant is easy to contact because most of us attended the conference," Dr Banda said.

While the SADC Groundwater conferences are a means to promote groundwater sustainability, they are also a means to raise revenue, forming part of SADC-GMI's financial sustainability plan.

“

SADC-GMI deliberately tries to encourage and provide support for young people to attend the conference and there are awards given.

- Dr Kawawa Banda, an academic at the University of Zambia's department of geology and Chief Rapporteur of the second SADC-GMI conference

Global Water Partnership Southern Africa, the International Water Management Institute, the World Bank, The Institute for Groundwater Studies, the International Association of Hydrogeologists, Groundwater Solutions Initiative for Policy and Practice, Bundesanstalt für Geowissenschaften und Rohstoffe and the International Union for Conservation of Nature.

“We need more participation and support from the private sector and we believe that this is possibly because they want to establish the value they would get out of us. So we are working very hard to build our brand so that once it's more known, we get to attract the private sector,” Mr Sauramba said.



The SADC groundwater conference gives likeminded people from across the region an opportunity to deliberate on critical groundwater issues in the region. Photo credit: SADC-GMI.

“We are a not-for-profit company and we are very much dependent on grants so in an attempt to diversify our income base or our income streams we included conferences,” Mr Sauramba said.

A way SADC-GMI maximises on attaining revenue is by seeking sponsorship from potential sponsors from the region and beyond. “The request for sponsorship goes to any potential organisation who might fund us. We have three categories of cash sponsorship in the sponsorship brochure. So we have the platinum, which is R100 000, gold which is R50 000 and bronze which is R10 000,” Mr Sauramba said.

Past conference sponsors and organising partners have included UNESCO's International Hydrological Programme, the International Groundwater Resources Assessment Centre, South Africa's Department of Water and Sanitation,



The inclusion of young professionals in groundwater issues is a core part of SADC-GMI's capacity-building mandate. At the 2018 conference, Albie Steyn from the University of the Free State, Institute for Groundwater Studies, was awarded first prize at the Young Professional Awards. Christina Fraser, a PhD research student from the University of Strathclyde in Glasgow, Scotland, was the runner-up. Photo credit: SADC-GMI.



Groundwater leaders have multiple presentations throughout the conference. Photo credit: SADC-GMI.



The SADC Groundwater conference pulls various groundwater experts from across the region to convene and discuss SADC groundwater issues. Photo credit: SADC-GMI.



Delegates had the opportunity to network between sessions. Photo credit: SADC-GMI.



The conference offers a unique opportunity for groundwater experts from across the globe to discuss critical issues face-to-face. Photo credit: SADC-GMI.



DATA MANAGEMENT

DATA HELPS MANAGE SADC'S PRECIOUS RESOURCE

When SADC-GMI launched in 2016, a need for an improved presence and sharing of data was identified.

f SADC groundwater officials had sufficient information about water resources of the region, this could transform how we manage this precious resource.

Data collection and management is a challenge in Southern Africa, hindering effective groundwater management in the region.

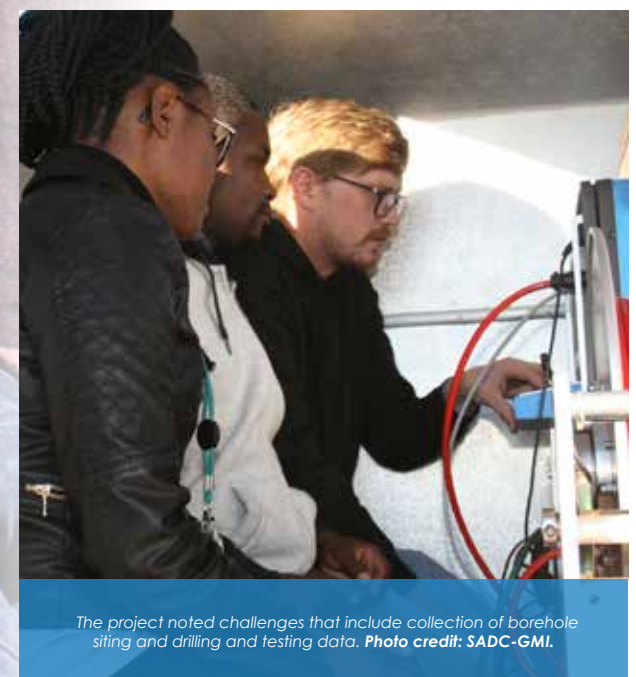
SADC-GMI Senior Groundwater Specialist Mr Brighton Munyai said most of Sub-Saharan Africa experience challenges with groundwater data collection and management.

"The current project that we are implementing which is the World Bank, GEF [Global Environment Facility and (CIWA) Cooperation in International Waters in Africa Trust Fund] funded project, identified data as one of the major challenges that hinders sustainable groundwater management.

"I think you know the saying that goes: 'you can't manage what you don't measure', " Mr Munyai said.

When SADC-GMI launched in 2016, a common desire from Member States and groundwater practitioners was to access the regional hydrogeological maps. SADC-GMI then commissioned the International Groundwater Resources Assessment Centre (IGRAC) to develop and maintain the SADC Groundwater Information Portal (GIP). The 2010 SADC Hydrogeological Mapping project was resuscitated under the project implemented by IGRAC.

Users can browse maps and data online and can create overlays of different maps to create new insights on the portal. Maps and data can also be downloaded for further analyses for offline use.



The project noted challenges that include collection of borehole sifting and drilling and testing data. **Photo credit: SADC-GMI.**

"Groundwater in SADC has high potential and at the same time, it's not used properly," said Dr Neno Kukuric, IGRAC Director.

In 2017, SADC-GMI contracted IGRAC in partnership with the Institute for Groundwater Studies (IGS) to execute the "Capacity Building for Groundwater Data Collection and Management in the SADC Member States" consultancy also known as the SADC-Groundwater DataCoM to address data collection and management in the region.

The project wrapped up in June 2019 and IGRAC & IGS published their findings in a capacity-building report. In their Capacity Building for Groundwater Data Collection and Data Management in SADC Member States report, IGRAC and IGS noted that for SADC countries, "Very few countries rely on dedicated software for storing, interpreting and monitoring groundwater data.

Some use spreadsheets, which can be a solution when few data are involved. Hardcopies should be avoided (other than for archiving/backup purposes).

When data is stored in different locations and in different formats, access to it becomes an issue," the report said.

IGS Senior Researcher Dr Modreck Gomo said the focus of the SADC-Groundwater DataCOM project was to improve data collection capacity and boost data storage processes.

"But first, we had to understand the needs in the region, what the needs are in terms of groundwater data collection, storage, processing, sharing, and also its use," he said.

“

We wish to move towards a platform where data is shared freely in the region especially among Member States sharing transboundary aquifers.

- Mr Brighton Munyai, SADC-GMI Senior Groundwater Specialist



The main thing when we think about continuity and sustainability we look at ourselves as the current experts but the idea is always to try and equip and train people, especially the young guys, for the future so that they can be able to replace us but also bring in new ideas. Eventually, we need people to take over.

- Institute for Groundwater Studies Senior Researcher Dr Modreck Gomo

The SADC-Groundwater DataCOM project report noted challenges that included the collection of borehole siting, drilling and testing data, the collection and management of data, as well as the management, analysis and dissemination of information.

Young professionals from the SADC Member States were seconded to the project to conduct groundwater data collection management research under the mentorship of IGRAC and IGS.

The young professionals came from Angola, Botswana, eSwatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe as well as IGS students. They were tasked to assess data collection, data storage and dissemination of data for their own countries.

"They learned about which information is required and how to process it, and why they should share that information. Tomorrow, they will be the driving force," said Dr Kukuric.

"The main thing when we think about continuity, and sustainability we look at ourselves as the current experts but the idea is always to try and equip and train people, especially the young guys, for the future so that they can be able to replace us but also bring in new ideas. Eventually, we need people to take over," Dr Gomo said.

When the young professionals had wrapped up their assignments in their different countries, they took part in workshops to engage their assignments with senior officials from Member States in November 2018.

Dr Gomo, who has taken part in training and facilitating some of the workshops on capacitating young professionals as part of continuous development in the region said workshops are a means to "enhance the standards and also help the region try and look at things in the same way".

However, not all Member States are the same in relation to groundwater data collection and management.

"It is true that the SADC region encompasses very different socioeconomic and environmental situations: there are obviously differences in terms of groundwater management between economically stronger developed and more arid countries," said the SADC-Groundwater DataCOM report.

However, it also noted that the majority of countries have reported insufficient budget and capacity, leading to challenges such as "monitoring gaps, almost all countries have reported insufficient budget and capacity, resulting in monitoring gaps; a need for training staff and monitoring procedures; a lack of interpretation [and] issues with data storage and sharing".

Mr Munyai said SADC Member States are at different levels of groundwater data collection and management where some are doing extremely well while others need significant support.

When SADC-GMI closed the SADC-Groundwater DataCOM project, the institute hosted presentations where "fairly advanced" Member States gave presentations of their data practices.

"We got colleagues from Namibia and Botswana to give presentations at a very senior level on their storage and management practices so as to inspire other Member States and to say: 'this is ideally where we wish you to be,'" Mr Munyai said.

A key output of the SADC-Groundwater DataCOM project was The SADC-Wide Framework for Groundwater Data Collection and Data Management. The framework acknowledges the different challenges and gaps SADC Member States face regarding groundwater data collection and management.

The framework was a first for the region that did not have an organisational and planning framework on the implementation of existing strategies and policies regarding water resources including groundwater.

Since its development in August 2019, it has become a tool that propels groundwater implementation and policies in the region while using existing technical guidelines.

The framework looks at various aspects of data collection and management such as borehole siting and drilling, groundwater monitoring, field data collection, databases, reporting and data sharing.

"We wish to move towards a platform where data is shared freely in the region especially among Member States sharing transboundary aquifers. There are a number of challenges. But I think we are making a big impact with young professionals and senior professionals. We have managed to get them together on several occasions and discuss these issues and how we can achieve them," Mr Munyai said.



Young professionals were a core part of the SADC-GWdataCoM project and were tasked to conduct research. **Photo credit: SADC-GMI.**

DATA SHARING CAN BE DIFFICULT



From the country visits, six Member States noted that data sharing can be difficult.



DATA MANAGEMENT

ONE YEAR IN REVIEW: THE BIG DATA AND TRANSBOUNDARY WATER COLLABORATION

SADC Research teams have been working with big data on the Ramotswa Aquifer to add value to water management.

Regional collaboration research teams have spent a year exploring how to improve managing southern African transboundary aquifers through the use of big data analytics.

The teams were led by the University of the Western Cape, the University of the Witwatersrand, as well as private sector companies Delta-H and Umvoto Africa. Together, they have been focusing on the Ramotswa Aquifer which is shared between Botswana and South Africa.

Clara Bocchino, the programme coordinator for the Big Data & Transboundary Water Collaboration Southern Africa project, said the team has to work collaboratively and simultaneously to achieve optimum results.

"[This] is to ensure that we obtain a full picture of the potential for big data analytics applied to the transboundary water sector in our region," Bocchino said.

IBM's website describes big data as a term referring to data sets beyond the means of traditional relational databases to capture, manage and process data.

The Sustainable Water Partnership, Southern African Development Community Groundwater Management Institute (SADC-GMI), United States Agency for International Development (USAID) E3/Water, USAID Global Development Lab and USAID Southern Africa Mission, the South African Department of Science and Innovation, IBM Research Africa, the Water Research Commission of South Africa, and the United States (U.S.) Geological Survey, form the consortium that implements the project.

"With our team on the go, the collaborating partners have also experimented on webinars on related issues and the United States Geological Survey completed a 2-months training on their applications, tools and methodological approaches to transboundary and/or data-poor aquifers," Bocchino said.

Geographic and Information Systems are instrumental in managing water resources but coupled with big data analytics, adds more value in water management.

"It creates sophisticated systems that are almost "self-driving" with constantly updating data showing through a tool that creates a holistic picture of a water system," Bocchino said.

“

In the water sector, using new data and coding technology will mean improved governance.

- Clara Bocchino, Programme coordinator, Big Data & Transboundary Water Collaboration Southern Africa project.

She added that the world is moving into a "new type of socio-economic change", making technologies such as artificial intelligence and big data more important.

