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SUSTAINABLE GROUNDWATER MANAGEMENT IN SADC MEMBER STATES PHASE 1 PROJECT

LESSONS LEARNED REPORT

SADC
SOUTHERN AFRICAN DEVELOPMENT COMMUNITY
TOWARDS A COMMON FUTURE

GROUNDWATER MANAGEMENT INSTITUTE

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Executive Summary

The Southern African Development Community Groundwater Management Institute (SADC – GMI) was established as a section 21 not-for-profit company registered under the South African Companies Act No. 71 of 2008, as amended, and it is a subsidiary structure of the SADC Secretariat. SADC-GMI's Vision as presented in its Strategic Business Plan (2018- 2023) is, "To be a Centre of Excellence in promoting equitable and sustainable groundwater management in the SADC region".

The role of the SADC-GMI is to:

- Promote sustainable groundwater management and provide solutions to groundwater challenges in the SADC region through building capacity, providing training, advancing research, supporting infrastructure development, and enabling dialogue and exchange of groundwater information.
- Conduct and support the SADC Member States in groundwater research, and serve as a focal interlocutor with national, regional, and international groundwater initiatives.

During the implementation of the Sustainable Groundwater Management in SADC Member States Project Phase1, funded by Global Environment Facility and the Cooperation in International Waters in Africa (CIWA), a sub-grant scheme was introduced. The main purpose of the sub-grant scheme was to provide support for infrastructure, improved groundwater utilization, management, and protection of groundwater. A total of up to $150 000 was allocated for each Member State's project. Through the sub-grant scheme 13 projects were implemented and completed in 10 SADC Member States.

Through the sub-grant scheme, Member States implemented a variety of impactful project. Water supply projects were implemented and these included rehabilitation of existing boreholes, drilling of new boreholes, installation of solar powered pumps, pipelines, and water tanks. For improved understanding and management of aquifers, installation of monitoring equipment, expansion of national groundwater monitoring network and updating of the hydrogeological map projects were carried out by some Member States. During the implementation stages of these projects, various challenges were experienced. Most of these projects experienced delays owing to lack of buy in from communities, government procurement processes, application of environmental impact assessment, water use licence application, awarding of contracts and Covid-19 pandemic. However, all projects implemented managed to achieve the objectives that were set up in the inception phase of each project. Despite the challenges immense successes were registered, Member States managed to develop community water supply and brought water closer to the people, expanded the monitoring network and improved the understanding of aquifers through installation of monitoring equipment and updating a hydrogeological map. Most of the beneficiaries of these projects were women and children.

Some of the key lessons learned from Member States that successfully implemented projects included, 1) community involvement is key to achieve successful project implementation 2) It is pertinent to have a competent, dedicated project manager implementing the project; 3) provision of contingency plans in cases of delays; 4) Training of community members in operation and maintenance of the solar systems is key to the sustainability of the projects since these technologies are new to them; 5) The use of country procurement systems coupled with direct payment to suppliers by the financiers was seen as a good practice. Lack of understanding of the Sub-grant manual and how it can be aligned with Member States procurement processes and change of governments (some countries conducted national elections during the project implementation) and this resulted in some Member States not starting projects in time.

ACKNOWLEDGEMENTS

This report is a combination of efforts and expertise from different individuals who worked tirelessly to ensure that the report is successfully completed.

This ranges from the entire SADC-GMI team to the Member States who were very instrumental in providing the content for the report.

As we complete this piece of work which I think will be very beneficial to our constituencies, I would like to acknowledge and extend a heartfelt thank you to the entire SADC-GMI team for their dedication towards completion of this work, Member States for their cooperation in supporting the development of the report by providing the needed information.

Last but certainly not least, a final thank you goes to **Mr Lindelani Lalumbe –** Young Professional seconded by the Department of Water and Sanitation, South Africa who helped greatly by synthesizing the content received into one coherent consumable document.

We trust this report will aid your understanding of the work completed and lessons learned during the implementation of the Sustainable Groundwater Management in SADC Member States Project Phase 1, more particularly sub-grant scheme projects.

Compiled for SADC-GMI by: SADC-GMI
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Approved by
James Sauramba

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1. INTRODUCTION

SADC-GMI received a grant from the World Bank to implement the five-year (2016 – 2021) regional project on Sustainable Groundwater Management in SADC Member States. The project aimed to mitigate the challenges of climate change, pollution, and rapidly growing water demand in Southern Africa through strengthening the management and development of groundwater for social and economic development at national, regional, and Transboundary levels. The budget available for each project was up to $150, 000 for each Member State. Through the sub-grant scheme, 10 Member States were able to implement their projects. Some Member States implemented more than 1 project as tabulated in Table 1. Botswana and Zimbabwe each implemented 3 projects.

This report aims to achieve the following:

- Summarize the main objectives of each report
- Highlight the strengths of approach to a specific project
- Highlight the weakness identified in the approach to specific project
- Highlight successes of each project
- Compile lessons learned from each project

Table 1: The number of completed projects by each Member State.

COUNTRY	NUMBER OF PROJECT IMPLEMENTED
BOTSWANA	3
ESWATINI	1
LESOTHO	1
MALAWI	1
MOZAMBIQUE	1
NAMIBIA	1
TANZANIA	1
ZAMBIA	1
ZIMBABWE	3

2. BOTSWANA

2.1 Rehabilitation of Pilot Projects to supply Water to Gobojango and Tsetsebjwe Villages.

2.1.1 Background

Pilot projects were implemented in Gobojango and Tsetsebjwe Villages between 2007 and 2011 as part of the Groundwater and Drought Management in SADC project funded by Global Environmental Facility (GEF), and the infrastructure was later abandoned. SADC-GMI conducted an assessment of the projects in 2018 and it was discovered that the projects were not operational, and rehabilitation of the infrastructures was recommended. In May 2019, the SADC Groundwater Management Institute (SADC-GMI), in collaboration with the Botswana Department of Water Affairs, appointed Kalahari Conservation Society (KCS) as sub-grantee to implement the "Rehabilitation of the Pilot Projects to Supply Water to Communities in Gobojango and Tsetsebjwe Villages by Exploring Alternative Water Sources". These projects were implemented between March 2019 and May 2021. Both Gobojango and Tsetsebjwe are located in the Bobirwa sub-district of the central district of Botswana.

2.1.2 Problem statement

In changing climatic conditions, most rural communities in arid to semi-arid regions rely on groundwater as the sole source of freshwater. In Gobojango and Tsetsebjwe Villages, pilot projects were implemented between 2007 and 2011 to mitigate the impact of drought in the SADC region through GEF funding. This infrastructure was abandoned, leaving the communities of Gobojango and Tsetsebjwe deprived of a reliable water supply. There was a need therefore to resuscitate the abandoned pilot projects in these villages to have sustainable water supply for the communities.

2.1.3 Development objectives

The project intended to provide functioning and sustainable water supply for horticultural purposes in Gobojango and Tsetsebjwe Villages. The project's aim was to rehabilitate abandoned pilot projects that were implemented between 2007 and 2011.

2.1.4 Project Description

The project intended to provide functioning and sustainable water for horticultural purposes in Gobojango and Tsetsebjwe Villages. This project's aim was to rehabilitate abandoned pilot projects that were implemented between 2007 and 2011.

2.1.5 Project Beneficiaries

Gobojango and Tsetsebjwe Villages were identified as the main beneficiaries of the rehabilitated, functioning, and sustainable groundwater supply system. In Gobojango, 2246 people benefited from the project, while 4848 people benefited in Tsetsebjwe. The project resulted in improved livelihoods as community members are now able to access potable water for subsistence farming and ensure food security through community gardens that were rehabilitated.

2.1.6 Activities directly related to the Project (Gobojango)

The following activities and milestones were performed and achieved in Gobojango Village:

- An existing Council borehole was rehabilitated
- Inspection & pump testing of borehole was carried out
- A borehole with solar pump system was equipped
- The gardening plot was fenced
- Reticulation of water, erection of elevated water tanks and installation of irrigation system was completed.
- Capacity building of project beneficiaries in horticulture was conducted.

2.1.7 Activities directly related to the Project (Tsetsebjwe)

The following activities and milestones were performed and achieved in Tsetsebjwe Village:Surveying of a new borehole.Drilling and testing of a new borehole.Equipping the borehole with solar pump system.Repairing the gardening plot fence.Reticulating water, construction of elevated water tanks and installation of and irrigation system was completed.Capacity building of project beneficiaries in horticulture.Undertake Environmental and Social Safeguards – Environmental Management Planning (ESSG –EMP).

2.1.8 Lessons Learned from Project Implementation

Lessons learned from the Gobojango and Tsetsebjwe projects are discussed below based on four categories.

Community Empowerment and Livelihoods

- The consultation processes took extensive time due to lack of buy-in by beneficiaries, poor Project coordination and buy-in by the village leadership, resulted in further delay in the implementation of the planned activities.
- Community participation was seen as a necessity for project implementation and success.
- Project beneficiaries were capacitated in horticulture.
- Issuing of the environmental impact assessment (EIA) by the Department of Environmental Affairs was also delayed.

