Report on the 3rd Regional Meeting on Tools for the Sustainable Management of Transboundary Aquifers

6-9 March 2018

Submitted by:

Implemented by:

In partnership with:

This report was made possible by the support of the American people through the United States Agency for International Development (USAID). Its contents are the sole responsibility of IWMI, and do not necessarily reflect the views of USAID or the United States Government.

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Acknowledgments

The authors would like to thank the participants of the 3rd Regional Meeting on Tools for the Sustainable Management of Transboundary Aquifers for their presentations and discussions that make the basis of the input in this report.

Contents

Acronyms and Abbreviations

BUPUSA	Buzi-Pungwe-Save
DWA	Department of Water Affairs (Botswana)
DWS	Department of Water and Sanitation (South Africa)
EWR	Ecological Water Requirements
GGRETA	Governance of Groundwater Resources in Transboundary Aquifers
IGRAC	International Groundwater Resources Assessment Centre
IWMI	International Water Management Institute
JPTC	Joint Permanent Technical Committee
JSAP	Joint Strategic Action Plan
LIMCOM	Limpopo Watercourse Commission
MAWF	Ministry of Agriculture, Water and Forestry
MCCM	Multi-Country Cooperation Mechanism
OMVS	Organization for the Development of the Senegal River
ORASECOM	Orange-Senqu River Commission
RAMOTSWA	Ramotswa Aquifer Project
RBO	River Basin Organizations
RESILIM	Resilience in the Limpopo Basin program
RIMS	Ramotswa Information Management System
RTBAA	Ramotswa Transboundary Aquifer Area
SADC	Southern African Development Community
SADC-GMI	Southern Africa Development Community Groundwater Management Institute
SDG	Sustainable Development Goals
STAS	Stampriet Aquifer System
TBA	Transboundary Aquifer
TDA	Transboundary Diagnostic Analysis
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
WUC	Water utilities Corporation

1. Introduction

This report documents the discussions and recommendations from the third joint workshop between stakeholders from the Stampriet and Ramotswa transboundary aquifer projects. The workshop was held at Cresta Lodge in Gaborone, Botswana, from 6 to 9 March 2018. The workshop was convened by the International Water Management Institute (IWMI), as implementers of the RAMOTSWA project, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) International Hydrological Programme (IHP), as implementers of the Stampriet Transboundary Aquifer System (STAS), and the Southern Africa Development Community Groundwater Management Institute (SADC-GMI), who are implementing sustainable groundwater management programmes in the SADC member states.

1.1 Objectives

This meeting follows from the *1st and 2nd Regional Meetings on Tools for the Sustainable Management of Transboundary Aquifers* held in July 2015 and November 2016, respectively. It is therefore the third in a series of regional meetings on transboundary aquifers in the Southern Africa, which aim to address contemporary issues related to the management of transboundary aquifers in the region, with particular focus on the Stampriet and Ramotswa transboundary aquifers. The Stampriet Aquifer is shared between, Botswana, Namibia and South Africa; and the Ramotswa Aquifer is shared by Botswana and South Africa.

This workshop had two objectives. First, to share experiences on mainstreaming the importance of groundwater in transboundary river basin organizations (RBOs) in the SADC region, and second, to place focus on recent progress and upcoming activities in two parallel projects on transboundary aquifers in SADC: the Stampriet and the Ramotswa. The SADC-GMI will pick from the best practices from ongoing work for upscaling in the more than 25 other TBAs in the SADC region

1.2 Target Audience

The target audience was groundwater practitioners in the government water departments from the SADC region, most notably from Botswana, Namibia and South Africa, as prominent stakeholders in the two projects that were discussed. Further, cooperating partners including the United States Agency for International Development (USAID) and Swiss Agency for Development and Cooperation (SDC) and researchers were also present, notably from Avignon University, University of Botswana and University of Strathclyde. River basin organisations (RBOs) from the region were also invited, and the Buzi-Pungwe-Save (BUPUSA), Inkomati, Organization for the Development of the Senegal River (OMVS), and Orange-Senqu River Commission (ORASECOM) attended. A complete participant list can be found in Annex 1.

1.3 Topics Covered

The workshop consisted of a one and a half day combined plenary, and two days of breakaway/parallel sessions that focused on RAMOTSWA and GRETA/Stampriet projects. The first day of plenary covered presentations on transboundary cooperation in the context of sustainable development goals (SDGs), assessment of cooperation and project progress on each of the two aquifers and lessons learnt from those experiences. The second day focused on the incorporation of groundwater in RBOs, mainly the institutional and technical considerations necessary. Invited RBOs shared their experiences and challenges.