Bocchino said in 2019 the highlight of the team was presenting the project at 2nd SADC Groundwater Conference hosted by SADC-GMI in September 2019, which was to a "wider audience of decision-makers and researchers from the region and beyond."

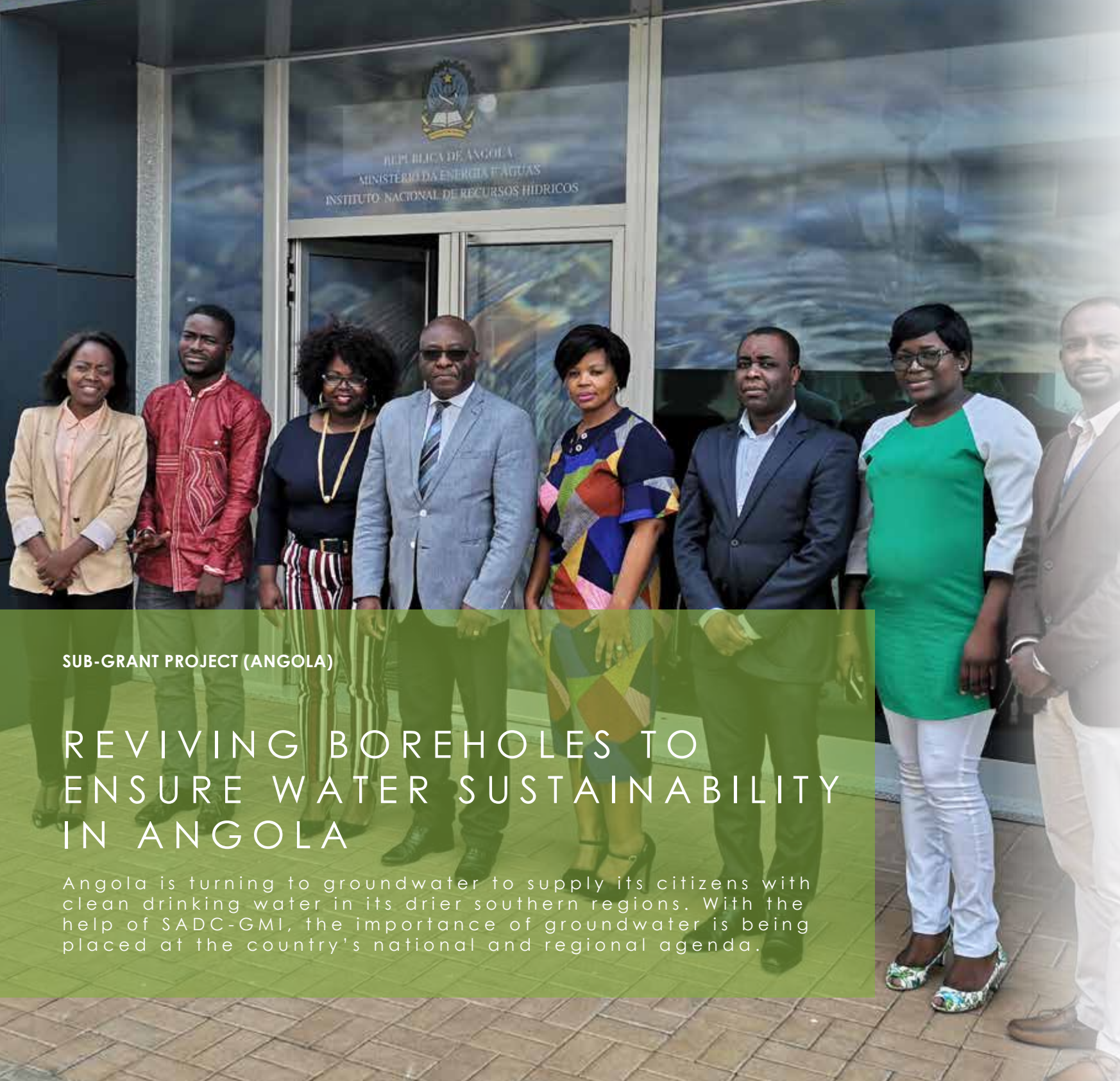
In 2020, the team will focus on the remaining milestones of the project, said Bocchino.

"This first initiative was conceived as a seed grant. Through the organic creation of a Community of Practice, we also hope to increase the partnership and funding available to improve on the outcome of this first phase," she said.

For that reason, the team plans to attend the 2020 Water Institute of Southern Africa's conference where they would like to host idea jams with academia and government, expand its network in the sector and socialise the importance of using big data for transboundary water management.

"In the water sector, using new data and coding technology will mean improved governance, and with it an increase in water security, especially for the most vulnerable segments of our society," Bocchino said.

INSTITUTO NACIONAL DE RECURSOS HÍDRICOS



SUB-GRANT PROJECT (ANGOLA)

REVIVING BOREHOLES TO ENSURE WATER SUSTAINABILITY IN ANGOLA

Angola is turning to groundwater to supply its citizens with clean drinking water in its drier southern regions. With the help of SADC-GMI, the importance of groundwater is being placed at the country's national and regional agenda.

Angola has a total 77 river basins but, in the drier South, communities are turning to an invisible source - groundwater - as a relief to low rainfall and climate change.

The north of Angola receives its rain during the months of February through to April. In the south, mainly in four provinces namely Huila, Namibe, Cunene and Cuando Cubango which partly run against the coast and parts of which are semi-arid, receive approximately 400mm of rainfall per year which is a third of the rain received by the northern provinces.

Groundwater is the main source of water for people, industries, agriculture and livestock in Southern provinces.

Angola has a total of four transboundary aquifers namely the Congo Intra-cratonic (Angola/Congo/DRC), Dolomitic aquifer (Angola/DR Congo), Northern Kalahari/Karoo basin (Angola/Botswana/Namibia/Zambia), and the Cuvelai and Etosha basin (Angola/Namibia).

Mr Manuel Quintino, Director General of the National Institute for Water Resources, Ministry of Energy and Water in Angola says the country "has 11.3% of the groundwater potential in the SADC region but unfortunately only a very little percentage of this amount is being used".

“Our motto for this project is to transform the invisible resource into a visible resource. We want to put it [groundwater] on the political agenda so that using groundwater becomes a priority for the country.”

- Mr Manuel Quintino, Director General of the National Institute for Water Resources, Ministry of Energy and Water in Angola

Mr Quintino says that due to climate change and the severity of droughts in the southern region, people are turning to groundwater as their primary source. The National Institute for Water Resources is part of SADC, and are also a member of the steering committee of the SADC Groundwater Management Institute and have at least one pilot project in the Benguela region in the Caimbambo Municipality, which is implemented by the National Institute for Water Resources as part of the SADC-GMI Sub-grants pilot projects.

The National Institute for Water Resources manages three transboundary river basins; Cunene (Angola/Namibia), Cuvelai (Angola/Namibia) and Okavango (Angola/Namibia/Botswana). There are two more river basins namely the Zambezi and the Congo river basins. Angola is also part of the International River Basin Commission.

The Caimbambo Municipality has over 80 000 inhabitants and is part of the Coporolo River basin which supplies 500 boreholes. "Our motto for this project is to transform the invisible resource into a visible resource. We want to put groundwater on the political agenda so that using groundwater becomes a priority for the country" said Mr Quintino.

The only way to give water to people is to rely on groundwater. The landscape in this area is tricky, but there are places where there is an opportunity to drill boreholes.

In the past, the Spanish Red Cross and the Department of Geology from the Agostinho Neto University, partnered to provide Caimbambo with 3-5 boreholes but due to lack of maintenance and funding are not functioning optimally.

Now, the National Institute of Water Resources in Angola is utilising funds from the World Bank through SADC-GMI to rehabilitate the existing boreholes and to increase the amount of water to meet water demands for people living in Caimbambo.

Through SADC-GMI, the World Bank granted USD 150 000 and the project is expected to be completed in December 2020.

"As a strategy to guarantee the sustainability of the boreholes, we will create focal groups who will manage the running of these boreholes so that they could last many years," said Mr Quintino.

"But besides having the buy-in of the communities we have also brought on board the Caimbambo Municipality so that we can have a small amount of funds included in the budget of the municipality" to allow annual maintenance of the boreholes and keep the boreholes functioning, Mr Quintino added.

In the Benguela region the Angolan Red Cross will support the project by helping to educate people on how to maintain boreholes, the value of groundwater and how to ensure it is sustainable.

Mr Quintino highlights that one of the main milestones reached through this project thus far has been "to provide water to people living in rural areas of Caimbambo".

The project will also organise focal groups, carry out geological investigations, drill new boreholes, install submersible pumps, and supply the communities with water. The project will also rehabilitate at least three existing boreholes to increase the amount of water to satisfy people in that area.

In the past, groundwater had been neglected. "It is a kind of a disease, called hydro-schizophrenia, which means that we give more importance to surface water and we put in second place the importance of groundwater".

"But now with the presence of SADC-GMI, the importance of groundwater is discussed in national and regional discourses. And that is a success, right now when we sit with the politicians more importance is being given to groundwater," said Mr Quintino.

“
But besides having the buy-in of the communities we have also brought on board the Caimbambo Municipality so that we can have a small amount of funds included in the budget of the municipality.
- Mr Manuel Quintino, Director General of the National Institute for Water Resources, Ministry of Energy and Water in Angola

ANGOLA - TRANSBOUNDARY RIVER BASINS AND AQUIFERS

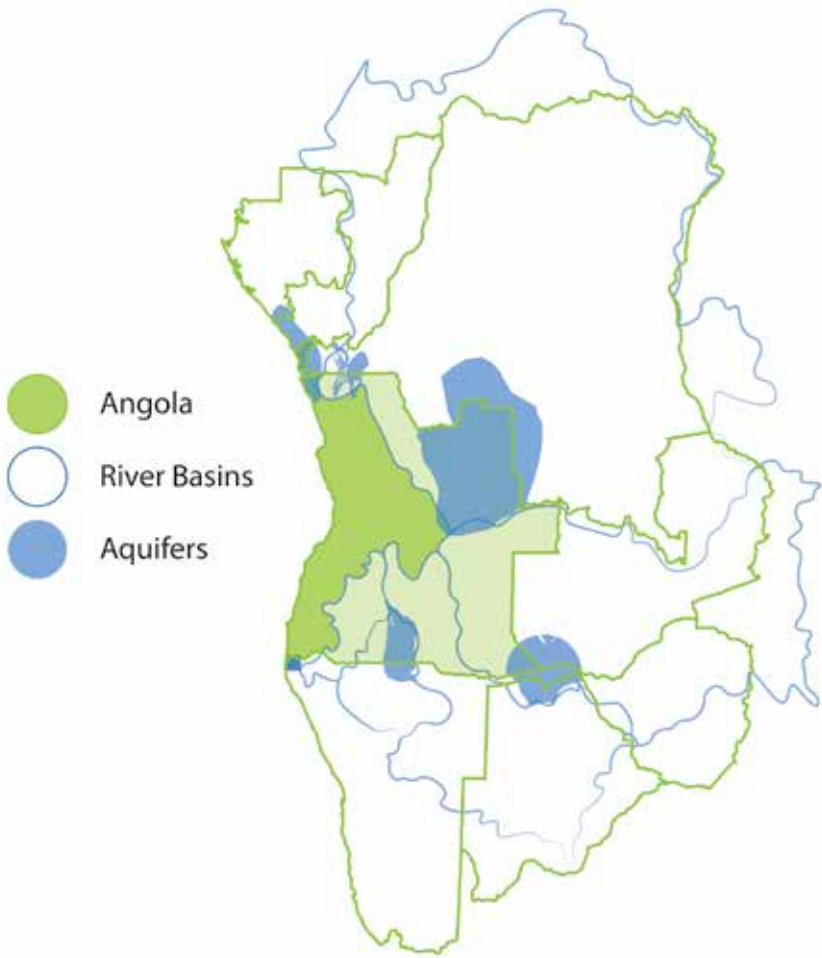


Illustration showing the transboundary river basins and aquifers across Angola.