Community Empowerment and Livelihoods

This project experienced delays in obtaining various environmental related licences, obtaining water rights for existing boreholes, permission to drill new boreholes and plots permits proved to be a challenge during the implementation.

Issuing of the environmental impact assessment (EIA) by the Department of Environmental Affairs was also delayed.

Implementation Arrangements

Awarding of a contract to a service provider was delayed due to change of scope, mainly with the drilling of borehole activity, and undertaking environmental and social safeguards activity.

- Postponement of project implementation activities due to government measures to curb the spread of COVID-19 (State of Emergency as of 1st April 2020 for 6 months then extension), resulting in movement restrictions, prohibiting public gatherings and limitations of number of people attending meetings further delayed the implementation of the project.
- Role clarity and responsibilities of the project focal points in supporting the project implementation.

Lack of proper planning by the sub-grantee from the onset affected the timelines and budget of the

- Project (holidays and national elections period were not considered during planning).
- The need to develop a contingency plan in case the project encounters challenges and incur extra costs to cover some of the activities.
- The implementing partner should have a dedicated project manager for the duration of the project to create consistency.

Payments to Contractors and Service Providers

- Changes in prices and availability of the service provider affected the budget and delayed the implantation of the project.

2.2 Integration of Groundwater Resource Data Management System

2.2.1Background

The objective of the project was the integration of the National Geoscience Information system (NIGIS) database model with the HydroGeo Analyst (HGA), load all the data from NIGIS (Water modules) into HGA and develop a web-based application to access the HGA customized solution. The integrated Groundwater Resource Data Management System has the capacity to deliver centralised and secure access to boreholes completion report, groundwater production and monitoring data (levels, quality and quantity) over the internet.

2.2.2 Problem statement

Information on water monitoring sites and data in Botswana was stored in different systems. This proved to be a challenge in terms of integrated data analysis. There was a need to centralise data to one information system.

2.2.3 Development Objectives

The project provided the Department of Water Affairs with a reliable system to effectively and efficiently manage groundwater resources and be able to provide timely required data for water resources planning in the country.

2.2.4 Project Description

This project developed a web-based groundwater data management system in Botswana. This project intended to integrate two systems, the National Geoscience Information system with HydroGeo Analyst to improve groundwater resource management. The project delivered the following:

- A secure and reliable system that will allow data exchange with key organizations.
- Cost savings through improved workflows and data management.
- Holistic oversight management of the nation's water resources in an efficient and effective way using the HydroGeo Analyst.

2.2.5 Project Description

The Department of Water Affairs in Botswana was the direct beneficiary for this project.

2.2.6 Activities directly related to the Project

The following activities were performed during the integration of groundwater resource data management system:

- Development of an integrated Groundwater Resource Data Management System using GeoHydro Analyst system software available at the Department of Water Affairs – Botswana.
- Integration of available database management systems to have one web system accessible to the Department of Water Affairs employees and other stakeholders.

2.2.7 Lessons Learned from Project Implementation

It was learned that specialised services to develop a web-based groundwater data management system can be provided by competent contractors efficiently within record time.

3. ESWATINI

3.1 Groundwater Monitoring and Installation of Solar Powered Pumps

3.1.1 Background

The Department of Water Affairs through the Ministry of Natural Resources and Energy is mandated by the provisions of the Water Act of 2003 to ensure equitable access to clean and safe water by all citizens and sustainable availability of water resources for the present and future generations. The Kingdom of Eswatini implemented a pilot project on groundwater monitoring and renewable energy application on ten (10) and four (4) selected sites, respectively.

The sites were distributed over four River Basins: The Lomati, Nkomati, Mbuluzi and Lusutfu. Each site is unique in its hydrogeological, social, and environmental setting. These are aquifers with different stress levels exerted by various elements. The implementation stage introduced an additional site because of water quality challenges on one production sites requiring redirection of resources to another institution.

This resulted in the project having 7 monitoring stations and 4 production sites. The project expensed 100% of the funds (USD 127 656.26) disbursed to WaterAid Eswatini as of November 2020 at the end of project and delivered the intended objectives of the project.

3.1.2 Problem statement

Groundwater has gained gradual recognition over surface water in recent years as more perennial rivers run dry due to emerging negative impacts of Climate Change and population growth. The demand for groundwater as a commodity for domestic use is sharply on the rise as a result more than 75% of the rural population inEswatini is dependent on groundwater. This has since attracted private drilling contractors to do business in the country on random borehole drilling for groundwater supply.

The exploitation of the resource without stringent monitoring controls exposes groundwater to risks such as over abstraction and pollution. Therefore, the importance of integrated monitoring and management of groundwater and surface water resources can no longer be overemphasized in this era of Climate Change.

3.1.3 Development objrectives

The followings were the development objectives of the project:

- Installation of a groundwater monitoring network on ten (10) selected sites.
- Installation and promotion of renewable energy application on groundwater abstraction on four (4) sites.

3.1.4 Project Description

This project was about the installation of groundwater monitoring network in 10 selected sites around the Kingdom of Eswatini. The installation of the groundwater monitoring network has facilitated the process of generating scientific evidence on the performance of the groundwater resources for the selected 10 sites under pilot. This creates real time data on the groundwater resources quality and quantity to inform the strategic decision to be taken by the Department of Water Affairs in managing, preserving, and conserving the groundwater resource. In contribution to increased access to clean water, solar powered systems were constructed, which were also connected to the groundwater monitoring stations to correlate the relationship between renewable energy and aquifer recharge performance. This is aimed at generating evidence on the performance of groundwater when pumped with solar compared to electricity. It was hoped that this would provide evidence on the appropriate recommendations to be made on the best choice pumping option the country should plan and advocate for in future.

3.1.5 Project beneficiaries

This project benefitted communities from selected sites, including women and children through installation of solar powered pumps. The Department of Water Affairs is also a beneficiary through an improved understanding of groundwater resources.

3.1.6 Activities directly related to the Project

The following activities were carried out and completed during the implementation of the groundwater monitoring and installation of solar powered pumps project:

- Designing of ground water monitoring stations.
- Drilling of 4 boreholes.
- Rehabilitation of 7 boreholes.
- Installation of groundwater stations.
- Commission of monitoring and pumping sites.
- Installation of solar powered pumps.
- Training on database management.
- Community trainings on groundwater resource management.
- Social and environmental impact assessment feasibility study.

2.1.7 Lessons Learned from Project Implementation

Lessons learned from groundwater monitoring and installation of solar powered pumps are discussed below based on four categories.

Community Empowerment and Livelihoods

- Knowledge and skills enhancement on project proposal development, social and environmental scoping skills, project progress reporting and interaction with stakeholders needs to be improved going forward.

Implementation Arrangements

- It is very critical to outsource works to competent artisans or firms while being mindful of the cost.
- Adoption of virtual communication and information technology tools in all project's execution programs.
- First-hand learning experience on handling of external funds including communication protocols.

Payments to Contractors and Service Providers

- Exorbitant foreign exchange fluctuation during and post Covid-19 era first wave.
- Lack of contingency budget to cater for unanticipated eventualities.
- Appropriate budgeting (realistic rates) informed by current market prices and comprehensive itemization of project elements is crucial for any project undertaking.

4. LESOTHO

4.1 Expansion of the national groundwater monitoring network

4.1.1 Background

The project was about the Expansion and Re-design of the National Groundwater Monitoring Network. The projects managed to design a Nationwide Groundwater Monitoring Network and drilled 20 monitoring boreholes spread across the country. The Ministry of Water through the Department of Water Affairs implemented the project. The project had the duration of 8 months from June 2019 to February 2020.However due to the lengthy procurement procedures, Covid-19 restrictions, and heavy rains it was delayed and was completed by 31 March 2021.

4.1.2 Problem statement

Prior to the project, the monitoring network maintained by the Department of Water Affairs was limited and had been shrinking due to some of them being captured for water supply as the result it was not able to provide a full picture of the state of groundwater resources in the entire country.

4.1.3 Development objectives

The followings were the development objectives of the project:

- The objective of the project was to expand the existing groundwater monitoring network to form a comprehensive nationwide network for the support and guidance of groundwater management activities in Lesotho.
- The project was therefore designed to improve the availability and reliability of groundwater data required for appropriate management of groundwater resources and development planning in the country.

4.1.4 Project description

The project was about expanding the national groundwater monitoring network. The existing national groundwater monitoring network was deemed not sufficient in terms of spatial distribution and data availability. This project intended to expand and improve the national groundwater monitoring network that would be comprehensive and support groundwater management in Lesotho.

4.1.5 Project beneficiaries

The Department of Water Affairs - Lesotho is the direct beneficiary of this project. Stakeholders such as the Ministry of Agriculture and Food security, Ministry of Forestry, Range, Soil Conservation, farmers, research institutes and developers are also benefitting from the expanded national groundwater monitoring network.