The parallel session on Ramotswa provided project updates on the five components of the second phase: managed aquifer recharge (MAR), hydrological modelling, joint strategic action plan (JSAP), Ramotswa Information Mangement Systems (RIMS) and Ag-Water solutions. Further, a presentation on of gender issues in the aquifer area was made, and a report on the Ramotswa Advisory Committee, which met for the first time at the event, was also discussed.

1.4 Participants and Outputs

More than 50 participants attended the workshop (Annex 1). Participants from the Botswana Department of Water Affairs (10) and Department of Agriculture (one) attended. Two delegates came from the Department of Water, Agriculture and Forestry of Namibia and eight delegates came from the Department of Water and Sanitation in South Africa. From SADC member states, seven countries send a representative each. These are Angola, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. From IWMI, five participants attended, while three each came from SADC-GMI and UNESCO. Seven participants from invited RBOs attended, and cooperating partners were represented by a delegate at least one delegate: SDC and USAID. From academic institutions, there were two participants from University of Botswana, two from University of Strathclyde and one from Avignon University. There was also a delegate each from the SADC secretariat, Aquamatters and the International Groundwater Resources Assessment Centre (IGRAC).

The presentations from the workshop have been uploaded on the RAMOTSWA project website http://ramotswa.iwmi.org/resources.aspx

2. Content of Workshop Plenary

2.1 Sessions on Day 1

2.1.1 Welcome Remarks

Welcome remarks were made by government departments heads from Botswana, Namibia and South Africa, and from project implementers: IWMI, UNESCO and SADC-GMI. Further remarks were made by SDC and USAID, and from RBO representatives present. Representatives from the three governments expressed gratitude to project funders and implementers and noted the growing capacity they to manage groundwater as a result of these projects. Key messages to note from project implementers.

- UNESCO: a Stampriet Agreement has been concluded, which is a significant outcome of the STAS project - It is the first TBA agreement since the SDGs in 2016 and it is also the first TBA arrangement nested within an RBO.
- IWMI: There has been a lot of progress between the first and second phases of the RAMOTSWA project. It is now critical to map out where and how that fits in regional frameworks to achieve sustainability.
- SADC-GMI: there is an estimated 30 TBA's in SADC, where 70% of the population rely on groundwater resources.

The SADC secretariat emphasised their commitment to groundwater programming, especially conjunctive water management, and the SDC announced their increasing focus on groundwater management.

2.1.2 Transboundary Waters Cooperation and the Sustainable Development Goals

Measuring transboundary waters cooperation through the SDG 6.5.2 indicator: process and outcomes of the first reporting exercise. Tales Resende

UNESCO and UNECE were appointed as co-custodians for monitoring the SDG 6, target 6.5 (*By 2030, implement integrated water recourse management at all levels, including though transboundary cooperation as appropriate*). Indicator 6.5.2 is the dedicated indicator for transboundary cooperation in 6.5.2: "*Proportion of transboundary basin area with an operational arrangement for transboundary water cooperation*" and a global framework for measuring it was adopted by the UN. The framework uses four criteria for assessment:

- Existence of a joint body, joint mechanism or commission for transboundary cooperation
- Regularity of formal communication in form of meetings
- Existence of a joint or coordinated water management plan or of joint objectives
- Regular exchange of information and data

A cooperative arrangement is considered operational only if all these four indicators are achieved

Preliminary results and experiences from the SDG 6.5.2 baseline data. Tales Resende

A brief introduction was provided to what is currently happening within the projects at a global scale. A study was implemented to measure cooperation in 153 UN member states. The first round of reporting through questionnaire and feedback was done in 2017. The finalization of the validation process was commenced in January 2018. This is a very long process and will only be completed in 2024. About 103 out of the 153 questionnaires send have been received so far. Within SADC eight countries responded to the questionnaire but only five provided enough data to enable assessment of SDG 6.5.2: Angola, Botswana, Lesotho, Namibia and Zambia. Three countries provided insufficient data. Four countries did not respond at all. The preliminary results show that SADC regional average for SDG 6.5.2 is 80%. A major challenge is that data on groundwater cooperation is lacking. In SADC's transboundary aquifers (TBAs) there is only one specific arrangement (STAS with ORASECOM), the rest are still to achieve cooperation. The process provided valuable lessons, two notable one being:

- Validation of data requires intensive engagement with countries and shows needs for capacity building on the indicator
- Availability of information + interpretation of groundwater is a major challenge and focus of future work (UNESCO)

2.1.3 Cooperation Over the Stampriet Transboundary Aquifer System

Stampriet Transboundary Aquifer System (STAS) assessment: Main findings and achievements. Piet Kenabatho, University of Botswana

The Governance of Groundwater Resources in Transboundary Aquifers (GGRETA) Phase 1's main objective was to undertake a multidisciplinary in depth assessment (hydrogeological, environmental, socio-economics, institutional and legal frameworks) in the STAS. The main achievements from this phase are:

- A step forward towards better cooperation and improved trust between the 3 countries
- Improved knowledge and recognition of the importance and vulnerability of transboundary groundwater resources
- Development of shared management tools (IMS)
- Compilation of a joint STAS borehole database (around 6000 boreholes)
- Preparation of 60 thematic maps providing information on groundwater levels, quality etc.
- Strengthened cross-border dialogue and cooperation
- Facilitation of governance reforms focused on improved livelihoods, economic development and environmental sustainability
- Capacity building trainings

Key findings and recommendations (Hydrogeological and S&E):

- The general perception is that there is no long terms groundwater depletion/pollution in the area
- However, within the context of climate change, the fragility of the system could create conditions of stress in the future if there is overexploitation
- Measures to prevent or counteract potential depletion and pollution problems are required

Key findings and recommendations (Legal and Institutional):

- A domestic policy, legal and institutional framework for groundwater is in place in all three countries
- From the domestic legal and institutional perspective, it is fair to conclude that the laws in place in the STAS countries are adequate to deal with the challenges ahead of the aquifer
- Strengthening domestic capacities in implementation and enforcement is necessary to support cooperation for the management of the STAS.

The Way forward.

The second phase of the GGRETA (STAS) aims at establishing a Multi-Country Cooperation Mechanism (MCCM) that would be a direct contribution to SDG indicator 6.5.2 on transboundary water cooperation. This is achieved through: (1) Establishment of three national transboundary technical groups (NTTG's) for: Modelling, Legal and institutional aspects and Gender aspects and (2) Establishment of a working group for multi-country cooperation mechanism (MCCM)

Expected Outcomes in Phase 2:

1. Improved resource knowledge and monitoring based on recognition of the importance and vulnerability of transboundary groundwater resources.
2. Enhanced cross-border dialogue and cooperation based on development of shared management tools, and recommendations for governance reforms focused on improving livelihoods, economic development, gender equality and environmental sustainability.

3. Improved capacity in groundwater governance, hydro-diplomacy and gender, and effective communication aiming at replication of project experiences and approaches.

Institutionalizing cooperation over the STAS: Nesting the STAS MCCM in ORASECOM: Bertram Swartz, Ministry of Agriculture, Water and Forestry, Namibia

The presenter described how the RBO of ORASECOM is changing, broadening its mandate to include the MCCM, which is nested in the Groundwater Hydrology Committee within ORASECOM. The MCCM also includes the country focal point persons and SADC-GMI as an invited member. Planned projects will be coordinated, facilitated and managed at a basin level through the secretariat.

The overarching objective of the MCCM is to transition from GGRETA project-driven cooperation to institutionalised cooperation. The short-term objective is to continue the joint study and characterization of STAS and generate flow of data feeding the STAS numerical model. The long-term objectives is to move from data collection and exchange to joint strategizing/ advising countries on management of STAS resources

Further Functions of the MCCM:

- Aquifer and aquifer-related data collection & exchange,
- Developing and maintaining the STAS joint borehole database and numerical model,
- Managing the data flow feeding the STAS model,
- Set-up the framework and work plan for joint monitoring activities
- Promoting and incorporating the STAS on the agenda of ORASECOM,
- Attracting donor interest and eventually funding for STAS-related activities,
- Liaising and coordinating joint activities with the SADC Groundwater Management Institute,

2.1.4 Cooperation on the Ramotswa Transboundary Aquifer

***RAMOTSWA 2 Project main findings and achievements*.** Kwazikwakhe Majola, Department of Water and Sanitation, South Africa

Key Findings from the first phase of the project:

- Management parameters related to groundwater recharge and withdrawal remain uncertain because of substantial data gaps. Broader data needs cut across different areas, including climate, hydrology, hydrogeology, socioeconomics and water supply and sanitation.
- Groundwater contamination is high, and vulnerability to pollution is high. One of the major issues concerns the risks associated with the proximity of pit latrines to boreholes.
- Incongruity between water requirements and available water. The discrepancy between local water availability and aggregate water requirements poses challenges to water security.
- Challenges in the implementation of policies and institutional compliance have hampered the effectiveness of water management.
- Inadequate water and sanitation access for vulnerable people, mostly the lack of financial resources to ensure sufficient and continuous service during drought conditions or infrastructure/service delivery failure.