SUB-GRANT PILOT PROJECT (BOTSWANA AND ZAMBIA)

DIGITALISING WATER MANAGEMENT IN BOTSWANA AND ZAMBIA

Botswana and Zambia are facing similar challenges: rising population and an increased demand on water. Through digitising the management and supply of water, they are successfully meeting the demand.



In a country with low rainfall and a flat terrain where seasonal rain does not recharge dams and groundwater efficiently, Botswana needed an urgent solution for its population which is dependent on groundwater for survival.

The country has a semi-arid climate and surface water is very limited. There are transboundary perennial rivers in the north and east while citizens in the west are completely reliant on groundwater for domestic use, livestock and mining.

Continued drought and a rising population in the region has caused these dams to dry up creating higher groundwater abstractions which, in turn, causes declining borehole yields.

Groundwater in some places in Botswana is also characterised by high salinity and requires desalination processes.



This [Botswana] project offers the Department of Water and Sanitation unique opportunities in managing groundwater data.

Country initiatives to secure water availability include treating wastewater as well as brackish-saline groundwater, monitoring aquifer recharge and managing the demand and use of water.

Mr Keodumetse Keetile, Principal Hydrogeologist at Department of Water and Sanitation, Government of Botswana, said the State holds water in its trust on behalf of the people as water is also a basic human necessity. "The [Botswana] government developed the National Water Policy (2016) to provide a national framework that will facilitate access to water of suitable quality and standards for the citizenry and provide the foundations for sustainable development of water resources in support of economic growth, diversification and poverty eradication."

As a result the government, facilitated by SADC-GMI and funded by the World Bank, implemented the 'Integration of Groundwater Resource Data Management System' pilot project.

"The pilot project has been developed to integrate a previously-developed National Integrated Geoscience Information system (NIGIS) database and applications of hydrogeological data, records, publications and GIS information using HydroGeo Analyst (HGA) as Phase 1 of the Integrated Water Resources Monitoring and Management System," said Mr Keetile. Digitising the process of capturing data and granting access to it on a shared database

improves the efficiency of managing water sources and fast-track decision making around what is needed to achieve the objectives.

This project offers the Department of Water and Sanitation unique opportunities in managing groundwater data. These consolidated databases include boreholes, WellMon, WaterBoard, Test pumping, AquaBase, Hydro measurements, Department of Water and Sanitation (DWS) pollution and a borehole geophysical database.

Project milestones achieved thus far include:

- Data acquisition and database implementation; - getting copies of the databases and reviewing them in HGA context templates
- Integration of the borehole module
- Integration of other NIGIS modules (databases)
- Web application development
- Oversight and delivering of HGA project file, comprehensive database and web application to Department of Water and Sanitation (DWS).

These achievements, said Mr Keetile, were achieved with the available funds: "It should be noted that the project was implemented with a full understanding that it was not a complete Integrated Water Resources Monitoring and Management System but a step towards it.

"As a result there are still some gaps to be filled and improvements to be made that require additional funds," Mr Keetile added. The project will allow for data to be integrated from standalone databases into one, the provision of analytical and visualisation tools and remote access.

Mr Keetile said that the Integrated Water Resources Monitoring and Management System would be a web-based groundwater resources development and data management system that delivers centralised and secure access to borehole completion reports, dams, river draw offs, monitoring data (levels, quality and quantity) over the web-browser.

Mr Keetile says that "by combining all water resources-related databases with specialised analytical tools, decision support systems and an easy-to-use online web interface, the project would provide DWS with a reliable system for effectively and efficiently managing water resources."

SUB-GRANT PROJECT IN ZAMBIA

Over the years Chongwe Township has been expanding at a steady rate which has resulted in the need to meet the increasing demand for various socio-economic needs for the growing population. One challenge faced by the township is the widening gap between water demand and the available sources of water. In recent years the town has experienced recurrent water deficit due to low water levels in the Chongwe River as the result of climate change and variability. Furthermore the weir (source of water supply to Chongwe Township) has been drying up more frequently.

In the quest to mitigate recurrent water shortages experienced in Chongwe Township, SADC-GMI in collaboration with the Government of Zambia (Ministry of Water Development, Sanitation and Environmental Protection) are implementing the 'Groundwater Mapping and Wellfield Development' pilot project which aims to achieve an automated groundwater monitoring borehole to measure various groundwater quality parameters.

The project will see the drilling of 3 boreholes that will be an additional 100m3/hours to the existing water reticulation system supplying 137, 461 Chongwe inhabitants with clean water.



The [Zambia] project will see the drilling of 3 boreholes that will be an additional 100m3/hours to the existing water reticulation system supplying 137, 461 Chongwe inhabitants with clean water.

The project's objective is to identify an aquifer in the Chongwe region with the capacity to be used for settlement level water supply and to develop a well field to supplement an existing wellfield developed by the Lusaka Water and Sewerage Company (LWSC).

Chongwe community largely depends on groundwater, accessed through communal tap water systems for their livelihoods. The current water supply system is failing to meet the water demands of the community. The current project augments water supply to meet the water demand of the community.

Similar to the Botswana sub-grant project, the Zambia project is also incorporating digitisation of monitoring water resources to ensure its sustainability. The project will also include the installation of an automated groundwater monitoring borehole.

Expected Outputs Include:

- Functional well field(s) for water supply and sanitation in the Chongwe area identified and characterized;
- At least three production boreholes drilled and equipped with electrical submersible pumps;
- Water reticulation system installed for conveyance of water from constructed borehole to storage facility at existing LWSC well field; and
- An automated groundwater monitoring borehole to measure various groundwater quality parameters.

Modernising the way in which boreholes and groundwater is monitored will promote the long term sustainability of groundwater in Botswana and Zambia, allowing the Government to provide clean drinking water to all its citizens.



The 'Groundwater Mapping and Wellfield Development' project will help mitigate the effects of climate change and drought. Photo credit: SADC-GMI.



The project will deliver clean potable water to 137, 461 Chongwe inhabitants. Photo credit: SADC-GMI.



SUB-GRANT PROJECT (MALAWI)

DIGGING DEEP TO SUSTAIN A COMMUNITY

Over 15 000 Malawian lives have been transformed through a high yielding borehole.

Running 100m deep, a borehole in Dedza District, Malawi, provides life for the Chimbiya Trading Centre community.

It is the source of clean water for drinking, cooking, washing, agriculture, and even entrepreneurship for over 15 000 people since it was completed and commissioned in February 2020.

“Now that there is this borehole, the socioeconomics of Chimbiya has changed,” said Zione Butao, SADC-GMI’s Focal Point in Malawi and the Chief Groundwater Development Officer at the country’s Department of Water Development.

Dedza District lies in the central region of Malawi, 80 km south-east of the country’s capital city Lilongwe. Malawi Tourism said the district lures tourists to the Warm Heart of Africa through its lush forests and highlands and is synonymous with pottery.

Butao said Chimbiya is a fast-growing trading centre in the Dedza District and that the accessibility of water will boost it further.

Unlike the existing hand-pumped boreholes subject to regular breakdowns in the district, the new one in Chimbiya is solar powered. It reticulates water to ten communal-style distribution points around the community.

“Whether people want to go to work, whether they want to go to the market, whether they want to go to school, people will get their water from this borehole and go,” Butao said.

The average borehole depth in Malawi is 60m, according to Earth Wise. The project team realised that in order to tap into deep aquifers and provide a sustainable groundwater yield, they had to drill much deeper.



“

Malawi was the first out of the ten SADC Member States to complete a sub-grant pilot project implemented by SADC-GMI.

“We wanted a borehole that is deep, but also provides water that is enough,” Butao said, adding that the existing boreholes in the community were low yielding.

Butao is particularly proud that Malawi was the first out of the ten SADC Member States to complete a sub-grant pilot project implemented by the Southern African Development Community- Groundwater Management Institute (SADC-GMI).

The pilot projects are funded by the Global Environment Facility (GEF) and the Cooperation in International Waters in Africa (CIWA) through the World Bank.

Chimbiya Safe Water Project Chairperson Esau Zinyongo was pleased that the community had access to safe drinking water.



The Malawi sub-grant project was implemented in February 2020 to serve the Chimbiya community with clean water. Photo credit: Malawi’s Department of Water Development.

“

The system works well. More people have drinking water now.

- Esau Zinyongo, Chimbiya Safe Water Project Chairperson

"The system works well. More people have drinking water now," he said.

According to a Freshwater Project International article, 23% of rural Malawi inhabitants depend on unsafe water sources such as shallow hand-dug wells and surface water bodies.

For the 83% of Malawians live in rural areas according to the World Bank data, this poses a great health risk to the small country.

"Poor quality water can have serious health implications including: the increased prevalence of water-borne diseases such as cholera, typhoid, and dysentery; higher rates of child mortality; and greater chance of infection amongst mothers and new-borns," according to the Freshwater Project International.

The absence of a reliable borehole in a growing community has not only impacted trading growth but put a strain on community members to go through different lengths to access water.

Chimbiya was not exempt.

"Some people would resort to getting water from shallow wells, risking their health as there may be waterborne diseases in that water which is not good," Butao said, adding that the borehole's water is treated to rid it of diseases.

Inaccessible water also put a strain on women and girls in the community, whom the responsibility of fetching water fell on.

"Women would complain that they would have to wake up at 4 AM to get water," Butao said.

Inspired by the impact of the new Chimbiya borehole, Butao hopes to use it as an upscaling model in other communities.



The presence of the Chimbiya borehole alleviates several socioeconomic issues in the community. Photo credit: SADC-GMI.



Malawi is the first SADC Member State to have successfully completed their SADC-GMI sub-grant project. Photo credit: SADC-GMI.



Over 15 000 people are benefitting from the high yielding solar powered pump in Chimbiya. Photo credit: SADC-GMI.



Water is now easily accessible as there are ten tap points dotted around the Chimbiya community. Photo credit: Malawi's Department of Water Development.



The borehole water is treated providing the Chimbiya community with safe drinking water. Photo credit: SADC-GMI.

SUB-GRANT PROJECT (TANZANIA)

TAPPING DEEP TO SUSTAIN DAR ES SALAAM'S SPROUTING POPULATION

A Neogene aquifer is being explored in coastal Tanzania to help sustain Dar es Salaam.

Tanzania's city of Dar es Salaam has a sky-rocketing population growth, spurring it to become a megacity and increasing the need for the sustainable use of resources to cater to its people. Access to clean water is one of them.

"Cairo, Kinshasa and Lagos are the only megacities in Africa as of 2018, but two more are expected to emerge by 2030, as Dar es Salaam (Tanzania) and Luanda (Angola) are each projected to grow beyond 10 million inhabitants," according to the UN's 2018 World Urbanisation Prospects.

According to World Population Review data, Dar es Salaam's population is nearing the 7 million mark. Principal Hydrogeologist at Tanzania's Ministry of Water Mrs Mwanamkuu Zilu Mwanyika said there is a pressing need for the city to look for other water sources, removing the strain from Ruvu River, Dar es Salaam's primary water source.

"As the ministry, we're in a process of increasing sources to supply water in the Dar es Salaam region. During the process of looking for alternative water sources, Kimbiji Aquifer System was identified," she said.

The Southern African Community Development Groundwater Management Institute (SADC-GMI) fund is supporting Tanzania's Ministry of Water with sub-grant funding for the Groundwater Management in the Kimbiji Aquifer System project.

The project seeks to develop a monitoring network in the aquifer to observe the response of the aquifer to large scale pumping and to inform management of the aquifer.

The Kimbiji Aquifer System is situated along the coast south of Dar es Salaam and is a Neogene aquifer.

"Thick successions of Neogene sands underlie most of coastal Tanzania. From Dar es Salaam and northwards, the Neogene is overlain by thick Holocene deposits, but to the south Neogene sands are exposed over an area of approximately 10,000 km²," said Norwegian Hydrogeologist Fridtjov Ruden in his research.

The SADC-GMI funded project includes the drilling of five monitoring boreholes and installing monitoring loggers, the establishment of a groundwater abstractions register.

The Groundwater Management in the Kimbiji Aquifer System project also seeks to minimize any negative impact abstraction could have on the environment. It monitors possible saline water intrusion, including streamflow and any changes to environmental conditions and ecosystem health of wetlands.

"Another exercise in the same project is that we are planning to do a borehole inventory system just to know other boreholes around the area, which will also be used as monitoring," said Mrs Mwanyika.