4.1.6 Activities directly related to the Project

The following activities were carried out and completed during the implementation of the expansion of the national groundwater monitoring network project:

- Desktop study on the existing groundwater monitoring network.
- Geophysical investigations and siting drilling points in target areas identified during the desktop study.
- Drilling of 20 additional monitoring boreholes.
- Procurement of software for monitoring data analysis and laptops.
- Calibration and installation of data loggers in selected boreholes.
- Training of Department of Water Affairs personnel.
- Initial monitoring.

Women harvesting Covo from the rehabilitated garden in Whunga, Zimbabwe. The community is now able to use fresh produce to feed their families and generate income from the surplus. Photo Credit: SADC-GMI

4.1.7 Lessons Learned from Project Implementation

Lessons learned from the expansion of the national groundwater monitoring network project are discussed below based on four categories.

Community Empowerment and Livelihoods

- Lack of cooperation and communication within the project team can ruin the intended purpose of the project.
- The project activities must be well strategized according to the objective proposed to avoid unnecessary mistakes. Design of the project must recognize the resources available to the project team.
- Due to lack or limited fresh water supply to some communities, it became difficult to secure political buy-in either from a central or local government as the project did not address the current needs of the local communities which is water supply.

Environmental and Social Considerations

- Environmental and Social Safeguard Assessment in a project is important no matter the scale project.

Implementation Arrangements

- Proposed deadlines should be respected.
- Lack of capacitation in terms of project management can destroy the project purpose.
- Due diligence should be done to avoid having contractor who does not understand the assignment properly even though they demonstrated capability.
- Procurement can be outsourced to SADC-GMI if the subgrantee is unable to fulfill that role.

Payments to Contractors and Service Providers

- The project was implemented by the Department of Water Affairs with some services outsourced to try and mitigate potential delays in the implementation should the activities be done internally.
- The project's procurement regulations should allow for use of local regulations or SADC GMI's regulations to avoid lengthy processes which might have an impact on the overall project progress.

5. MALAWI

5.1 A Pilot project of water supply, exploring a deeper groundwater source was implemented in Chimbiya Trading Centre.

5.1.1 Background

The proposal for a pilot project to supply water to Chimbiya Trading Centre by exploring a deeper groundwater source, originated from responding to a call for proposal expressed bySADC-GMI to the Malawi focal group under the Ministry of Agriculture Irrigation and Water Development (MoAIWD). The purpose of the project was to highlight a strategic response to address the identified need through sustainable abstraction of groundwater, treatment, and distribution to the community with the aim of reducing water related morbidities and mortalities thereby improving socio-economic livelihoods of the people of Chimbiya. The project has served 15,300 people from 15 villages including a primary school. The total budget of $170,000 was disbursed in two phases. The first contract agreement of $149,000 was implemented from August 2018 to April 2019. The project was later extended with an addendum agreement budget of $21,000 to run from September 2019 to February 2020.

Dr Yanira Ntupanyama Chief Director Ministry of Agriculture, Irrigation and Water Development, Malawi is Cutting the ribbon during the commissioning of the project to the community. Photo Credits: SADC-GMI

5.1.2 Problem statement

In changing climatic conditions, most rural communities in arid to semi-arid regions are relying on groundwater as the sole source of freshwater. In Chimbiya area with over 15000 people, a pilot project exploring a deeper source of groundwater supply was implemented to solve the issue of access to freshwater.

5.1.3 Development objectives

The following were the development objectives of the project:

- The development objective of Chimbiya Groundwater Project was systematic and sustainable utilization, protection, and management of ground water resource for the benefit of the people.
- The project also aimed at understanding deeper wells and hydro-geological analyses of the groundwater of the area for recommendation of appropriate abstraction models for human use and consumption thereby complimenting the Government of Malawi's agenda of providing safe potable water to the citizens.

5.1.4 Project Description

This project was about exploring a deeper aquifer as a source of groundwater supply to the Chimbiya Trading Centre. This project entailed assessment, designing, water source development, community mobilization, construction of structures, system installation, safe water committee training, WASH promotion, commissioning, followup & support and administrative monitoring.

5.1.5 Project Description

The project has served 15,300 people from 15 villages including the primary school, women, and children.

5.1.6 Activities directly related to the Project

The following activities were carried out and completed during the implementation of the Chimbiya project:

- Development of a deeper aquifer (100m well with 2.0L/S).
- Installation of water pump, solar power, storage tanks and distribution networks (10 taps).
- Initially installed two 11 SQF-2 pumps and later replaced with Renewable Solar Inverter (RSI) 3-phase pump for optimum use of the Borehole.
- Installation of a borehole water monitoring probe to facilitate controlled water abstraction and borehole data monitoring.
- Installation of a borehole water monitoring probe to facilitate controlled water abstraction and borehole data monitoring.
- Substitution of the initial 16-250W with 24-355W panels to increase power to run the new pump.
- Capacity building through water point management committee training, district, and community mobilizations.
- Health hygiene & sanitation education and promotion to increase knowledge and practice.

5.1.7 Lessons Learned from Project Implementation

Lessons learned from the Chimbiya pilot project are discussed below based on four categories.

Community Empowerment and Livelihoods

- Slow participation of the community members prolonged the installation period which had a negative impact on the budget.
- Community empowerment through operation and maintenance training is key to the sustainability of the project.
- Gender equity and social inclusion main streaming encourages the participation of women, youth, and the elderly in groundwater projects, and this has positive outcomes.

The Chimbiya Trading Centre community is tasting fresh water from one of the communal taps during the commissioning of the project. Photo Credit: SADC-GMI

Environmental and Social Considerations

- Compliance to Environmental and social standards is possible using the Environmental and Social Management Framework
- Mitigating possible environmental risks is possible through use of alternative energy sources for groundwater abstraction such as solar powered pumps instead of diesel.

Implementation Arrangements

- Despite government being the prime partner mandated to contribute towards implementation, there is need to include budget lines to enable them to participate & support the project fully.
- It is important to provide for contingency plans and timing for water source development in perspective of the time taken to pursue this activity with formidable difficulties.
- Deep wells are advantageous to supplying adequate water in dry/problematicareas.

Payments to Contractors and Service Providers

- Direct payment not convenient to all suppliers /stakeholders.
- Variations between invoiced amount and received amounts due to the exchange rates caused problems.

6. MOZAMBIQUE

6.1 Mucholote Water Supply Project

6.1.1 Background

The Southern African Development Community Groundwater Management Institute (SADC-GMI) and the Government of Mozambique signed a Sub-Grant agreement on 16 May 2019 for the implementation of the Muchocolote Water Supply Project in Matutuine District, Maputo Province. The project implementation started officially on 01 June 2019, and it was initially planned to be completed by 31 December 2019. Due to the unforeseen events including delays caused by the Covid-19 pandemic, the project closing date was extended to 30 June 2020. The project sought to install a submersible pump powered by a solar panel, two elevated water tanks with a capacity of 10,000 litres each, distribution network and water troughs for livestock. The cost of implementation of the project amounted to $149 524.84.

6.1.2 Problem statement

The community of Muchocolote used hand pumps to abstract groundwater from boreholes for many years. Using hand pumps to abstract groundwater for a community water supply scheme presented challenges of a social and technical nature. Therefore, a need to invest in new technology and install a submersible solar powered pump to reticulate water closerto the households in the Muchocolate village was identified.

6.1.3 Development objectives

The objective of the project was to install a solar powered groundwater supply system and water reticulation network for 2000 people in the village of Muchocolote in the PA of Catembe Simbe in the Matutuine district of Maputo Province.

6.1.4 Project Description

The project intended to replace a hand pump with a solar powered submersible pump from one borehole at Muchocolote Village. Muchocolote Village already had an existing borehole with a yield of 4 m3/hour. This project included the design of the groundwater supply scheme for a life span of 20 years utilising a solar powered submersible pump to function in all weather conditions. The groundwater supply has a capacity to supply 20 L/person/day.

6.1.5 Project Benificiaries

About 600 people from the Muchocolote Village directly benefited from the project.

improved water borne sanitation in Mochocolate

6.1.6 Activities directly related to the Project

The following activities were completed:

- Hand Pump with submersible pump was installed
- A 12-meter-high tower and two 10 000 litre water tanks on top of the tower were installed.
- Solar panels to use as an energy source for the water pump were installed.
- Water from the tanks is distributed to three different villages through a 6km water reticulation network
- Four taps were installed in each village (4 villages) to reduce the distance locals had to travel to access water.
- Operator cabin was constructed.

6.1.7 Lessons Learned from Project Implementation

Lessons learned from the Muchocolote Village project are discussed below based on four categories.