RAMOTSWA 2 has commenced and it has five main components: Hydrogeological modelling, assessment of managed aquifer recharge (MAR) potential, agricultural water (Ag-water) solutions, RIMS expansion and the development of a joint strategic action plan (JSAP).

Project main achievements to date:

- Strengthening cross-border dialogue including engagements with the Joint Permanent Technical Committee (JPTC) and Limpopo Watercourse Commission (LIMCOM)
- Agreement on boundaries of the Ramotswa Transboundary Aquifer and associated Ramotswa Transboundary Aquifer Area (RTBAA)
- Stakeholder engagement activities
- Managed aquifer recharge (review and synthesis MAR practice in Africa, development of MAR suitability map for RTAA)
- Hydrogeological modelling (steady-state model developed using MODFLOW 2005 in MODELMUSE on compartment 3)
- Ag-Water Solutions (3 irrigation schemes selected and evaluated, testing of water sensing technologies, training of farmers)
- Strategic action plan (more than 100 actions identified to improve water management in RTBAA, institutional framework was compatible with these, half judged to be transboundary in nature)

***RAMOTSWA 2: MAR and Hydrological Modelling*.** Girma Ebrahim, IWMI.

Hydrogeological modelling in Ramotswa aquifer: The main objectives of the Ramotswa Aquifer hydrogeological modeling is to 1) investigate the use and movement of groundwater recharge, discharge and storage process and 2) to assess the feasibility of MAR, through model scenario analysis. The steady state model being used in the Ramotswa provides an initial condition or reference level for transient model calibration. The forthcoming transient hydrogeological modeling will enable us:

- to determined the assimilative capacity of the aquifer without causing undesirable groundwater mounding
- to assess how the aquifer reacts for additional recharge
- to assess the recharged water will be stay in the aquifer for the required period

Assessment of MAR site suitability uses GIS and multi-criteria analysis. Preliminary results show that there is substantial potential for MAR in the Ramotswa Aquifer. About 52% of the Ramotswa Aquifer Flight Area (RAFA) was mapped as suitable and about 26% of the RAFA falls in a very suitable class. About 63% of the RTBAA belongs to the suitable class, while 16% is very suitable.

RAMOTSWA Information Management System. Geert-Jan Nijsten, Senior Researcher, IGRAC

RIMS moves data sharing beyond just reports, to visualisation and sharing through maps. In the Ramotswa we gathered 85 different maps with underlying data in Phase 1, and in Phase 2; we are still expanding the data and outcomes from MAR and hydrogeological modelling investigations will be incorporated.

Currently, RIMS can do the following:

- View maps (e.g. geology, climate, socio-economics)
- View data from statistics offices (e.g. population, employment)
- View water supply in an area (households)
- View pollutions risks (e.g. waste disposal)
- Create your own maps with multiple overlays
- Get information behind the maps (that is tabulated)
- Download data to excel or shapefile format
- Can filter data (e.g. locate boreholes with water supply)
- View interpreted cross sections

***RAMOTSWA 2 Joint Strategic Action Plan/Linkages to RBOs*.** Piet Kenabatho, University of Botswana

Rationale for a JSAP in the Ramotswa Transboundary Aquifer Area (RTBAA) is to undertake to identify and prioritize investments and actions that can be pursued to enhance the benefits derived from the shared water resource. The JSAP process followed four major steps:

1. Conceptualising JSAP vision and framework
2. Identifying and considering actions
3. Reviewing compatibility of actions with existing institutional frameworks
4. Filtering and prioritizing actions; estimating cost and feasibility

Key actions identified in JSAP link project outcomes to RBOs. In Ramotswa, an advisory committee to advise on the project's strategic direction and prioritization of key areas and topics was set up to Foster incremental transition from project committee to standalone working committee, securing support from national authorities and endorsement from the Joint Permanent Technical Committee (JPTC). Among its potential roles is to report to the JPTC on key areas of progress. The committee will be composed of officials from the water departments from the two countries, a SADC representative, two members from the JPTC, the Limpopo watercourse Commission (LIMCOM) secretary and a research expert from IWMI.