A brief from Tanzania's water ministry said the Kimbiji Aquifer System, a previously unknown aquifer, was discovered in 2006 as a crucial water source for Tanzania's largest city through to 2030.

Despite the aquifer's great potential to buffer Dar es Salaam's water demand, Mrs Mwanyika said the ministry was not able to secure funding for the project before SADC-GMI's 2018 sub-grant project.

The use of the Kimbiji Aquifer System to supply water to Dar es Salaam will help the city meet the sixth Sustainable Development Goal (SDG6) that speaks to providing access to clean water. An International Institute for Environment and Development brief said meeting SDG6 is a challenge for a growing city like Dar es Salaam where only half of the population has access to "secure and safe water supplies".

The project has not been completed, however, Mrs Mwanyika anticipates that once finalised, it will greatly impact communities in the Dar es Salaam region.

"The city lies at the bottom of a small catchment. River flows are highly seasonal and upstream demands for dry season agriculture are increasing. Demand for drinking water, irrigation and environmental flows compete with one another and operate at different institutional and spatial scales.

"Hydrological modelling suggests the city's plans for expanded supply will fall short unless supply and extraction regulators work jointly to use all the available water resources sustainably and flexibly," said the brief.

Mrs Mwanyika said it is often difficult to prioritise groundwater and manage it effectively as with surface water.

"Groundwater issues have not been given priority in most SADC countries, even in Tanzania. I think it is because most of the countries have more surface waters. For instance, if you take Tanzania, we have plenty of surface waters. It's only some regions which have no surface waters that are forced to use groundwater," she said.

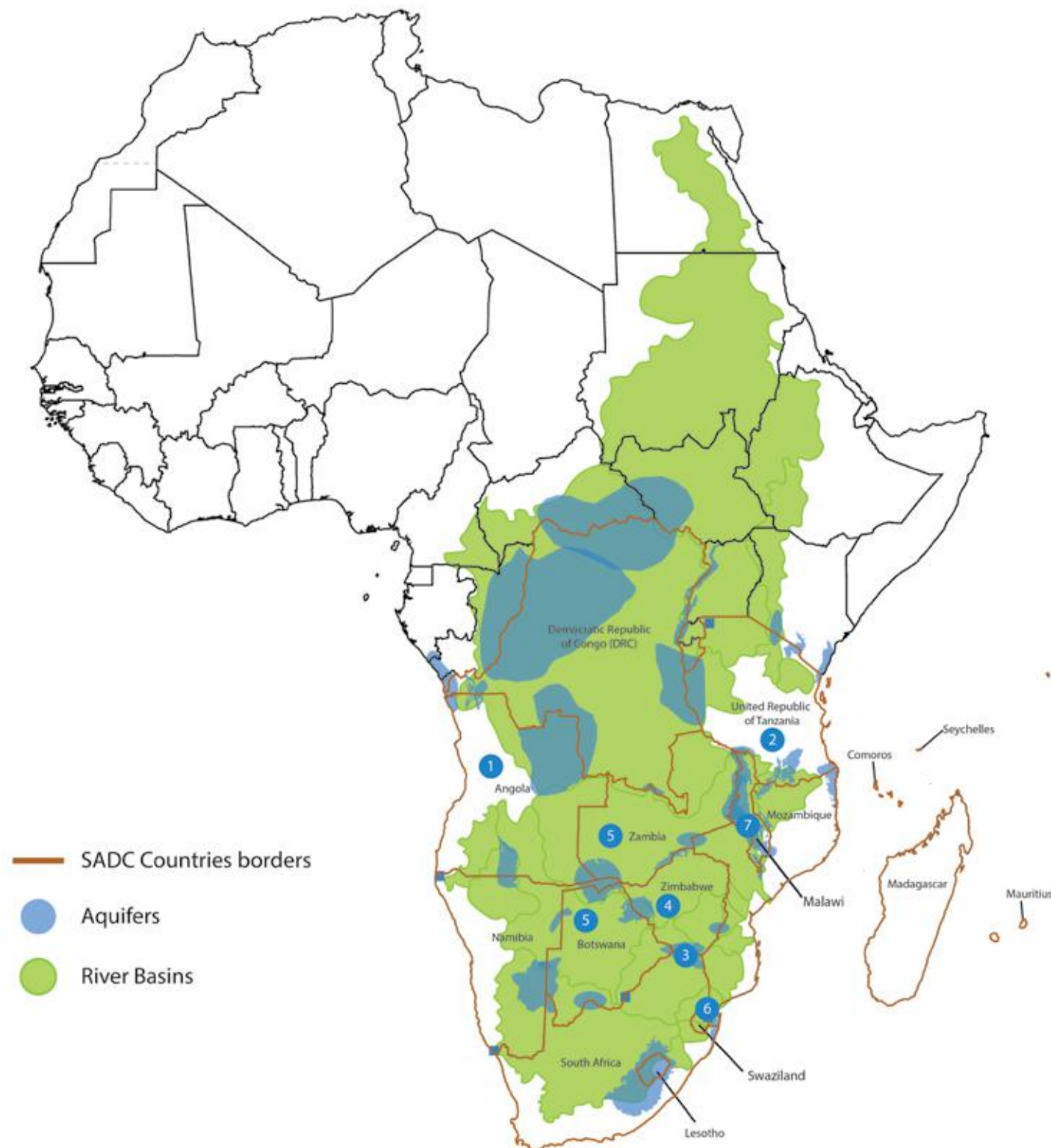
The Kimbiji Aquifer Monitoring System project is close to completion. It not only will give groundwater more attention but map a way to support Dar es Salaam's water needs.

"We are now drilling the five boreholes. We're finished with our borehole inventory. We have also finished the wetland mapping, the geophysical survey has also been completed so we are now drilling the five monitoring boreholes after that we will be installing the loggers," Mrs Mwanyika said.

“As the ministry, we're in a process of increasing sources to supply water in the Dar es Salaam region. So during that process of looking for other sources Kimbiji Aquifer System was identified.

- Mrs Mwanamkuu Zilu Mwanyika, Tanzania's Ministry of Water Principal hydrogeologist

TRANSBOUNDARY AQUIFERS AND INTERNATIONAL RIVER/LAKE BASINS IN SADC



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LEGACY PROJECT

REVIVING DRY GROUND

SADC-GMI revived seven pilot projects in the Limpopo Basin including those in drought-prone areas in Botswana and Zimbabwe.

Close to Zimbabwe's border town of Beitbridge, two high-yielding boreholes are watering life for over 1 000 people in the Dite and Whunga communities, Zimbabwe.

As part of the ongoing Sustainable Groundwater Management in SADC Member States project, SADC-GMI was mandated by the SADC Secretariat to undertake a follow-up study of the seven pilot interventions in the Limpopo River Basin. (Botswana and Zimbabwe).

The lifesaving intervention was made possible through the SADC Groundwater and Drought Management Project undertaken with World Bank funding between 2007 and 2011. Culminating from the assessment it was discovered that the pilot projects were not functional or had been used for a short period of time and abandoned, and there was a great need to rehabilitate these projects for water security and improved livelihoods in the communities.

“

For them to find gardens that are green that are being irrigated is a huge impact because there are very few people that are able to have vegetables or any other farmed produce.

- Mr Albert Ndanga, Water, Sanitation and Hygiene Programme Manager World Vision Zimbabwe

SADC-GMI contracted World Vision Zimbabwe to undertake the rehabilitation process that commenced in May 2019. With the help of World Vision Zimbabwe, SADC-GMI installed two solar-powered boreholes that yield between 5 000 - 6 000 litres of water per hour for the Dite and Whunga communities.

“When SADC-GMI revived the project, we came in and they allowed us to look at other technologies and at groundwater potential in those areas,” said Mr Albert Ndanga, a Water, Sanitation and Hygiene Programme Manager at World Vision Zimbabwe.

The use of groundwater is particularly important in dry areas such as Beitbridge district, where temperatures escalate to 40 degrees Celsius. Households in Dite and Whunga face the challenge of surviving in a semi-arid area with high temperatures but with low rainfall.

The rehabilitation of these projects will allow the community to tap into under-utilized groundwater resources and enhance water and food security and economic development for the community.

Mr Ndanga said the drilling of the two boreholes not only addressed water insecurity in the communities but also watered the one hectare-sized gardens in the community that were reconstructed and fenced as the core part of the project rehabilitation. The direct beneficiaries of the Dite garden plot are 21 men, 48 women and 325 children while 23 men, 48 women, and 75 children are direct beneficiaries of the Whunga garden.

Mr Ndanga said the garden plots are a great achievement for an area synonymous with cattle-rearing as the most practical form of farming due to the difficulty in finding water to sustain crops.

“For them to find gardens that are green that are being irrigated is a huge impact because there are very few people that are able to have vegetables or any other farmed produce,” said Mr Ndanga. Due to lack of water (surface water) the community could not conduct activities that require reliable and effective supply of water such as subsistence farming and household chores, and now the community is able to have nutritious vegetables and also generate some income by selling fresh produce locally.

“As we speak, they are doing their gardening,” he said, adding that the families farm produce such as covo which is popular during the winter season in Zimbabwe.

“Through this project, our children are able to have food with fresh vegetables such as spinach and that has improved the livelihoods of both adults and children in the community. Through vegetables from the gardens, we are able to prepare nutritious meals and lunch packs for our children,” said Lillian Muleya, who has a garden in Whunga.

The boreholes' impact infiltrates to the wider Dite and Whunga communities where over 400 people indirectly benefit from the borehole.

World Vision roped in stakeholders in district level government departments to ensure that once the organisation had finalised the SADC-GMI project, the communities would be able to sustain the project on its own.

“There are specific capacity development initiatives we have conducted to ensure that we have sustainability of the project,” Mr Ndanga said.

The involvement of the community in managing their new water infrastructure was important. Mr Ndanga said World Vision facilitated the creation of committees that can draw up regulations on how the shared boreholes are used and managed.



The gardens allow community members to harvest leafy green vegetables such as covo. **Photo credit: SADC-GMI.**



The boreholes are installed close to the hectare-sized gardens and allows community members to easily water their gardens. **Photo credit: SADC-GMI.**



A beneficiary of the Whunga garden is growing butternut. **Photo credit: SADC-GMI.**

"Most importantly, they are able to make contributions and create a fund so that when they have any challenges, such as breakdowns for operation and maintenance, they are able to attend to that without having to go back to the government," he said.

REARING A DRY COMMUNITY WITH WATER IN BOTSWANA

Nested in eastern Botswana, lies Gobojango and Tsetsebjwe in the dry sub-district of Bobirwa.

"The Bobirwa sub-district in the Limpopo River Basin is a hot spot in relation to climate change impacts. Cattle rearing and crop production are the dominant livelihood activities in the subdistrict," said an Adaptation at Scale in Semi-Arid Areas report.

To help bring relief to the dry area, SADC-GMI appointed Kalahari Conservation Society (KCS) to implement the "Rehabilitation Pilot Projects to Supply Water to Communities in Gobojango and Tsetsebjwe Villages by Exploring Alternative Water Sources" project which commenced in March 2019.

"Bobirwa is a hard-hit area in terms of drought," said Ms Thato Morule, KCS CEO, adding that while the community depends on rain to feed their crops, poor rainfall inhibits agriculture duties in the area.

An objective of the project is to provide "functioning and sustainable water for horticultural purposes in pilot sites through alternative and sustainable interventions, as a climate change mitigation measure," said a KCS report on the project.

Project activities in Tsetsebjwe included the repairing of the gardening plot fence, and providing capacity building for the horticulture beneficiaries. Once completed, Tsetsebjwe will have a solar panelled borehole that will reticulate water to the community. When the team first drilled the borehole, it, unfortunately, hit a dry hole.

"We managed to negotiate with the SADC-GMI to say with some of the funding which was meant for later activities we can use it to try and look for water and try for another borehole," Ms Morule said.

The Gobojango borehole project has similar planned activities to Tsetsebjwe but focussed on the rehabilitation of an existing council borehole.

"We have already tested the borehole and it shows it has sufficient water to supply the community," Ms Morule said.

Once completed, over 4400 people in Tsetsebjwe and over 2300 Gobojango community members will be direct beneficiaries of the project.