Community Empowerment and Livelihoods

The high level of community involvement was the key success factor for the implementation and basis for the sustainability of the project. Muchocolote is a remote village, but now has become attractive to more people as the result of the project implementation. According to the records of the local authorities, the number of new requests for land in Muchocolote has increased since the completion of the project and it is expected that the population will increase from the actual 600 to 2000 people within the near future. As a lesson learned, similar projects can contribute towards village development in many aspects including socio-economic development.

Environmental and Social Inclusion

The project was authorized by the local authorities as category B, without any potential damage to the environment. The most significant environmental impacts were identified and monitored during the implementation but not limited to the following: installation of solar powered pumps at production borehole without affecting the groundwater potential and destruction of vegetation to develop reticulation networks. In the future, similar projects in Mozambique will continue following the same approach to guarantee environmental sustainability.

Implementation Arrangements

As a lesson learned for the future, the stakeholders shall be made aware that it takes time to start-up a project, conduct procurement, and to comply with environmental requirements which required more time. It is also good practice to engage a competent contractor to implement the project.

Payments to Contractors and Service Providers

No information was provided on the lesson learned through payments to contractors and service providers.

Seen above are some of the infrastructures installed in Mozambique for the water supply project implemented in the Muchocolate village, where approximately 2000 inhabitants benefited from the project. Photo Credit: SADC-GMI

7. NAMIBIA

7.1 Review and update of the Hydrogeological map of Namibia

7.1.1 Background

The Directorate of Water Resources Management (DWRM) and the Geohydrology Division of the Ministry of Agriculture, Water and Forestry (MAWF and now the Ministry of Agriculture, Water and Land Reform (MAWLR)) commenced a review and upgrade of the National Hydrogeological Map of Namibia (2001) in December 2019 to better manage groundwater resources, which are affected by naturally occurring cycles of drought, increasing population and rising water supply demand from industrial and agricultural sectors. The impact of climate change has resulted in the pronounced fluctuation of the groundwater potential for not only the major aquifer systems but throughout the country. The Geohydrology Division of DWRM has the mandate and is responsible for monitoring and governing/ regulating groundwater resources in the country, guided by legislation in particular the Water Resources Management Act-Act No 11 of 2013.

The existing Hydrogeological Map of Namibia including an explanatory booklet “Groundwater in Namibia” was developed through an in-depth mapping project coordinated by the then Ministry of Agriculture, Water and Rural Development (now MAWLR) in 2001 when the first edition of “The Map” was produced. Since the development of “The Map”, there was an attempt to revise it in 2011 but no significant changes were made.

7.1.2 Problem statement

During this interim period, there have been many developments within the geohydrological sector in Namibia. These developments include amongst others the discovery and delineation of the transboundary aquifer of the Kalahari Ohangwena II (KOH II) aquifer and the quantification and improved understanding through studies of certain strategically important groundwater systems in other locations in the country. In addition, changes to the policies and legislation also need to be considered and mapped as part of the “Integrated Water Resources Management” approach.

7.1.3 Development objectives

The followings were the development objectives of the project:

- The main objective of the proposed project was to review and update the Hydrogeological Map of Namibia “The Map” and to integrate/merge the map withthe National groundwater database (GROWAS 2).

7.1.4 Project description

This project involved the reviewing and updating of the existing Hydrogeological Map of Namibia for improved management of the groundwater resource. The current map doesn’t consider the latest delineation of Ohangwena II (KOH II) transboundary aquifer of Kalahari and the quantification and improved understanding through studies of certain strategically important groundwater systems in other locations inthe country.

7.1.5 Project beneficiaries

The Ministry of Agriculture, Water and Land Reform as well as related stakeholders are the beneficiaries of this project of reviewing and updating the Hydrogeological Map of Namibia.

7.1.6 Activities directly related to the Project

The following activities were carried out and completed during the implementation of the review and updating of Hydro-geological map of Namibia project:

- Desk Study to review the current map.
- Compilation and updating of old information.
- Stakeholders' consultation.
- Updating the Map.
- Printing of a new updated map and booklet

7.1.7 Lessons Learned from Project Implementation

Lessons learned from the review and updating of Hydrogeological Map of Namibia project are discussed below based on four categories.

Community Empowerment and Livelihoods

It was learned that the project will eventually benefit local communities because the Hydrogeological Map is a valuable source of data for enhanced Groundwater Management in Namibia

Environmental and Social Considerations

No environmental and social inclusion was conducted.

Implementation Arrangements

- The workflow of data storage, evaluation and dissemination must be improved.
- The maintenance of databases and the information system must be improved so that data can be incorporated and distributed on demand.

Payments to Contractors and Service Providers

- Even with extension of project due to Covid-19, no issues were experienced with payments to contractors.

Above are the Solar Panels installed as part of the Groundwater Management in the Kimbiji Aquifer Systems project, in Tanzania. Photo Credit: SADC-GMI

8. TANZANIA

8.1 Groundwater Management in the Kimbiji Aquifer System

8.1.1 Background

Tanzania implemented a project on groundwater management in the Kimbiji Aquifer System located in the coastal region to the south of Dar es Salaam. In previous studies conducted in 2005 and 2007, the Kimbiji Aquifer System was identified as an alternative source of water supply for Dar es Salaam. The project total budget was $165,000 in which $150,000 was from SADC GMI sub grant and $15,000 from Wami Ruvu Basin Water Board own sources of funding. The Water Board's contribution covered costs for project monitoring and supervision including holding meetings, conducting tendering processes to acquire service providers.

8.1.2 Problem statement

The population of the city of Dar es Salaam in Tanzania is projected to grow from 6 million at present to more than 10 million by the year 2030 (World urbanization prospects, 2014). Until recently, most water for the city has been drawn from the Ruvu River, the single most important source of water for the city, involving significant operational costs. Prolonged droughts and deforestation have adversely affected the runoff characteristics within the river basin, and the search for more reliable water sources has been underway since 2004.

The project 'Development of New Water Sources for Dar es Salaam' was formulated to assess alternative sources, including groundwater resources in and around Dar es Salaam. It was through this project that the existence of the Kimbiji Aquifer System (KAS) as a potential new source of water was first described by Norconsult Ltd. (2005; 2007). Based on initial exploration activity, the KAS was further contextualized by Ruden (2007). The work by Norconsult was used as the basis for a strategic plan and design for water supply in DSM. This included design and related calculations for up to 30 production wells spread in two well fields referred to as the "Kimbiji" and "Mpera" wellfields. At present, more than 1,800 shallow (mostly private) wells are used to augment local water supplies in Dar es - Salaam.

The majority of these are less than 100m deep, with greatly varying capacities and water qualities (JICA, 2005). These wells produce water from shallow Neogene and Holocene formations (Bartholomew, 1963), mainly comprising sands and limestones. Before the development of the KAS, in depth Kimbijji Aquifer Assessment (KAA) was carried out aiming at examining technical questions about the nature and scale of the KAS as a potential new source of water for the city of Dar es Salaam and surrounding areas.

The KAA project is a groundwater resources study that aimed at undertaking indepth integrated qualitative and quantitative analysis of the Kimbiji Aquifer System (KAS) to define its sustainable development and management. A plan for development, monitoring and management was prepared which sought to maximize and optimize abstractions whilst limiting the potential risks of environmental impact.

The Aquifer Development Plan (ADP) and Strategic Environmental Assessment (SEA) were the main deliverables from the KAA project. As such, the ADP and SEA were separate but linked documents, and the SEA was carried out in context of the ADP.

To ensure a sustainable management of the KAS, an aquifer monitoring and management (AMM) unit under WRBWB was required to monitor and manage the well field operations. The AMM unit was responsible for conducting monitoring and reviewing field data in relation to the aquifer system's response to large-scale pumping and potential hydraulic impacts on existing well owners, stream flows and wetland habitats in the project area. The purpose of the AMM unit was to collect and manage data, review environmental and operational conditions, disseminate information, and inform decision-makers of results, trends, and patterns. Baseline monitoring had to immediately undertaken, involving ground-water level measurements, sampling of wells for laboratory analyses, and stream flow measurements. Therefore, this project intended to utilize allocated sub grant funds from SADC-GMI to implement some recommendations from the SEA to support the AMM unit.

8.1.3 Development objectives

The followings were the development objectives of the project:

- Development of groundwater monitoring infrastructures in the Kimbiji Aquifer System.
- To conduct ground and surface water monitoring and review field data in relation to the aquifer system's response to large-scale pumping and potential hydraulic impacts on existing well owners, stream flows and wetland habitats in the project area.

8.1.4 Project Description

The environmental monitoring plan for the ADP is relevant to the SEA, as it documents the data that is needed to identify, quantify and track the impacts predicted in the SEA. The recommended baseline monitoring of natural hydrogeological conditions in the KAS sought to address Groundwater levels, Groundwater abstractions, Groundwater quality; and Groundwater-surface water interaction in and around the project area.

The project was earmarked to support drilling of five (5) wells for monitoring of water levels in the recommended area spread out across the predicted drawdown areas between the two wells fields to supplement existing observation wells, OBS-1 near PW1 and OBS-3 near PW4, as well as private/public supply wells.