2.1.5 Lessons Learnt from the Stampriet and Ramotswa Experience: Implications to the SADC Region

***Sharing the STAS and experience in the SADC region*.** Fikile Guma, Department of Water and Sanitation, South Africa

The biggest lesson is the need to embed this in regional frameworks (SADC, RBOs and JPTC)

***Groundwater data management in the SADC region*.** A Discussion

Several points emerged from this discussion:

- Groundwater data management in the SADC region can be housed by SADC-GMI, but they will need to increase human and technical capacity to take on this task.
- Countries do have substantial data and are willing to share the data, however the challenge is inadequate platforms to store and share data
- Data dissemination is hampered by different technological resources among countries

- Countries do have a lot of raw data, but the challenge is that it has many gaps. For example, data is missing for some years.
- Some important data is owned by private agencies that profit from selling it and therefore cannot be shared publicly

Institutionalizing cooperation over transboundary aquifers in the SADC region: Potential for replication Discussion

In this section, participants from member states discussed the challenges of operationalising groundwater cooperation, and offered recommendations.

- While there is a lack of resources to aces and share data, data sharing is an urgent need. A possible solution is to form working groups across states so that officials can share data somehow.
- Some institutional changes are necessary. Gathering data is costly but all data collected by public money should be shared
- Resources should be mobilised to develop a harmonised protocol of collecting and storing data in the region. Currently different systems are used and this not useful
- Grow institutional capacity to gather high quality data as this is seriously lacking

2.2 Sessions on Day 2

2.2.1 Consideration of Groundwater in RBOs

Presentations of Needs Assessment and Consultation to support groundwater Management in African RBO's (from 2013). Karen Villholth, IWMI

Capacity/needs assessment in RBO's was done in nine RBOs in Africa and followed six general steps:

- Get baseline profiles about the targeted RBO's (a desk study)
- Develop interviews with key stakeholders
- SWOT analysis
- Compilation of results and recommendations
- Stakeholder workshop
- Training manual for best practices; a good starting point for RBO's

Some RBOs were more engaged than others and a SWOT analysis cannot be done across the whole of Africa that is completely representative of everyone - some RBOs are more developed in regards to their groundwater management. A policy brief was developed to distil some of the opportunities and requirements for RBO's to address groundwater, and can be downloaded online. An early review of TBA mapping exercises in Africa was done, and it produced maps overlapping TBAs with RBOs as a first step to identify who may be responsible for managing which parts of the aquifers. The uptake from this has been encouraging. The results contributed to the transboundary water assessment programme (TWAP) and even the African Network of River Basin Organizations (ANBO) announced this TBA training on their website.

From this assessment, we learnt that using existing organisations as platform to setoff is efficient. Further, providing coherent and user-friendly interdisciplinary information material and tools is crucial for effective uptake. And, a transboundary focus can be used to enhance attention to local and smallholder dependency on groundwater

Currently, the SDG focus on TBAs is a vehicle for more attention to groundwater. Bridging the gap of technical and management aspects is becoming the norm. We should explore a common framework for the cooperative management of TBAs in the SADC

Presentations by RBO representatives

Inkomati: Carlos Chaguala

The Inkomati is a small river basin shared between Mozambique, South Africa and Swaziland
We are in the process of establishing an organogram for the RBO. The RBO is not yet functional but there are catchment agencies in each country that are working. The mandate of the agencies encompasses groundwater management although systems for this are still underdeveloped. There are no committees yet as the RBO is still under development

To date, four transboundary aquifers have been identified in the catchment, although no map of the aquifers is available yet. The aquifers are:

- Sandstone aquifer
- Mswati granite aquifer
- Basalt aquifer
- Rhyollite aquifer

The main groundwater challenges in the basin are: Lack of borehole monitoring, and lack of relevant research.

OMVS: Papa Ndiaye

The OMVS includes four states: Guinea, Mali, Senegal and Mauritania. Its mandate is broad and we are involved in different missions (e.g. securing food). However, water management is quite a challenge as each country manages its own water resources differently. The OMVS houses a river basin management programme, which aims at increasing capacity for transboundary water management. In terms of funding, the OMVS receives assistance from the World Bank but member states also contribute annually. The OMVS also secures revenue from selling the energy that we produce to the member states. This enables infrastructure maintenance.