Through the rehabilitation of these projects we saw inclusion of more women in water resources management and research has shown that agricultural productivity improves when women have access to water management technologies and innovations at local level.

"Embarking on these interventions is another endeavour by SADC-GMI of ensuring that communities have access to clean and safe water for improved livelihoods in the SADC region, and that we are supporting the Sustainable Development Goal 6 which is summarised by the United Nations (UN) as ensuring "availability and sustainable management of water and sanitation for all," concluded Mr Brighton Munyai, SADC-GMI Senior Groundwater Specialist.



The Tsetsebjwe borehole drilling was conducted in February 2020. **Photo credit: SADC-GMI.**



The Gobojango project was launched in March 2020. **Photo credit: SADC-GMI.**



TRANSBOUNDARY AQUIFERS

BUILDING COMMUNITIES THROUGH SHARED AQUIFERS

Sustainable groundwater management in shared aquifers is a SADC-GMI priority.

There is limited understanding of groundwater systems in Southern Africa and when aquifers are shared between two or more countries, the challenges that arise are compounded.

When the SADC Groundwater Management Institute (SADC-GMI) was formed, management of transboundary aquifers was identified as a regional priority, said SADC-GMI Senior Groundwater Specialist Mr Brighton Munyai.

Munyai said river basin organisations in the region such as the Zambezi Watercourse Commission (ZAMCOM), Limpopo Watercourse Commission (LIMCOM), and the Okavango River Basin Water Commission (OKACOM) were traditionally seen as surface water management institutions.

"We had to advocate for the integration of transboundary aquifer management into river basin organisations," Mr Munyai said.

In an article about transboundary aquifers (TBA) in Africa, Mr Geert-Jan Nijsten, Mr Greg Christelis, Dr Karen G. Villholth, Prof. Eberhard Braune and Prof. Cheikh Bécaye Gaye said that "transboundary aquifers [TBAs] may be subject to conflicts of interests because of unequal resource partitioning and different management capacities within the social, economic and environmental contexts of sharing countries".

Despite the social, economic and environmental challenges that arise in understanding and managing TBAs, their work highlighted that these aquifers are crucial for the development of Africa.

Nijsten et al said 33% of the African continent live on shared aquifers and that most of the TBAs are in areas of "high storage and higher-yielding aquifers".

The Southern African Development Community (SADC) has about 30 aquifers but only the Ramotswa (shared between Botswana and South Africa), Stampriet (shared between Botswana, Namibia and South Africa), Shire (shared between Malawi and Mozambique) and the Tuli Karoo (shared between Botswana, South Africa and Zimbabwe) have detailed analysis and work done.

"That means there is a lot of scope for work to be done by SADC-GMI," Mr Munyai said.

"The big problem with transboundary aquifers is that it's hard enough just to understand how the water exists and flows under the ground law and how much of it is actually flowing across an artificial boundary, which is like a national boundary," said Prof. Robert Kalin, an Environmental Expert from the University of Strathclyde, Scotland.

The SADC Groundwater Management Institute, commissioned the "Conjunctive Transboundary Water Resources Management in the Shire River-Aquifer System project (ShireConWat)", implemented by the International Water Management Institute in collaboration with the University of Strathclyde, Department of Water Resources, Malawi, and the National Directorate of Water Resources Management, Mozambique. The project ran from July 2018 to April 2019.

The specific objective of the project was to enhance the capacity in SADC and its Member States to manage

integrated groundwater and surface water resources, using the Shire River-Aquifer System (shared between Malawi and Mozambique) as a pilot case.

The Shire system plays a crucial socio-economic role in Malawi and Mozambique where the majority of the districts surrounding the system have poverty rates higher than 45%, according to the ShireConWat TDA report.

"The populations of the Shire System primarily rely on firewood for cooking fuel, boreholes and unimproved sources for drinking water, and various types of latrines for sanitation," said the ShireConWat TDA report.

Mr Munyai said transboundary aquifers are not only important water resources for local communities as in some cases there can be strategic aquifers for the riparian nations.

Mr Munyai said an example of a strategic transboundary aquifer is the Eastern Kalahari Karoo aquifer shared between Botswana and Zimbabwe. It is a "significant" water source for Bulawayo, Zimbabwe's second-largest city that is drought-ridden. The Eastern Kalahari Aquifer also hosts a number of wellfields supplying water for some major settlements in Botswana.

Mr Munyai described SADC-GMI's "biggest success" as the institute's work with the Limpopo Watercourse Commission (LIMCOM): establishment and operationalisation of the Limpopo Groundwater Committee.

LIMCOM is shared by four riparian states – Botswana, Mozambique, South Africa, and Zimbabwe. SADC-GMI and LIMCOM signed a Memorandum of Understanding in 2018 to collaborate and form the LIMCOM Groundwater committee.

The focus of the SADC-GMI and LIMCOM committee is to work together on groundwater issues in the Limpopo River Basin with emphasis on transboundary aquifers that include the Ramotswa Aquifer, Tuli Karoo Aquifer, and the Limpopo Aquifer Basin.

Its main task is to coordinate the management of transboundary aquifers and groundwater resources in the Limpopo River Basin.

Mr Munyai said it has been at River Basin Organisations where SADC-GMI's TBA work has been mostly felt.

"The nature of the work that we are doing is based on Transboundary Diagnostic Analysis/Joint Strategic Action Planning (TDA/JSAP) approach which involves active participation of Member States," he said.

In the Shire River Basin, SADC-GMI brought together Malawi and Mozambique where Munyai said a lot of groundwork had been covered on the Malawian side as compared to the Mozambican side.

"So our success story is managing to bring the two Member States together to talk about a common water resource. The next stage would be to follow up on implementation of strategic actions that the Member States had identified," Mr Munyai said.

POLICY, LEGAL AND INSTITUTIONAL DEVELOPMENT FOR GROUNDWATER MANAGEMENT IN SADC MEMBER STATES (GMI-PLI)

DEVELOPING A REGIONAL APPROACH FOR SUSTAINABLE GROUNDWATER

16 SADC Member States participated in a project that reviewed regional legislation, regional water policy, regional water strategy, regional institutional framework, and regional development frameworks in the region.

As the demand for groundwater in Southern African Development Community (SADC) Member States increases, an improved approach to groundwater management is needed as depletion and pollution threaten its sustainability.

According to the World Bank, groundwater is not only for drinking and sanitation, "but supports livelihoods, agriculture, ecosystem health, and industrial growth". It adds that agriculture and mining practices can pollute aquifers while the expansion of industry puts pressure on aquifer levels.

Responding to the increasing pressure on groundwater in the region, the SADC Groundwater Management Institute (SADC-GMI) implemented the Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States (GMI-PLI) project in 2018. This was in line with SADC-GMI's focus on creating an enabling environment for groundwater management through policy, legal and regulatory frameworks.

"People don't fully understand groundwater. The challenge for SADC-GMI and Ministries is that the interest and the money flows towards surface water. The irony is that groundwater is so (much more) important to smaller communities and smaller urban centres than people give it credit for," said Mr Derek Weston, Pegasys Director.

An Africa Renewal article said that "a warming world" will impact precipitation. This highlights a need to give groundwater more attention.

"At 1.5° C, less rain would fall over the Limpopo basin and areas of the Zambezi basin in Zambia, as well as parts of Western Cape in South Africa.

"But at 2° C, Southern Africa is projected to face a decrease in precipitation of about 20% and increases in the number of consecutive dry days in Namibia, Botswana, northern Zimbabwe and southern Zambia. This will cause reductions in the volume of the Zambezi basin projected at 5% to 10%," it said.

On the surface, dry Southern African countries like Botswana look dry and seem to be at risk of being severely affected by climate change. However, aquifers beneath the surface can provide a critical lifeline. It is one reason why SADC-GMI put together a regional framework for groundwater sustainability for the region.

Weston was the GMI-PLI project lead where he and his team reviewed regional framework documents to understand legislative, policy and institutional (PLI) frameworks in the region.



Pegasys implemented the GMI-PLI project for SADC-GMI across all 16 SADC Member States. Photo credit: Pegasys.

"People generally are not having discussions on groundwater," he said.

Weston added that it was clear from the project that many countries had policies and legislation to support better groundwater management but these were "not being applied and implemented as they should".

"Generally, I think what a lot of people are finding is that if you don't have a policy rooted in evidence, it's not going to go anywhere. If you don't have a policy where you have the right kind of engagement, it isn't going to go anywhere. When we do develop these policies that impact or give guidance to legislation, we need to translate them to strategies for various instruments on the ground."

"If we don't have the right people buying into and giving into that document, it is going to sit on a shelf," said Ms Traci Reddy, a Managing Principal at Pegasys and GMI-PLI Project Manager.

To get a scope of PLI frameworks in each SADC Member State, the team worked with focal points from each country who reviewed their national groundwater management policies and worked with other groundwater stakeholders to create national gap analysis reports and action plans.

SADC-GMI Senior Groundwater Specialist Mr Brighton Munyai said the GMI-PLI project was one of the institute's flagship and successful projects, particularly because work was done in all 16 Member States, including the Comoros that had recently joined as a member of SADC.

"These were scoping level reports developed based upon desktop review and 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," states the GMI-PLI regional gap analysis report.

One thing that is often powerful with these multinational projects is that you get to bring people together through their projects SADC-GMI has done really well in getting people on board and Member States to participate in processes and that's always enriching.

- Derek Weston, Pegasys Director and GMI-PLI project lead

At a regional level, the project reviewed regional legislation, regional water policy, regional water strategy, regional institutional framework, and regional development frameworks.

"This was looking at the big policies, the national water policy, water resource strategy, and then things like master plans for national governments to put those in place," Weston said.

The GMI-PLI report highlights the SADC Regional Water Policy that states "the planning, development and management of watercourses, particularly in shared watercourses will consider the integrated use of surface and groundwater resources, the reuse of water, proper pollution management and the provision of environmental requirements".

A gap the GMI-PLI project identified in the SADC Regional Water Policy is that the document has a strong focus on surface water, even though a "watercourse is inclusive of both surface and groundwater".

"The policy is clear in stating the importance of conjunctive use of surface water and groundwater 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," the report said.

Mr Weston said it becomes more complex in transboundary aquifers.

"The moment you step into a transboundary context, people can't wrap their head around it.

Not only because of science of understanding the transboundary aquifer but the political context between countries is difficult," he said.

The GMI-PLI estimates that there are about 30 transboundary aquifers and 15 transboundary river systems in the region. It adds that there is a need for Member States to strengthen PLI frameworks to achieve "equitable and sustainable access to water resources" because of their importance in ensuring water security in the region.

The GMI-PLI suggests that the Regional Water Policy "must have" an addendum to "strengthen groundwater management, conjunctive use and transboundary aquifer management". This forms part of the GMI-PLI action plan that ranks ways to close gaps identified for each Member State in order of importance.

Another "must have" at an institutional level is the "strengthening of the network of groundwater specialists" in the region.

"It's very much around building a community of practice and I think you don't hold knowledge to yourself, you share it and by sharing it you strengthen your community of practice," said Ms Reddy, Pegasys' Managing Principal and GMI-PLI Project Manager.

Mr Weston said groundwater projects such as the GMI-PLI help countries realise their good work but also helps them learn from other states.

Generally, I think what a lot of people are finding is that if you don't have policy rooted in evidence, it's not going to go anywhere. If you don't have a policy where you have the right kind of engagement, it isn't going to go anywhere and the reason is when we do develop these policies that impact or give guidance to legislation is to translate them to strategies for various instruments on the ground.

- Ms Traci Reddy, a Managing Principal at Pegasys and GMI-PLI Project Manager

"One thing that is often powerful with these multinational projects is that you get to bring people together through their projects, SADC-GMI has done really well in getting people on board and Member States to participate in processes and that's always enriching," said Mr Weston.

The GMI-PLI project also included the development of a guideline, targeted advocacy and development of a groundwater roadmap for a pilot Member State to address the gaps identified for that Member State during the gap analysis.

"We developed roadmaps in Tanzania and Eswatini and what that has done is that the Tanzanians and Swazis have a document to improve groundwater management from a PLI perspective which is a big contribution to sustainable groundwater management in the region," said Mr Munyai.