The project was also intended to support the establishment of a groundwater abstractions register and data base for the project area that indicates industrial and commercial uses for proper monitoring of groundwater abstraction. The register would be regularly updated and maintained to allow licensing and regulatory body; Wami Ruvu Basin water Board (WRWBO) to track groundwater usage and potential operations that could interfere with the planned wellfield operations. The register would include a detailed survey of water users in and around the predicted impact areas, by user type and source of water (wells, wetlands, streams, and springs).

To establish surface and groundwater interaction within the project area, a comprehensive wetland monitoring was required through a Wetland mapping program to: a) delineate wetland pockets in the Nguva and Mbezi River catchments; b) describe their ecological characteristics; and c) describe their socio-economic value for local communities.

8.1.5 Project beneficiaries

The beneficiaries of this project included all stakeholders within and surrounding the Kimbiji Aquifer System such as follows:

- Ministry of Water and Irrigation (Dar es Salaam Water and Sewerage Authority and Wami Ruvu Basin Water Board).
- Ministry of Natural Resources and Tourism; Ministry of Regional Administration and Local Government (Dar es Salaam CC, Temeke MC, Ilala MC, KinondoniMC, Kigamboni MC and Mkuranga DC).
- National Environment Management Council; University of DSM.
- Wildlife Conservation Society– Tanzania.
- The communities living in the project area (4 689 060 people, in which 2 284 441 are male and 2 404 619 are female).

8.1.6 Activities directly related to the Project

The following activities were carried out and completed during the implementation of the project.

- A geophysical survey was carried out for the purpose of siting 5 boreholes.
- Installation of borehole loggers carried out
- Terms of Reference for the Consultancy services to conduct wetland mapping was prepared.
- Project brief was submitted to NEMC (National Environmental Management Council) for approval.
- An ESMP report was produced.
- Five (5) observation monitoring wells were drilled, and monitoring instruments were installed.
- Groundwater abstraction (industrial and commercial) register was established.
- Mapping and characterization of wetland pockets and riverine wetlands that are present within and in proximity of 2 km of the predicted impact areas.

8.1.7 Lessons Learned from Project Implementation

Lessons learned from groundwater management projects in the Kimbiji Aquifer Systems are discussed below based on four categories.

Community Empowerment and Livelihoods

The project did not provide direct groundwater supply to the communities in the project areas. However, the installed project components enhanced the enabling environment for the sustainable use and protection of groundwater resources to the benefit of the communities utilizing the resource.

Environmental and Social Inclusion

An Environmental and Social Management Plan (ESMP) was developed by a consultant hired by the sub-Grantee, Ministry of Water and Irrigation to accommodate both the country and World Bank provisions. The development and approval of the ESMP by SADC-GMI's framework consultant for Environmental and Social Safeguards (SRK Consultants) was a prerequisite for physical infrastructure works (namely drilling) to commence.

- The identification of the project sites was delayed by the lengthy procurement process of the consultant to undertake the geophysical surveys
- There was some confusion at the beginning whether an ESMP would be required since there was already a SEA for the bigger project. However, clarification was later given that the ESMP was necessary to specifically cover the project sites, however, the ESMP was successfully implemented in compliance with all the in-country and World Bank requirements.

Implementation Arrangements

The sub-Grant Agreement was signed between SADC-GMI and the Ministry of Water and Irrigation and implemented through the Wami/Ruvu Basin Water Board. The project was implemented through the Wami/Ruvu Basin Water Board in Morogoro because project sites fell under the Water Board. Moreover, this was also intended to circumvent the lengthy government processes in the implementation.

However, because the Water Board is under the Ministry of Water and Irrigation, the lengthy government processes still had to be applied especially for procurement of works, goods and services. The lengthy procurement process presented a challenge in terms of complying with time frames and deadlines for the project.

The proximity of the Water Board to the Ministry of water and irrigation helped the National Focal Point to work very well in operationalizing a relatively seamless linkage with the SADC-GMI. This also resulted in smoother implementation of project activities. The leadership offered by the National Focal Point was predominantly exemplary.

Payments to Contractors and Service Providers

For this project, all payments were made directly to the respective contractors and service providers after completing the prior-agreed milestones. All payments were certified by the Water Board and the Ministry before they were forwarded to SADC-GMI for payment. Besides the delays experienced registering the sub- Grant amount with the South African Reserve Bank (SARB) to facilitate payment of foreign currency to the payees, all the payments went smoothly.

At no point did the sub-Grantee invoice the SADC-GMI directly for professional and other services provided to the project. Although not quantified, these inputs are credited to their in-kind contribution, which, according to the sub-Grant Manual, should be up to 10% of the grant.

9. ZAMBIA

9.1 Groundwater Mapping and Development in the Chongwe District

9.1.1 Background

Over the years, Chongwe Township has been expanding at a steady rate. This has resulted in the need to meet the increasing demand for various socio-economic needs for the growing population. One of the challenges faced by the township was the gap between water demand and the available sources of water.

In recent years, the town has experienced recurrent water shortages due to the low water levels in the Chongwe River considering climate change and variability. Furthermore, the weir (source of water supply to Chongwe Township) has been drying up more frequently and for longer periods.

To mitigate this situation, individual residents in residential areas and small holdings have drilled private boreholes to meet the demand for domestic water supply and animal watering. In addition, the government and various non-governmental organizations have supported and facilitated studies to find alternative and sustainable sources of water for the township and surrounding areas.

Analysis of the information derived from the boreholes indicated that the aquifers have not been fully penetrated to enable the derivation of information that would lead to the establishment of aquifer depths, dimensions, and correct hydraulic parameters. The actual disbursement of funds under the project was at $180,055.4 representing 92.8 % of the revised budget of $ 194, 077

9.1.2 Problem statement

In view of the recurrent water shortages experienced in Chongwe and other places, there was an urgent need to develop and explore the groundwater resources of the Chongwe area to supplement the diminishing surface water sources. This aquifer mapping needed to be initiated in order to identify aquifers in the area and produce large scale maps (considering any existing data and hydrogeological maps). Based on this, the identified aquifers were going to be developed into well fields..

9.1.3 Development objectives

The followings were the development objectives of the project:

- To identify and characterize a local aquifer in the Chongwe area with sufficient productive capacity such that it can be used for settlement level water supply.
- To develop at least one well field for settlement level water supply for use by the Lusaka Water and Sewerage Company (LWSC).

9.1.4 Development objectives

The project had the following dimensions:

- Assessment and characterization of a suitable local aquifer in the Chongwe area through geophysical investigations and hydrogeological assessments.
- Drilling and equipping of at least three production boreholes to augment the water supply to Chongwe Town.

9.1.5 Project beneficiaries

It is estimated that 2000 people directly benefitted from this project, including males (1015), females (985) and children (1050) in Chongwe Town. This project was also estimated to indirectly benefit about 262 408 people, in which 133 227 were males, 129 181 were females and 137 764 children.

Her Royal Highness Senior Chieftainess Nkhomeshya Mukamambo II supported the implementation of the project - in this interview she was explaining the water challenges faced by Chongwe community and how the project was going to augment water supply for the Chongwe community. Photo Credit: SADC-GMI

9.1.6 Project beneficiaries

The following activities were carried out and completed during the implementation of the ground-water mapping and development in the Chongwe District project:

- Hydrogeological assessments including geophysical surveys, groundwater exploration
- Development of well fields for Water Supply and Sanitation.
- Environmental and social safeguards.
- Procurement of goods and services.
- Project follow up and support.
- Monitoring and evaluation.
- Installation of an automated groundwater monitoring borehole.

Drilling in progress at the project site in Chongwe, Zambia. Photo Credit: SADC-GMI

9.1.7 Lessons Learned from Project Implementation

Lessons learned from groundwater mapping and development in the Chongwe District are discussed below based on four categories.

Community Empowerment and Livelihoods

- It is important to undertake adequate stakeholder mapping and engagements on the project no matter how small to ensure potential issues are identified, resolved, or mitigated in good time. This would be helpful especially when the key stakeholders championing the project are no longer able to provide such support due to changes in their status or other reasons.

Environmental and Social Inclusion

- Always have project proposals developed in advance with as much of the Environmental and Social safeguards and Project Planning dealt with as far as is possible before project implementation commences.

Implementation Arrangements

- Involve procurement personnel in the estimation of project costs to avoid significant cost differences between planned estimates and actual costs.
- Always prepare accurate designs of infrastructure to be constructed and ensure that the specifications of required materials and other items are detailed and accurate enough not to cause procurement related issues.

Payments to Contractors and Service Providers

- Use of country procurement systems coupled with direct payment to suppliers by the financiers is a good practice. In addition, reimbursement of costs or payment for works done by government departments on the project is an equally good practice. However, it may lead to implementation challenges especially when a team has to be mobilized for field work and the government coffers are dry. A system of advance payment for such issues should be considered.

10. ZIMBABWE

10.1 Rehabilitation of Pilot Projects to supply Water to communities and institutions in Dite and Whunga areas of Beitbridge District

10.1.1 Background

SADC-GMI partnered with World Vision Zimbabwe to facilitate the implementation of the projects entitled“Rehabilitation of the pilot projects to supply water to communities and institutions in Dite and Whunga in the Beitbridge district”. The projects sought to rehabilitate the water supply infrastructure and resuscitate the failed interventions of the pilot projects that were implemented by the SADC Secretariat and its partners between 2007 - 2011 under the project, “Development and Testing of Ground-water Drought Management Strategies in the Limpopo Basin”. In 2018, SADC-GMI contracted Wellfields Consulting Services to undertake a follow-up study of the seven pilot interventions in the Limpopo River basin, to determine their status. The study revealed that the pilot projects were not functional, and recommendations were made to rehabilitate the projects in Dite and Whunga, situated close to Beitbridge, a dry area with extremely elevated temperatures mounting to 40 degrees.

A happy beneficiary is collecting freshwater from one of the communal taps installed as part of the project. Photo Credit: SADC-GMI

10.1.2 Problem statement

In the midst of changing climatic conditions, most rural communities in arid to semiarid regions are relying on groundwater as the sole source of freshwater. In Dite and Whunga areas, pilot projects were implemented between 2007 and 2011 to mitigate the impact of drought in the SADC region through a GEF funded project. These projects were abandoned leaving communities of Dite and Whunga deprived of a reliable water supply. There was a need to resuscitate the abandoned pilot projects in Dite and Whunga areas for sustainable water supply and improved livelihoods.

10.1.3 Development objectives

The project sought to rehabilitate the water infrastructure and resuscitate the failed interventions of the pilot projects which were implemented by the SADC Secretariat and its partners between 2007 - 2011 under the GEF funded project, “Development and Testing of Groundwater Drought Management Strategies in the Limpopo Basin”. The objective of the rehabilitation was to provide communities with water through piloting drought intervention, innovative strategies, and the use of renewable energy. The other objective was to reestablish nutrition gardens and provide an accessible water supply system within the gardens. The project also sought to ensure sustainability of the interventions by providing capacity building to the community on management, operation, maintenance, health, and hygiene related issues.

10.1.4 Project Description

World Vision Zimbabwe was identified as a potential partner to implement the rehabilitation works given their presence in the Beitbridge area. The implementation of the projects started in April 2019 and was expected to end in December 2020 but due to some unforeseen delays in programming, the project was given 3 months no cost extension to the end of March 2020.

10.1.5 Project beneficiaries

Dite and Whunga communities were the beneficiaries of the rehabilitated, functioning, and sustainable groundwater supply system.

10.1.6 Activities directly related to the Project (Dite)

The following activities and milestones were performed and achieved in Dite area:

- Capacity testing for existing boreholes at the school to determine supply water for multiple uses to include community gardens.
- Hydrogeological surveys to identify alternative sources for developing a new borehole or equipping the well next to the shopping centre with a solar pump and a tank and a few taps in the shopping centre and at the community garden.

The project made water accessible to the community. Beneficiaries are fetching water to irrigate their gardens. Photo Credit: SADC-GMI

- Designed and installed a solar powered community piped water scheme to provide water for multiple uses complete with supply storage, distribution and institutional arrangements for sustainable community-based management and providing water to the school and productive use in community gardens and for community households.
- Facilitated the capacity building for the establishment of WPUCs (water point user committee) for managing water supply infrastructure.
- Facilitated training of WPUC on sustainable management of water supply infrastructure.
- Facilitated refresher training for WHWs on CHC (continuing healthcare) approaches for hygiene promotion and on advocacy for self-supply of sanitation and hygiene enabling facilities.
- Designed and distributed education information and communication (IEC) material facilitating PHHE Sessions and hygiene promotion campaigns.

A communal tap in Whunga where the community collect water for domestic use and subsistence farming. Photo Credit: SADC-GMI

10.1.7 Development objectives

The following activities and milestones were performed and achieved in Whunga area:

- Conducted hydrogeological surveys to identify alternative sources for developing a new borehole or equipping the well next to the shopping centre with a solar pump and a tank and a few taps in the shopping Centre and at the community garden.
- Developed a new high yield borehole to provide water for multiple uses.
- Designed and installed a solar powered community piped water scheme to provide water for multiple uses complete with supply storage, distribution and institutional arrangements for sustainable community-based management and providing water to domestic & productive use for community households, community garden irrigation and business centre.
- Facilitated establishment of WPUCs for managing water supply infrastructure
- Facilitated training of WPUC on sustainable management of water supply infrastructure.
- Facilitated refresher training for WHWs on CHC approaches for hygiene promotion and on advocacy for self-supply of sanitation and hygiene enabling facilities.
- Facilitated the revival of Community and School Health Clubs.
- Designed and distributed educational information and communication (IEC) materials Facilitating PHHE Sessions and hygiene promotion campaigns.

10.1.8 Lessons Learned from Project Implementation

Lessons learned from this project are discussed below based on four categories.

Community Empowerment and Livelihoods

- Involvement of all stakeholders from the planning stages of a project created a sense of ownership and made the project implementation easy.
- Training of community members in operation and maintenance of the solar systems was key to the sustainability of the projects since this technology was new to the community.
- The high yielding boreholes identified in this project also demonstrated the possibility of using groundwater for irrigation in this arid region.

Environmental and Social Inclusion

- The project design gave priority for carrying out an environmental impact and social safeguard assessment that was a key lesson to all stakeholders including World Vision Zimbabwe on the importance of this activity particularly the sequencing in the project.

Implementation Arrangements

- Partnership with a non-governmental and non-profit organisation was recommended, hence World Vision was contracted to implement the project.

Payments to Contractors and Service Providers

- Since the inception of the project, the economic landscape in Zimbabwe continued to face a downward trend- hyperinflation and cash shortages resulted in continuous increase of costs of goods and services.
- This situation had a negative effect on the program as it led to a high cost of doing business ultimately affecting the project budget. To facilitate the implementation of all planned activities, budget negotiation meetings with potential suppliers had to be conducted.

Women from Maitazwitoma community garden showing off Covo from their rehabilitated garden. Photo Credit: SADC-GMI

10.2. Greater Harare Groundwater Monitoring: Upper Manyame Sub- Catchment

10.2.1 Background

The Greater Harare Groundwater Monitoring Pilot Project sought to establish a comprehensive Groundwater Monitoring Network for Greater Harare. This was aimed at addressing two key challenges which were: (i) Groundwater Depletion and (ii) Groundwater Quality Deterioration; for the benefit of groundwater users and water managers. The project involved the characterisation of the Greater Harare aquifers, both quantitatively and qualitatively, determining the available groundwater resources, flow patterns, aquifer dimensions, storage, flow properties as well as recharge and discharge processes. This was envisaged to provide comprehensive information which is vital for informing sustainable groundwater use and management.

Greater Harare had been reported to experience extensive groundwater dependence as residents strive to augment piped water deficits. This contributed to significant drawdown of the water table, hence increased cases of drying boreholes. Furthermore, indiscriminate waste disposal contributed to groundwater pollution. Groundwater contamination triggered the high recurrence of water borne diseases over the past decade. It is a critical fact that, once groundwater is depleted and/or polluted, remediation is extremely expensive and almost impossible. As such, the project was driven by the need to address the groundwater information gap which was precluding its sustainable development and management. Quantitative and spatially explicit information gathered on groundwater was going to inform strategies of adapting to the growing groundwater demands and deteriorating quality.

The project, which was funded by the World Bank through SADC-GMI, was implemented from 25 February 2019 – 31 August 2020. This project was anticipated to benefit various stakeholders, not limited to: Harare residents, Industry, Institutions and Water Managers,amongst other beneficiaries.

10.2.2 Problem statement

Zimbabwean cities and towns, like other Sub-Saharan countries, are faced with a myriad of problems, amongst them, poor water services provision. Harare, Zimbabwe's Capital City has been on the eye of the devastating water woes over the past two decades, with the Harare City Council having perennially failed to supply adequate water. Potable water demand has outstripped the supply due to continued urban expansion coupled with the impacts of climate change. Water supply infrastructure has largely become dilapidated over the years, with non-revenue water accounting for over 40% of the pumped volumes. Daily average demand was estimated at 820ML per day, versus a supply capacity averaging of 425ML per day, excluding industrial demand.