Five guidelines were developed as part of the project: The development of the Groundwater PLI Roadmap, the Operation and Management of Groundwater Schemes, the Guidance Document: Building Groundwater resilience, the Framework for institutionalizing groundwater management, and the Strategic Approach to Financing groundwater management.

"SADC-GMI can still assist with the development of their roadmaps but that needs to be seen in the next phase of the project," Mr Munyai said.



Groundwater needs to be granted more attention to help the region face water security challenges such as climate change.
Photo credit: Pegasys.



EKK TBA

EASTERN KALAHARI KAROO BASIN: SETTING THE BENCHMARK FOR TRANSBOUNDARY AQUIFER MANAGEMENT

Through monitoring and evaluating the Eastern Kalahari Karoo Basin, experts are expanding their understanding of aquifers in the SADC region and how to better manage this resource to ensure groundwater sustainability for generations to come.

The Eastern Kalahari-Karoo Basin Transboundary Aquifer (EKK TBA) supports a fast growing population of a quarter million with only 500mm rainfall annually.

Situated between the Zambezi River to the north and Nata River to the west, this confined to semi-confined aquifer is fast becoming the case study for transboundary aquifer management.

Due to the dependence on this aquifer as a source of water, it is vulnerable facing a growing populace, climate change, land mismanagement and unsynchronised government management structures. To avoid a situation in which the EKK TBA shared between Botswana and Zimbabwe is so strained that it can no longer be sustainable, early intervention is needed.

EKK TBA research has already discovered that the extent of the aquifer system is more than double the size initially thought and that the aquifer system falls within the Okavango and Zambezi River basin. Priority has been given to EKK TBA as not much is known about many aquifers in the SADC region. Out of a total of 30 Transboundary aquifers in the region, only four have been studied exhaustively.

Through proper research, monitoring, evaluation and management the research team hopes that this project will set the criterion to which other transboundary management projects will be undertaken.

One of the challenges in the foreseeable future is climate variability and climate change, according to Dr Kevin Pietersen, Extraordinary Senior Lecturer in the Department of Earth Science at the University of the Western Cape and Senior Researcher on the project.

Dr Pietersen notes that one of the implications of climate change is declining rainfall: "So we are working in an environment with reduced rainfall and the implications. But this is not necessarily bad as reduced rainfall will imply more intense rainfall over shorter periods which recharges aquifers." It is important to understand how variations may affect the aquifer, especially in the long term.

According to Dr Pietersen, groundwater management was highlighted as key at a recent prioritisation workshop between Botswana and Zimbabwe.

"There were three aspects that we dealt with in the workshop. We wanted to understand the issues in the basin and we also wanted to understand the importance of various issues and the priority in those issues. What we went through is understanding the issues, classifying the issues as part of the risk."

Dr Pietersen says that multiple water risks for the EKK TBA have been identified and include: insufficient potable water for human consumption, groundwater overexploitation, contamination of groundwater, competing demands for groundwater from various sectors, climate variability and climate change, data and knowledge gaps, institutional gaps and barriers and inadequate groundwater monitoring systems, lack of joint groundwater management of the EKK TBA.

While these issues are not unique to the EKK TBA, they are important to monitoring and evaluation of this project to enable it to become the benchmark against which any aquifer research in SADC will be measured.

Commenting on the role SADC-GMI plays in groundwater management in the region, Dr Pietersen said: "I think [SADC-GMI] is critically important and really I think they already started to demonstrate their value in playing a coordinating role throughout the region disseminating and sharing knowledge and bringing like-minded people together around the number of groundwater management issues."

The research is funded by the Global Environment Facility (GEF) and the Multi Donor Trust Fund Corporation in International Waters in Africa (CIWA) through the World Bank. The project is being implemented by L2K2 Consultants (Pty) LTD based in Cape Town, South Africa, on behalf of SADC-GMI. SADC-GMI has a portion of the project funding to specifically undertake the research in the EKK TBA as part of its mandate to advocate for joint management to ensure the sustainability and the protection of groundwater.



PARTNERSHIPS

PARTNERING TO COVER MORE GROUND TOGETHER

Collaborating with various stakeholders across Member States helps deepen SADC-GMI's impact in the region.

Working together builds community and, for the Southern African Development Community Groundwater Management Institute, it helps the institute enlarge its footprint in the region to advance sustainable groundwater management in Southern Africa and beyond.

"A partnership is inherently a benefit," said SADC-GMI Executive Director Mr James Sauramba.

SADC-GMI strives to be a Centre of Excellence in sustainable and equitable groundwater management in the region. Mr Sauramba said partnering with various stakeholders helps SADC-GMI execute its mandate without "stretching itself".

"We cannot leverage the existence of the massive number of other institutions that exist in the region. So with partnerships, we are able [to do so]," Mr Sauramba said.

SADC-GMI's footprint spans across 16 Member States on the continent and funding is a key driving force enabling the institution to carry out work in the region.

The World Bank is the funding entity that has given SADC-GMI its biggest grant through the Global Environment Facility and Cooperation in International Waters in Africa.

Part of the World Bank project are sub-grant pilot projects carried out in Angola, Botswana, Eswatini, Lesotho, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe for different groundwater infrastructure developments. Working with SADC Member States, SADC-GMI formed partnerships with Focal Persons in ministries of water in the region to carry out the sub-grant projects.

The collaboration has seen successes such as the implementation of a yielding borehole in Chimbiya, Malawi, that supplies water to over 15 000 people in the community.

In Namibia, the sub-grant project works to advance the country's existing hydrogeological map.

"As a SADC Member State, we're required to develop these set guidelines and principles in order to uniformly develop these tools and using this project, SADC-GMI gave tremendous technical support prior and also during the project development and contracting phases.

"So the highlight really would be the fact that SADC-GMI has provided us with that knowledge they have," said Bertram Swartz, the Deputy Director of hydrogeology at Namibia's Ministry of Agriculture, Water and Land Reform.

Recently, SADC-GMI received funding from the JRS Biodiversity Foundation to undertake some work in the Bray transboundary aquifer shared between South Africa and Botswana. Other transboundary aquifer funded work

includes that of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) helping SADC-GMI with its transboundary water management programme based in Botswana.

"We are working with CRIDF [Climate Resilient Infrastructure Development Facility] to prepare proposals for accessing the Adaptation Fund and as well as the Green Climate Fund. We are also working with the AfDB [African Development Bank] to try and access additional funding for our work," Mr Sauramba said.

Over the past four years SADC-GMI has forged strong partnerships with national, regional and international partners. This includes Africa's leading groundwater research group Institute for Groundwater Studies from the University of the Free State. Another academic institution SADC-GMI works with is the University of Strathclyde in Scotland.



The importance of now having a dedicated center of excellence, which SADC-GMI is for groundwater is an important one not only for OKACOM as a recipient or collaborator in that context but for the region as a whole.

- Mr Phera Ramoeli, Okavango River Basin Water Commission Executive Secretary

SADC-GMI has also partnered with the United Nations Educational, Scientific and Cultural Organisation – International Hydrological Programme, WaterNet, Africa Groundwater Network, International Water Management Institute, International Groundwater Resources Assessment Centre, Global Water Partnerships for Southern Africa, Southern African Research and Documentation Centre, the South African Water Research Commission, and the British Geological Survey.

SADC-GMI is also benefiting from resources of the United States Agency for International Development through the Resilient Waters Programme. The programme seeks to build resilience and help Southern African countries become more water secure.

As climate change threatens water security in the region, it has become more important that SADC Member States look to groundwater to alleviate the burden on dwindling surface water.

"For a long time, groundwater has not been given visibility like it has always been with surface water," said Trevor Shongwe, Eswatini's focal person for SADC-GMI and the Director at the country's Department of Water Affairs.

"But we know that surface water is fed from groundwater sources. Partnership and collaboration is needed to educate people on the importance of groundwater, more particularly in the face of climate change phenomenon where our rivers are running low, and more people are now relying on groundwater as a source of water for their basic needs," Shongwe added.

In the midst of water challenges hampering the region, Dr Patrice Kabeya, a Senior Programme Officer for water at the SADC Secretariat said SADC-GMI is positioning itself to be a leader, driving the much-needed conversation and change on groundwater.

"It's becoming a Centre of Excellence in terms of research, generating knowledge on groundwater in the region," Dr Kabeya said.

The SADC secretariat plays a critical role in mobilising resources for SADC-GMI. Dr Kabeya said the SADC secretariat guides the operationalisation and implementation activity of SADC-GMI.

Dr Kabeya said he has seen value and synergy between SADC-GMI and river basin organisations collaborating, describing them as "arms" of SADC in managing water in the region.

"We have seen that river basin organisations are really strongly partnering with SADC-GMI to drive groundwater [management] at a basin level," he said.

A fairly new SADC-GMI and river basin organisation partnership was formed in March this year where SADC-GMI signed a memorandum of understanding with the Okavango River Basin Water Commission (OKACOM).

"However, that was just a formality, our partnership predates the signing of the agreement," said Mr Phera Ramoeli, OKACOM's Executive Secretary.

In the same vein, SADC-GMI signed memoranda of understanding with the Limpopo Watercourse Commission (LIMCOM), Zambezi Watercourse Commission (ZAMCOM) and Cuvelai Watercourse Commission (CUVECOM), while also collaborating with the Orange-Senqu River Commission (ORASECOM) through participation in the Groundwater Hydrology Committee.



As a SADC Member State, you're required to develop these set guidelines and principles in order to uniformly develop these tools [and] and using this project, SADC-GMI gave tremendous support.

- Mr Bertram Swartz, Deputy Director of hydrogeology at Namibia's Ministry of Agriculture, Water and Land Reform

OKACOM was formed out of a 1994 agreement between Angola Botswana and Namibia to help Member States manage and develop the Okavango River Basin.

According to International Waters Governance: "The Okavango River has its source in the Cuito and Cubango Rivers in Angola. The river flows uninterrupted through Namibia to Botswana and discharges an average of 10 billion cubic meters per year to the Okavango Delta".

Mr Ramoeli said it was important for SADC-GMI and OKACOM to collaborate because OKACOM, as it is, does not have the "necessary strength in terms of expertise in groundwater issues".

"Therefore we needed to partner with those who have already been working in the area," said Mr Ramoeli.

"I think the importance of now having a dedicated Centre of Excellence, which SADC-GMI is for groundwater is an important one not only for OKACOM as a recipient or collaborator in that context but for the region as a whole," Mr Ramoeli added.

COMMUNITY IMPACT (ESWATINI AND MOZAMBIQUE)

CLEAN WATER TO GROW YOUNG LIVES

Groundwater is important to rural communities that often lack access to clean and secure water sources.



Access to clean and reliable water is important for rural communities to sustain themselves socio-economically.

"Safe and dependable water supply is so very important in any society, be it Eswatini, Johannesburg or Timbuktu," said Mr John Weatherston, who runs Action Four Africa Swaziland, an NGO that works to improve the lives of rural children in Eswatini.

Mr Weatherston said there are still many homesteads in rural Eswatini where clean water supply is a major challenge and that he has noted that children often suffer from diarrhoea as a result.

"This is usually in summer when there are more active rains and we encounter a lot of diarrhoea cases," said Bongumenzi Mdluli, a Senior Nurse at Ekufikeni Clinic in the northern region of Hhohho.

Ekufikeni Clinic is one of the six sites benefitting from the Southern African Development Community's (SADC-GMI) Eswatini sub-grant project that is focussing on resuscitating the kingdom's old groundwater monitoring system.

"We are initiating a groundwater monitoring exercise because we would want to have an understanding of our groundwater resources noting the current demand on groundwater resources in the country," said Mr Trevor Shongwe, SADC-GMI's Focal Person for Eswatini and the kingdom's Department of Water Affairs Director.

The Eswatini project is also installing solar-powered boreholes to benefit communities and rural schools.

"Eswatini is currently using electricity to energise most of their groundwater supply schemes. Due to the increase in the tariffs for electricity, most of our schemes are then having challenges operating because these are actually powered by the communities," Mr Shongwe said.

Eswatini also faces climate change challenges.

According to the Food and Agriculture Organisation of the United Nations, the 2015/16 El Nino phenomenon caused by a rising of temperatures in the Pacific had devastating effects on the small landlocked country.