Coupled with industrial demand, total demand shot up to 1200 ML per day, leading into a crisis. These water supply deficits have triggered enormous dependence on groundwater. Industries, institutions, agriculture, domestic users, among other crosssectoral uses, are competing for the limited groundwater resources. Resultantly, groundwater is under serious stress from massive drawdown with water table recession in marginal boreholes becoming seasonally apparent around Harare. This is most noticeable in areas such as Greendale, Highlands, Newlands, parts of Borrowdale, parts of Pomona, Vainona and Mount Pleasant Waterfalls and Emerald Hills amongst other low-density suburbs. These areas rarely receive municipal water supplies, with some of them having last received piped water in more than a decade. The influx of migrants coupled with several poor rainy seasons also adds to the severe water crisis within Harare. Drilling proliferated over the years, with an average of 30 boreholes per month across Greater Harare. Coupled with slow implementation of dam projects such as the Kunzvi Dam (design completed in 1996) which is meant to augment the ever-growing Harare population, groundwater mining is highly likely. In 2013, the Government of Zimbabwe passed a legislation allowing the commercialisation of groundwater, through bulk water supply, thus further exerting more pressure on the limited groundwater resources.

Illegal bulk water activities as well as climate change phenomena further exacerbates the groundwater stress. A hydro census carried out by the UMSCC in 2017 identified over 20 000 boreholes and wells; this excludes wells in undesignated areas, i.e., high-density suburbs. This huge demand for groundwater has not been complemented by science informed management practices, but rather ad-hoc use and allocation. Groundwater quality problems have also become apparent in the past years due to poor waste management. Water borne disease outbreaks such as cholera and typhoid, experienced within Greater Harare for the periods 2008/2009, 2016 and 2018 were greatly attributed to groundwater contamination.

Once groundwater is depleted or polluted, remediation is extremely difficult and costly, especially in third world countries. Prevention and control of groundwater mining and pollution are principally critical for its effective management and use. Given the above, it became highly imperative that there be a scientific way of analysing both the quantity and quality of groundwater on a real time to near real time basis to safeguard limited groundwater resources. Apart from other indirect benefits, this pilot project capacitated both individuals and Upper Manyame Sub-Catchment Council (UMSCC) in effective groundwater management.

10.2.3 Development objectives

The development objective of this pilot Project was to enable informed development, use and management of Groundwater Resources within Greater Harare, while promoting equitable and sustainable use.

10.2.4 Project Description

The project was aimed at catalysing improved groundwater management for the benefit of diverse stakeholders in the Upper Manyame and Nyagui Sub-catchments, currently and into the future. Improve groundwater management through conducting characterisation of the Greater Harare aquifer system, optimisation of groundwater monitoring network, installation of real-time groundwater level and quality data collection equipment and estimation of groundwater quantity. he development objective of this pilot Project was to enable informed development, use and management of Groundwater Resources within Greater Harare, while promoting equitable and sustainable use.

Identification and delineation of groundwater recharge-discharge zones and actual-potential sources of groundwater contamination was one of the key factors in this project. This project also intended to develop groundwater maps for the Greater Harare aquifer.

10.2.5 Project beneficiaries

Stakeholders in and around the Upper Manyame and Nyagui Sub-catchments were the main beneficiaries for the improved groundwater management.

10.2.6 Activities directly related to the Project

The following activities were carried out and completed during the implementation of the project:

- Groundwater Monitoring Network Design.
- Borehole drilling, casing, and equipping (9 monitoring boreholes & 3 Production boreholes).
- Capacity testing of 9 monitoring boreholes & 3 Production boreholes.
- Soil analysis of 20 soil profiling sites was carried out.
- Procurement of equipment.
- Installation of telemetric equipment.
- Stakeholder Workshops
- Test runs were conducted.
- After the completion, the project was commissioned to the stakeholders.

The community using a hand pump to access water in Harare, Zimbabwe: Photo: SADC-GMI

Lessons Learned from Project Implementation

Lessons learned from the Greater Harare monitoring project are discussed below based on four categories.

Community Empowerment and Livelihoods

- Any project implementation should be stakeholder driven and participation should be at all levels, inclusive stakeholder participation should be observed at the inception of the project. This ensures ownership/sustainability of the project and comprehensiveness.

Environmental and Social Considerations

- The project should be planned with a clear understanding of the PESTEL Environment. Thus, there should be a full understanding of political Factors, environmental factors, social factors, technological factors, economic factors, and legal factors that could have an impact on the project implementation.

Implementation Arrangements

- Project timelines should be set with proper understanding of various stakeholder behavioural traits, e.g., government institutions are always associated with bureaucratic tendencies, hence much delay may be experienced in undertaking the engagement processes.
- The subgrant should ensure that there is room for a case-on-case basis implementation plan for the regional projects rather than using a blanket approach. Countries' socio-political and economic conditions vary greatly.
- Future projects need to include exchange visits before implementation by Member States. This will ensure experience sharing and clarity of expectations during project implementation.

Payments to Contractors and Service Providers

- Future projects need to include contingency costs e.g., duty, field vehicles and sundries to enable smooth flow of the project. There are many contingency components that arise during project implementation which are not usually accounted for in the budget timelines and costs, hence this delays progress, especially in unstable economies.

11. MEMBER STATES THAT DID NOT IMPLEMENT OR COMPLETE A PROJECT

11.1 Angola: Groundwater project in Caimbambo municipality

11.1.1 Background

The municipality of Caimbambo is located between the Central - West basins and the Southwest basin, specifically between the sub basin of the Cubal Hanha - Catumbela system and the sub - basin of the Coporolo - Hanja - Hole System, presenting as main hydrogeological units, granites, and low-permeability Precambrian gneisses, mostly located in the eastern part. Despite the importance of groundwater in the Caimbambo region, there is a general lack of knowledge of the regional aquifer systems, namely their geometrical and hydraulic characteristics.

The aim of the project was the characterization of hydrogeology of the municipality of Caimbambo with a component of complete registration of all collections, surface, and groundwater sources in the region. This project was however not completed because of challenges with banks, unit cost and change in the scope of the project, which delayed the implementation. From the $150 000 budget, about $90 000 was spent.

11.1.2 Problem statement

According to the World Health Organization (WHO), the water source should be located at a maximum distance of 1,000 meters from home and the collection time should not exceed 30 minutes. The Municipality of Caimbambo presents a precarious system of water supply which often forces the population to travel more than 3 kilometers in search of this precious liquid.

The main sources of supply are from rivers, excavations in the sandy bed of the same ones (in the dry season), cacimbas and wells. The Municipality of Caimbambo has been affected by events of extreme drought which makes these sources insufficient due to population growth in the region and the continuous climatic variations.

The exploitation of groundwater in this region is aimed not only at supplying local populations but also at the development of agricultural and livestock activities.

11.1.3 Development objectives

WHO has set a goal 2030 for universal and equitable access to affordable drinking water for all. The objective of the proposed work was to raise, generate and make available information and knowledge about the occurrence, potentialities, circulation, and use of groundwater, with the purpose of increasing water availability from water sources for human supply and productive activities, to promote sustainable socioeconomic development of the region and improve the living conditions of Caimbambo population.

11.1.4 Problem statement

The project aimed at the hydrogeological characterization of the municipality of Caimbambo and the registration of all surface and groundwater sources in the region.

11.1.5 Problem statement

The project was going to benefit communities within the municipality of Caimbambo, 80 715 inhabitants, 47.2% male population and 52.8% female.

11.1.6 Activities directly related to the Project

Activities directly related to the Project were:

- Hydrogeological characterization of the region
- Inventory of water points, water flow tests and pumping tests for hydrodynamic characterization of the aquifers present in the Caimbambo region
- Improvement of existing wells
- Execution of production tests to verify the efficiency of the wells and determine the productive capacity of the aquifer

11.1.7 Lessons Learned from Project Implementation

- The municipality of Caimbambo has human capital with poor technical execution capacity. It is necessary for training to take place.
- It is necessary to create Water and Sanitation Groups (GAS), a fundamental element to ensure the sustainability of the holes (water points).
- The Project Coordination considers that the involvement of the Delegation of the Red Cross of Angola, in Benguela is a guarantee for the success of the formation of gas members.
- For the best technical knowledge of the Hydrogeology of the Municipality of Caimbambo it is necessary that there are synergies between the institutions – academic institutions, the Provincial Office of Infrastructure and Technical Services of Benguela and the Municipal Administration of Caimbambo.

Democratic Republic of Congo (DRC)

The project concept note for the Democratic Republic of Congo project was approved by SADC-GMI. However certain deadlines were unfortunately not met because of a change in the national government. Consequently, the project in the DRC was not implemented.

South Africa

South Africa did not implement any project owing to the lack of clarity in the sub-grant manual on how to navigate national government procurement processes. The long consultation processes on how to navigate the procurement processes resulted in the country missing the deadline. One of the key lessons learned is the need to partner with a non-government implementing partner. It is hoped that lessons learned during the consultation processes of phase 1 will enable the country to implement future projects.

12. Comoros, Madagascar And The Sychelles

Due to unforeseen circumstances beyond Member States and SADC-GMI control, Comoros, Madagascar, and the Seychelles were unable to submit their Subgrants Concept Notes and Project Proposals. Consequently, these nations were unable to partake in the implementation of the sub-grant projects during Phase 1 implementation.