"Drought is a pressing economic, social and environmental issue that is of great importance to Eswatini, similar to the rest of southern Africa, where for the past few decades the region has been affected by recurring droughts which had negative impacts on rain-fed agriculture, environment, economy and the livelihoods of the people," said Mr Daniel H. Mlenga, Prof. Andries J. Jordaan and Mr Brian Mandebvu in a Jamba journal article.

About 76% of Eswatini's population lives in rural areas, according to World Bank data. The World Food Programme adds that 58.9% of the rural Eswatini population lives below the national poverty line, making access to water and sanitation a critical need to those who need it most.

The project has ten monitoring sites spread across the country to analyse the quality of the groundwater. Apart from Ekufikeni Clinic, other sites include boreholes in Mkhuzweni Health Centre, St Pauls Primary School and Mseni Primary School. The project is also monitoring boreholes at the Lufafa gold mine and the Bulembu gold mine to check industrial activities.

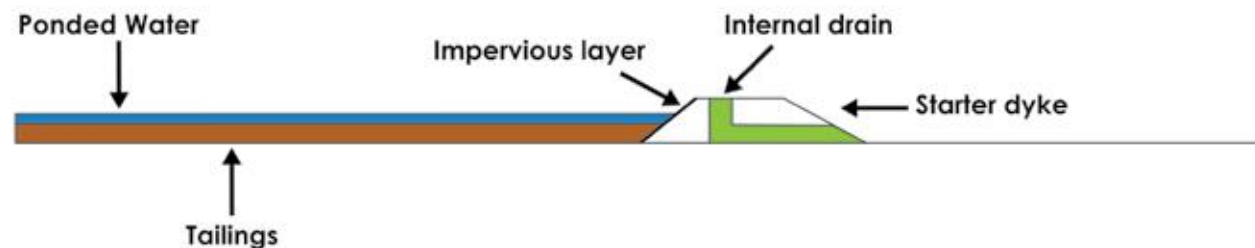
"There are two boreholes located within the mines [that we are monitoring] so that we can protect the communities around those areas on issues of pollution of the groundwater resources," Mr Shongwe said.

Mining practices can have dire effects on the environment. Mr Shongwe said the monitoring sites were strategically placed in the gold mines to note and check the activities of the tailing dams of the mines and how it can impact other nearby bodies of water.



Front row: L-R: Winile Khumalo (DWA), Thokozani Dlamini (SADC-GMI), Marcus Wijnen (World Bank), Kasonde Mulenga (SADC-GMI), Brighton Muniyai (SADC-GMI), Palesa Mokorosi (World Bank) Back row: L-R: Musawenkosi Mwelase (DWA), Anna Castani (World Bank), James Sauramba (SADC-GMI) The Maguga Dam on the Komati River that helps provide water to Eswatini. Photo credit: SADC-GMI.

TAILING DAM



"Poor management of most of the tailings dams resulted in the escape of seepage, adversely affecting soils and water quality. Some tailings dams have been partially or completely reclaimed leaving contaminated footprints. These zones pose a serious threat to the underlying dolomitic aquifers," said Dr Thorsten Rösner and Prof. Annalet van Schalkwyk in their abstract for their article on the impact of gold mine tailings in Johannesburg, South Africa.

Mr Shongwe explained that gold mining uses heavy metals for purification.

"So if there is water in the dams, there's potential that the water can then actually penetrate groundwater," Mr Shongwe said.

Mr Mdluli said he hopes the project will spread out to the rest of the Eswatini community especially through the drilling of more boreholes.

"If water becomes more readily available, more people will be safe. And it can be of great assistance," he said.

Mr Shongwe said Eswatini's sub-grant project is similar to Malawi's. Malawi successfully installed a solar pumped yielding borehole in February to benefit the Chimbiya community. Over 15 000 people have access to the borehole.

About 5000 people will benefit from the Eswatini sub-grant project, including rural schools.

"So we're looking forward to maybe if we are allowed to scale this one up through this SADC-GMI. I believe in future projects".

Successful projects can help Member States realise the benefits and importance of groundwater in the SADC region. As a result of the much-needed attention, groundwater management could be improved in the future, Mr Shongwe said.

SUB-GRANT (MOZAMBIQUE)

Looking forward, focusing on watering rural communities is particularly important. South-eastwards of the SADC region, 63% of Mozambicans live in the rural areas, estimates the World Bank. "Livelihoods in Mozambique depend to a large extent on natural resources, such as rain-fed agriculture and fishing", according to the UNDP.

Mozambique installed a solar-powered borehole to supply water to a rural community in dire need through its sub-grants project. Before the intervention, the Muchocolote village in the administrative post of Catembe Simbe in the Matutuine district of Maputo Province was using a hand-pumped borehole.

The hand-pumped borehole is the only borehole in the community and people often have to walk long distances to fetch water, said Mozambique's Focal Person Ms Ana Isabel Fotine Mponda, a Civil Engineer from the Ministry of Public Works Housing and Water Resources' National Directorate of Water.

The Mozambique sub-grant project will replace that hand-pumped borehole with a solar-powered one that will fill two 10 000 litre tanks with water.

"[The installation of the solar-powered pump] will reduce the distance between the source and the home, it will reduce time at the source and the population will have more time with their daily activities," Fotine Mponda said.

"Handpump-equipped boreholes are one of the most common water supply technologies adopted in rural Africa, but often demonstrate low levels of sustainability. In addition to operational problems with the pump, the borehole itself may cease to provide adequate quantities of safe drinking water only a short time after construction," said Assistant Programme Manager at the Water, Engineering and Development Centre Peter Harvey in a conference paper.

Mozambique is one of Africa's most vulnerable countries to climate change, according to a Relief Web article. Issues that exacerbate Mozambique's vulnerability are weak institutional development, poverty, and frequent extreme weather events.

"Climate-related hazards such as droughts, floods, and cyclones are occurring with increasing frequency, which is having a cumulative and devastating impact on a population that is insufficiently prepared," said the article.

About 2 000 people will benefit from the Mozambique sub-grant project once it is completed. The water will be distributed to three different villages through subterranean pipelines. Each village will have a tap to access the water.

Fotine Mponda said the Mozambican team has made good progress on the project. "But it remains to be finished, including the following aspects: the source, the distribution network, fountains, the management house and pump installation," she said.



Local primary schools such as Mseni Primary School and St Paul's primary schools are beneficiaries of the Eswatini project. Photo credit: SADC-GMI.



The water tanks hold 10 000 litres of water. Photo credit: SADC-GMI.



The Mozambique sub-grant project also promotes hygiene and sanitation. Photo credit: SADC-GMI.



A management house has been built on the Mozambique sub-grant project site. The community will be in charge of maintaining the water network. Photo credit: SADC-GMI.



Over 2000 people will benefit from the Mozambique sub-grant project. Photo credit: SADC-GMI.



COMMUNITY IMPACT (SOUTH AFRICA)

TRAINING OPPORTUNITY BRINGS WATER TO RURAL SCHOOL

Nzame Primary school, Bloemfontein South Africa, received a new borehole commissioned by SADC-GMI to aid the supply of freshwater to the school.

Groundwater is a vital resource, perhaps even more for critical public facilities in rural areas such as schools and clinics. Drilling boreholes can be the most efficient way to provide these facilities with water. One of the borehole projects SADC-GMI has developed is in Nzame Primary School situated in Bloemfontein, Free State province. The school's principal, Mr Skosana, said once the borehole is operational it will ease the financial strain on their budget. Currently the school pays rates to the municipality for the water they use. Mr Skosana said: "Our budget can't keep up with the costs to pay the municipality rates for water. And sometimes if the water is closed in the vicinity the community members come to the school to ask for water. We end up paying for water we didn't even make use of."

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Our budget can't keep up with the costs to pay the municipality rates for water.

- Mr Skosana, Principal; Nzame Primary School, South Africa

He said since the borehole is a natural resource it will help them focus their finances on educational related items.

The need for a borehole was identified during a training initiative where SADC-GMI collaborated with the Institute for Groundwater Studies and Central University of Technology (Bloemfontein).

The drilling of the borehole was used as a training opportunity in which all SADC Member States could take part. The Professional borehole Drilling Supervision course was run for five days (April 23 – 27, 2018) at the University of the Free State. The primary objective of the course was to provide participants with knowledge relating to Borehole Drilling and management. The fieldwork at Nzame Primary School exposed the trainees to Practical experience borehole drilling. The positive change brought by the borehole development will need measures to be put in place to ensure its sustainability. Some of these include sanitation, protecting the borehole with a tight-fitting head cap and avoiding the mixing of chemicals near the borehole.



Nzame Primary School pupils. Photo credit: SADC-GMI.



Nzame Primary School pupils look at how deep the borehole newly drilled borehole is. Photo credit: SADC-GMI.



DATA SHARING AND YOUNG PROFESSIONALS

WATERING PROFESSIONAL DEVELOPMENT

Young professionals from across SADC are being equipped with the skills and knowledge to make impactful contributions to transboundary water management in their respective Member States.

Boreholes made such an impression on one boy growing up in a small town in Limpopo, South Africa, that he went on to pursue a career as a Hydrogeologist.

Today Mr Lindelani Lalumbe, Hydrogeologist and young professional, is pursuing his doctorate degree in hydrogeology with a particular interest in groundwater: "I grew up in a village where there used to be hand pump boreholes, so I enrolled in hydrogeology for my honours at the University of the Free State."

SADC-GMI runs a Young Professionals Programme in which two candidates from each Member State are chosen to network and train with the brightest minds in groundwater. The Young Professional Programme is linked to a project SADC-GMI is implementing at a particular time.

Mr Lalumbe, who describes the programme as one that fills the gap between studying and working, has been part of the programme since 2018. The programme shares practical skills in data collection and capturing and participants get a deeper understanding of groundwater in the SADC region.

"I learned a lot of technical skills, also learning how other countries through the young professionals are tackling groundwater management," said Mr Lalumbe. "The idea of groundwater management is what this programme is about."

Mr Lalumbe explained that while a groundwater work environment would usually involve technicalities, the programme grooms young professionals to understand and develop the skills to manage groundwater resources - not only within their country but at a larger scale and across borders.

Mr Nelson Cornélio Malikito, Civil Engineer in the Ministry of Public Works, Housing and Water Resources, Mozambique sees the programme as a unique opportunity to grow his career.

Mr Malikito said his interest in groundwater peaked because of the complexities, challenges and opportunities countries are faced with regarding water resources.

"Groundwater is really a challenging area in water resource management and also I realised that in my country most rural areas depend on groundwater," said Mr Malikito.

"Particularly in Mozambique surface water is more available than groundwater but surface water often needs a lot of investment to put in houses but groundwater comes with an advantage. And all these benefits are what make me feel very interested in studying and learning about groundwater," he added.

These young professionals agree that one of the highlights of the programme has been the networking aspect. They rely on fellow programme participants when needing an overview of water resources in different Member States.

Ms Reginalda Joseph, Hydrogeologist at the Ministry of Agriculture Water and Land Reform Government of

Namibia, says because Namibia is one of the drier countries in SADC and is therefore heavily reliant on groundwater; "Working in an industry where you help change lives is really beautiful".

Ms Joseph says she is grateful to be a part of the programme and to gain knowledge beyond her studies and learn from experts in the field. "I'm also getting an idea of what I can do as a young professional especially in our monitoring strategy in my country [Namibia]. Monitoring is the main thing to making sure that we're taking care of our underground water, and managing it better. It [the programme] really gave me a lot of insight on what we need to put in our monitoring strategy to make sure that we manage our groundwater resources better."

The training emphasises the importance and practical skills of using different data tools to capture information. Platforms being used for data and research sharing is the SADC GIP Portal and the SADC-GMI Africa Grey Water Literature Archive where each country can upload data and anyone can access it. The programme also involves intensive training on how to use these platforms and criteria for data to ensure it is as accurate as possible.

In a region where not much data and research has been collected, stored and shared, this programme is ensuring that the future of groundwater will be advanced by these young professionals who will implement best practice throughout their careers.

This has presented a new way of looking at things. Mr Lalumbe said: "The experienced generation are not really open to the Fourth Industrial Revolution way of monitoring groundwater. Their way of monitoring and data collection is about physically going to the field every month."

Now, with the Young Professionals Programme, there is greater openness to using new technology to advance groundwater data collection, sharing and management.



The experienced generation are not really open to the Fourth Industrial Revolution way of monitoring groundwater. Their way of monitoring and data collection is about physically going to the field every month.

- Young Professional Mr Lindelani Lalumbe, Hydrogeologist



Mr Nelson Cornélio Malikito, Civil Engineer in the Ministry of Public Works, Housing and Water Resources in Mozambique. **Photo credit: SADC-GMI.**



Young professionals receive training in the field. **Photo credit: SADC-GMI.**



Young Professional Ms Reginalda Joseph, Hydrogeologist at the Ministry of Agriculture Water and Land Reform Government of Namibia. **Photo credit: Haimetu Media House in Namibia.**



Young Professional Mr Lindelani Lalumbe, Hydrogeologist, Department of Water and Sanitation in South Africa.



The programme offers young professionals hands on experience they can apply in their respective Member States. **Photo credit: SADC-GMI.**

LESSONS LEARNT

GROWING TO BE A CENTRE OF EXCELLENCE: THINKING BEYOND 2020

The World Bank's Sustainable Groundwater Management project is coming to an end, providing SADC-GMI a time to reflect and grow.



ver the last four years, the Southern African Development Community Groundwater Management Institute has sought to establish itself as the leading regional institution driving much-needed conversation and action for groundwater sustainability in the SADC region.

At the heart of SADC-GMI is promoting sustainable groundwater management and providing solutions to groundwater challenges across Member States.

The institute has been working to execute its mandate through funding by the Global Environment Facility and Cooperation in International Waters in Africa through the World Bank.

The World Bank-funded 'Sustainable Groundwater Management (SGM) in SADC Member States Project' kicked off at the inception of the institute in 2016 and it is nearing its end which is in December 2020.

SADC-GMI commissioned The Lessons Learned Programme (LLP) which "aims to prepare a background document on the emerging issues and lessons learned from implementation of the SGM Project, and secondly, develop a ten-year (split into two five-year periods) bankable project proposal document for the implementation of a new SADC groundwater programme from 2021 to 2031".

"Basically, in a nutshell, this project is for the future life of SADC-GMI. It's a future programme to help SADC-GMI become a 'Centre of Excellence'," said Ms Natasha Anamuthoo, a Senior Environmental Scientist at SRK Consulting.

The LLP project seeks to review SADC-GMI's governance, compliance and funding assessment, financial management assessment and cost-benefit analysis of SADC-GMI's geographic location.

While compiling the report for SADC-GMI, Ms Anamuthoo said a common issue that came out from SADC Member States was a lack of capacity in Member States.



When SADC-GMI formed in 2016, many Member States highlighted that improved access to hydrogeological maps was a priority.

"You must remember that Member States don't always have the capacity required or the knowledge," she said. A key technical recommendation that was highlighted in the LLP report is that capacity building of groundwater management for regional and national institutions is an important component to be incorporated in the new SADC groundwater programme.

Going forward, SADC-GMI should fill several capacity building and training gaps in its internal planning processes. This includes the development of appropriate training materials and tools, the development of a capacity building and training calendar, developing a capacity building implementation plan and monitoring and evaluating the progress of the plan.

The report highlighted that SADC-GMI has made positive contributions towards institutional strengthening and capacity building. This is through initiatives that involve young groundwater professionals internship programme, other training initiatives targeted to groundwater professionals in the region, and the participation of SADC-GMI in transboundary river organisations to ensure that groundwater is incorporated in River Basin Organizations activities.

"Water management governance frameworks and institutional arrangements are still largely under developed in SADC Member States. From a groundwater perspective there is still significant institutional development effort required at transboundary and national scales to secure sustainable [groundwater] development and management," the LLP report said.

However, from a data perspective, it added that river basin organisations and SADC-GMI are "well-positioned to lead and support transboundary data harmonisation".

The LLP report said policy limitations can inhibit Member States from fulfilling their groundwater mandate. Other challenges include limited funding, understaffed water ministries, water utilities and patchy and inconsistent groundwater data.

A recommendation in designing a new SADC-GMI programme included in the LLP report includes the continuation of data management and collection as it is an essential component to facilitate effective groundwater management.

Limited access to data and its subsequent management presents a gap for effective groundwater management. When SADC-GMI formed in 2016, many Member States highlighted that improved access to hydrogeological maps was a priority.

The formation of the SADC-GMI Groundwater Information Portal (SADC-GMI-GIP) helps fill the region's gap of accessing reliable groundwater data. The portal serves professionals, scientists and other stakeholders and provides data on information such as groundwater management, groundwater development and research of SADC Member States.

The SADC-GMI Grey Water Literature Archive (GLA) was developed and provides a range of resources less readily available such as groundwater reports, papers, manuals and hydrogeological maps on the SADC region. They are downloadable free of charge.

"It is evident that SADC-GMI has worked hard to fill the gap that was identified in data management and access to information for research, policy and decision-making at the SADC Member State level," said the LLP report, adding that SADC-GMI has to be well-equipped to keep up with data and information demands in the region.

"SADC-GMI, through the development of the [GIP] and [GLA] has established a central point for storing and linkages to groundwater data for the region. It is recommended that these initiatives are further expanded and improved upon to ensure that reliable data is captured and stored in the appropriate format," it said.

The SADC region has a variety of communities that each have their own needs regarding sustainable water solutions. Part of the current SGM World Bank funded project is made up of pilot projects running in Angola, Botswana, Eswatini, Lesotho, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe. Botswana and Malawi were the first to complete their projects in January/February 2020.

A number of key lessons were learned during the implementation of sub-grant projects in various SADC Member States, some lessons are generic while others are unique to certain Member States. One lesson learned was that SADC-GMI needs to capacitate Member States with project management skills in order to implement projects effectively and efficiently. This includes procurement issues which are also critical in the successful implementation of the projects.

However, it was also noted that sub-grant projects enabled capacity-building, research, infrastructure development and groundwater dialogue in Member States. Project planning and time management was another key lesson that stood out prominently during the implementation of the sub-grant projects. As we faced Covid 19 pandemic head on, it was evident that planning for the unforeseen circumstances/pandemics is critical in project planning. The COVID-19 pandemic largely impacted the pace at which the sub-grant projects were implemented and the completion time.

"We've hit some snags because of global issues, but when you're looking at some of the lessons learned during this process, I would definitely point out that sticking to timelines is vitally important as well as proper project management," said Mr Bertram Swartz, the Deputy Director of hydrogeology at Namibia's Ministry of Agriculture, Water and Land Reform.

The Regional Strategic Action Plan (RSAP) underpins the SADC-GMI's mandate of promoting sustainable groundwater management and providing solutions to groundwater challenges across the SADC region.

Lessons learnt from RSAP Phase IV (2016 to 2020) are that the SADC region is dynamic, as is the context in which water is managed and used.

"RSAP revisions respond to new regional circumstances and priorities whilst retaining core objectives," said the report. It added that themes that emerged from RSAP IV are water research, gender, climate variability and the relationship between water resources and human wellbeing. As SADC-GMI mandate is informed by the RSAP, it is imperative that SADC-GMI projects responds to RSAP.

Future SADC-GMI projects are dependent on securing funding. A key lesson gathered from the Financial Sustainability report is that: "financial sustainability is a priority for SADC-GMI, underpinning all future work. Grant funding remains the likely dominant source, but other income streams are potentially available".

The LLP report highlights that the value of groundwater is "well recognised" however, "mechanisms to finance and receive revenue from groundwater are often very weak, or even non-existent".

It adds that groundwater development is actually more cost effective than that of surface water. However, securing funds for groundwater development can be challenging because the nature of groundwater schemes is "discrete" and the scale of projects are largely small.

As the SADC-GMI moves into the next phase of the World Bank project, SADC Senior Programme Officer in the Water Division Dr Patrice Kabeya said he hopes SADC-GMI continues to grow.

"There is an appetite for groundwater issues in Africa and in the SADC region so that continuity is going to remain the way to reach a certain point where Member States become completely independent and SADC-GMI becomes a fully-established 'Centre of Excellence'," he said.



There is an appetite for groundwater issues in Africa and in the SADC region so that continuity is going to remain the way it is and to reach a certain point where member states become completely independent and SADC-GMI becomes a fully-established Centre of Excellence.

- Dr Patrice Kabeya, Senior Programme Officer, SADC Water Division



SADC-GMI Executive Director James Sauramba said SADC member states are provided a guiding framework for their various projects. Photo credit: SADC-GMI.



SADC-GMI's footprint spans across 16 Member States and works to improve groundwater management and sustainability in the region. Photo credit: SADC-GMI.



GOVERNANCE

A CENTRE FOR EXCELLENCE: SETTING THE PACE FOR WATER SYSTEMS MANAGEMENT

Five years of building a 'Centre of Excellence'.

Setting the pace in an area which is unexplored, undocumented and underground, has proven a difficult task, yet not impossible. And, the future looks promising.

"It's an exciting discussion we have going on," said Mr James Sauramba, Executive Director SADC-GMI.

"We also find ourselves in this area in groundwater in the SADC region where we've got 15 shared transboundary River Basin Organisations (RBOs), we also have 30 transboundary aquifers so these two water systems share the same challenges," said Mr Sauramba.

"If it is shared, it requires a governance mechanism that is consistent with the regional integration governance. So we find ourselves in this very exciting area where we are managing a resource that is invisible but that commands the same type of governance," he added.

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In a region of which 70% of its residents depend on groundwater, it is imperative for an overarching body to take the lead in coordinating safe, drinking, potable water for all of its citizens.

SADC-GMI has been working closely with five big River Basin Organization (RBOs) in SADC namely the Orange-Senqu River Commission (ORASECOM), Limpopo Watercourse Commission (LIMCOM), the Okavango River Basin Water Commission (OKACOM), Zambezi Watercourse Commission (ZAMCOM) and Cuvelai Watercourse Commission (CUVECOM) in implementing projects around river basins, with the next step to integrate aquifers into how these organisations manage water.

There have been many hurdles as there has never been specific tools to capture data, methodologies to follow or a shared platform where observations could be shared.

So SADC-GMI has needed to work from the ground up to establish the infrastructure needed and progress towards a shared goal.

For a small team with a big mandate, priority is given to building capacity. This means sharing skills, knowledge and tools with groundwater experts across the region: "To date we have provided more than five trainings and we have even covered all the way up to Lake Victoria and the Cisco in DRC and we also even collaborated with the Africa Groundwater Network to host a training in Senegal on the French-speaking River Basin organisation institutions and Member States to train them on Integration of groundwater into River Basin Organisations," said Mr Sauramba. This process is called 'nesting' in which transboundary aquifers are placed within the management of RBOs.

It has been a learning process: "With each experience we will learn a few more ways of doing things and we get better... It is still a long way to go so the idea is that we use the lessons learned out of this to inform the future, they are very different for example if you look at the Eastern Kalahari Karoo Transboundary Aquifer (EKK TBA) it's located in a very different region and its fitting into a River Basin Organisation is kind of quite complex," Mr Sauramba added.

In a region in which 70% of its inhabitants depend on groundwater, it is imperative for an overarching body to take the lead in coordinating safe, drinking, potable water for all of its citizens. To have a clearer understanding of what is happening in the region, understanding the life cycles, recharge methods, size and quantity is imperative in ensuring the longevity and sustainability of groundwater.

Drought and scarcity of rain has put a strain on water with many citizens realising and turning towards groundwater. But, as water systems are vulnerable to climate change, they are also vulnerable to pollution and water mismanagement.

Dr Patrice K. Kabeya, Senior Programme Officer - Water, Directorate of Infrastructure and Services (INS), said that communicating these projects to citizens had been challenging but they had received buy-in from all levels.

"In terms of groundwater volume in the region, if SADC-GMI does not continue then we will lose that information and that information is very critical in terms of assessing how we can attend to water security and assuring that people have access to water and we meet the Sustainable Development Goal six," said Dr Kabeya.

Looking ahead, said Dr Kabeya, SADC-GMI will complete its first tenure in December 2020. Thereafter they look forward to the next five years as SADC-GMI will continue to expand and ultimately ensure sustainable water for all citizens of SADC.



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