12. LESSONS LEARNED

We learned that it is imperative that Member States prepare their subgrants concept notes well in advance and have them submitted to SADC-GMI before set deadlines. Consultation between SADC-GMI and Member States is critical to clear any uncertainties that may prevail. Open communication between SADC-GMI and Member States to ensure that Member States are assisted with Concept notes/ proposals development, and that areas that not clear in Subgrant Manual are clarified in time.

12. LESSONS LEARNED FROM SADC-GMI

During the implementation of all the sub-grant projects in various Member States, SADC-GMI also learned key lessons that they will carry forward to the future project implementation. Below are the key lessons learned by SADC-GMI during the implementation:

12.1 Tracking of the subgrants project proved to be a problem since all projects were of different scope, and each Member State had its own monitoring method for the project. This is despite the fact that there were uniform reporting templates. There is a need for appropriate systems to track and record outputs at various levels of implementation. These systems can also be used as the means of verification at the reporting stage.

12.2 The other major challenge in the implementation of the projects was the lack of a standardized method to guide how to count the number of beneficiaries from the projects. This led to misaligned figures being reported as beneficiaries. In some cases, these figures were over reported while in other cases, numbers were not recorded at all for those that may have benefitted. A guiding document has been developed for this purpose and it will be introduced at the inception of the projects.

12.3 Moving forward, we should have a system that facilitates timely submission of reports by the Member States. All reports will have to be submitted into one database with varying access levels to all relevant stakeholders. This will also facilitate collaboration where there is a need for providing feedback and comments. This platform will be introduced at the inception of the projects.

12.4 In terms of procurement, SADC GMI should be involved in the subgrantee's procurement activities if the need arises.

12.5 One of key lessons learned was that it is difficult to quantify the impact and number of beneficiaries from soft projects as compared to physical projects. There was more appreciation of physical projects by communities over soft projects. A mix of physical and soft projects with a bias on the impact and benefit of communities should be prioritized.

13. CONCLUSION AND RECOMMENDATIONS

SADC-GMI successfully implement the five-year (2016 – 2021) regional project on Sustainable Groundwater Management in SADC Member States with the grant received from the World Bank. The project achieved its objective of mitigating the challenges of climate change, pollution, and rapidly growing water demand in Southern Africa through strengthening the management and development of groundwater for social and economic development at national, regional, and Transboundary levels. It is therefore important that this report was compiled to capture the lessons that were learned, before, during and after the period of implementation. The following are the recommendations from each project.

13.1 BOTSWANA - Gobojango and Tsetsebjwe

The project managed to achieve the objective of providing functioning and sustainable groundwater for horticultural purposes in Gobojango and Tsetsebjwe Villages despite the challenges experienced during the implementation phase of the project. Upon the completion of the project, the following were recommended:

- The need to determine the key milestones of the key Project activities at the planning phase of the project is critical; otherwise, lack of planning will compromise timeframes of the project.
- The need to develop a contingency plan in case the project encounters challenges and incur extra costs to cover some of the activities.
- Constant communication is essential with all the key partners for easy implementation of activities.
- A project like this needs to consider local processes and procedures in undertaking certain activities.
- Community participation is key for project implementation and success
- All the key partners to the project need to understand the description of the activities to be conducted and captured in the agreement before kick starting the project.
- The implementing partner should have a dedicated project manager for the duration of the project to create consistency.

13.2 ESWATINI

The project managed to reach its objective of installing a groundwater monitoring network in 10 selected sites. This creates real time data on the groundwater resources quality and quantity to inform the strategic decision to be taken by the Department of Water Affairs in managing, preserving, and conserving the groundwater resource. This project also managed to install renewable energy sources (solar system) that will enable abstraction of groundwater.

13.3 LESOTHO

The project managed to design and expand the Nationwide Groundwater Monitoring Network. During the implementation of this project, geophysical survey was conducted, 20 monitoring boreholes were drilled and equipped with the monitoring equipment. The expanded groundwater monitoring network will provide a comprehensive nationwide network for the support and guidance of groundwater management activities in Lesotho.

13.4 MALAWI

The project resulted in the installation of the water pump, solar power, storage tanks and distribution networks to provide water to Chimbiya Trading Centre. Groundwater monitoring equipment was installed to monitor parameters such as abstraction volumes for improved groundwater management. The successful implementation of this pilot project has not only benefited the population of Chimbiya by providing a sustainable source of safe water but has enabled the subgrantee to carry out hydrogeological analyses of the deep well. This is assisting in the sustainable utilization, protection, and management of groundwater in Malawi.

13.5 MOZAMBIQUE

In conclusion, this project managed to install the water supply system for the Muchocolote Village. The handpump was removed and replaced with a solar powered submersible pump. Construction of pipelines to four taps made life easier for the community of Muchocolote as they are no longer walking long distances to access water. This project recommended that projects of this nature should have a distinct “Start-up” Phase for at least three months, before the actual start of the Implementation Phase. This period will allow for the establishment of all required conditions including the right to access to, and possession of, all parts of the site within the time stated in the Contracts. The Project had a good and positive outcome in meeting the output objectives, despite taking longer than expected. Regarding the sustainability of the water system, the community was trained to safely operate all the key components of the installed infrastructure.

13.6 NAMIBIA

This project managed to achieve the main objective of the project. The Hydrogeological Map of Namibia was reviewed and updated. The Hydrogeological Map was integrated/merged with the National groundwater database (GROWAS 2).

13.7 TANZANIA

The groundwater management study in Kimbiji aquifer managed to drill five (5) boreholes and install monitoring gadgets. This will help in accomplishing project objectives by collecting vitally important field data as intended and specified by the environmental monitoring plan. New installed infrastructure (monitoring wells) will now provide the platform needed for monitoring of deep aquifer conditions, as detailed in the Aquifer Development Plan (ADP) report. However, the surface and groundwater monitoring as well as the review of field data in relation to the aquifer system’s response to large-scale pumping and potential hydraulic impacts on existing well owners, stream flows and wetland habitats in the project area was not fully executed as anticipated primarily due to limited implementation time.

The groundwater that has been tested from the drilled exploration wells is found to be soft, slightly alkaline (mostly) and of a sodium-bicarbonate type. The pumped water was also warm, between 25-30°C. The laboratory results concluded that all samples from the exploration wells are of potable quality. Some samples are slightly more saline than others, but all results are within drinking water guidance values.

Moving forward, the following recommendations are worth considering:

- Add project elements that will enable such projects to contribute to community development using groundwater
- Set up and operationalise a mechanism which allows the sub-Grantee such as the Ruvu/Wami Water Board to implement more flexibly without the influence of the Ministry, a scenario that delayed implementation
- Quantify the sub-Grantee’s in-kind contribution into the project
- Follow-up on the monitoring aspects of the project that were not completed as this phase is critical in informing the roll-out and upscaling of the monitoring network

13.8 ZAMBIA

This project managed to identify and characterize a local aquifer in the Chongwe area with sufficient productive capacity such that it can be used for settlement level water supply. The development of at least one well field for settlement level water supply for use by the Lusaka Water and Sewerage Company (LWSC) was achieved.

13.9 ZIMBABWE - Dite and Whunga

In conclusion, this project managed to achieve its objective of providing Dite and Whunga communities with water for domestic and productive use, community gardens irrigation and the business sector. The integration of WASH and Livelihoods interventions through establishment of water supply system and Nutrition gardens will go a long way in ensuring good nutritional status for the targeted children and their families if the established infrastructure and acquired knowledge are put to good use. Finally, the rehabilitation of this pilot project brought relief to the people of Dite and Whunga, restoring the trust between them and developmental agents.

Learning from the failure of the first phase of the pilot projects in Whunga and Dite communities, the rehabilitation project adopted a deliberate move to ensure sustainability of the project. The rehabilitation employed a more inclusive strategy which ensured that all stakeholders participated meaningfully during the project design and through to implementation and delivery. The inclusive approach increased the participation of women, youth and the elderly making the project an overall success.

Key to the approach was also consultative implementation methods employed by World Vision playing a facilitator role whilst the key partners including the community members took the lead in the actual implementation of project activities on the ground .to implement the proposed project activities. Existing WASH governance structures such as the DWSSC, WWSSC were responsible for the implementation and monitoring of activities.

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Capacity building interventions focused on operation and maintenance of WASH infrastructure and positive health and hygiene behaviour change was conducted. WASH Committees selected on gender equity were also trained on inclusive groundwater management based on the principle of Integrated Water Management

Tendering process and awarding of contracts was also done thoroughly with reliable and reputable companies being awarded the contracts. To ensure value for money, inspection of project materials was done with focus on using durable and high-quality material. The Upper Manyame project managed to achieve its objective of enabling informed development, use and management of groundwater resources within Greater Harare, while promoting equitable and sustainable use. A groundwater monitoring network was designed, boreholes were drilled and equipped with telemetric monitoring equipment.

We thank you for your continued support in our efforts to contribute to SADC.

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