We are now trying to create a separate agency that deals only with the production and sale of energy. Our organisation is very solid, and evolved from dealing only with navigation issues to the current multi-purpose mandate. The OMVS takes stakeholder participation seriously and takes any decision from the top to the bottom so that locals can have their opinion recognised. The OMVS has groundwater management schools in the countries but not a platform for this at the transboundary scale.

ORASECOM: Rapule Pule

The organizational structure has four layers:

- Forum of parties
- Council of Commissioners
- Task Teams
- Secretariat (executive secretary).

The groundwater committee comes under one of the task teams. The groundwater mandate in ORASECOM is provided for especially in article 8 91, which says *The objective of the Commission shall be to initiate, enhance, and maintain greater collaboration between the Parties on matters relating but not limited to- (e) groundwater management and use*. ORASECOM has a Groundwater Hydrogeology Committee (GWHC). The function of the GWHC is to oversee and advise the technical task team and the Commission on:

- The development and management of the ground water resources of the Basin;
- the implementation of the relevant provisions of the ORASECOM Agreement and its revised versions, including the standardised form of collecting, processing and disseminating ground water data or information;
- the implementation of the ground water activities and projects in the Integrated Water Resources Management (IWRM) Plan for the Orange-Senqu River Basin;
- the implementation of the activities, projects, and programmes aimed at the development and management of the trans-boundary aquifers of the Basin; and
- Undertake any other activities that may be assigned to it by the TTT and/or the Commission.

Four TBAs have been identified to date. The ongoing project being mobilised is the "Improved understanding of groundwater systems in the basin", with support of GIZ, to be concluded by June 2018.

Challenges in managing groundwater activities:

- Capacity constraints in terms of finances, sufficient groundwater dedicated human resource etc.
- Disparity in the level of assessment and diagnosis of the 4 TBA's
- Currently relying on external funding for most of the ground activities

Group Exercise: Identification and assessment of RBO's strengths, weaknesses, opportunities, threats (SWOT) in TBA management

Session devoted to a SWOT Analysis to gain a broader image of how groundwater is being considered within RBO's in the SADC region. It was an update to compare to the SWOT done in 2013. From discussions, some conclusion can be drawn:'

- Operational RBO's all have technical task teams with experts that fit within the RBO's mandate
- RBO's currently in place are still in infancy stage s
- When it comes to integrating groundwater in RBOs, there is no "one size fit all" solution

- Having several task teams for water will lead to mushrooming of uncoordinated decision-making points
- If groundwater is indeed a priority in the basin then it is worth having a dedicated committee to groundwater (as is the case in ORASECOM), otherwise, one technical TASK TEAM would suffice
- In the secretariats that already exist - there is a lack of capacity in terms of groundwater

2.3 Concluding Remarks

Participants gave a vote of thanks for a successful workshop and acknowledged the beneficial learning exchanges that took place. Notably, the SADC GMI recommended that after such a successful meeting, the region needs to move forward from these two projects and widen the scope. IWMI also emphasised the need to start moving towards conjunctive management and conjunctive issues. IWMI also highlighted other common threads emerging from the meeting including: i) a need to think about sustainable financing, and ii) the need to create a toolbox of options – learning from the initial efforts in Ramotswa and Stampriet – rather than impose a blueprint to cooperation. The SDC expressed confidence that groundwater management in the region is moving in the right direction and more financial and technical support is required going forward.

3. RAMOTSWA Parallel Session

***RAMOTSWA 2 Progress and Status*.** Jonathan Lautze, IWMI (Day 2)

Lautze gave an update on the five components of the Phase 2 of the RAMOTSWA project. First, the MAR Potential assessment is ongoing, with a report produced that examines MAR experience in Africa, and moving forward, the focus is now on MAR feasibility. Second, the Hydrogeological Modelling component, which is working on the prediction of future impacts on changes in water use and storage, has also produced a first report. Third, the agricultural Water solutions component has done a lot of work in identifying sites and collection of data. Fourth, the RIMS component has recently produced project outputs and potential to absorb the outputs looks good, but some work is still to be done. Finally, the JSAP has produced a first draft that has identified actions that can improve water management, and over the next year, will focus on refining and finalizing these actions, endorsing the JSAP and disseminating to key stakeholders

Currently ownership of the project is internal, and there is need to transition more responsibility to partners. Engagement with regional institutions has been made, but there is need to formalize this and map out how best to use LIMCOM, JPTC and others.

***Hydrogeological Modelling in the Ramotswa Aquifer*.** Girma Ebrahim. IWMI (Day 2)

Study areas is in the Limpopo River Basin in the Gaborone Dam catchment. Compartments within the aquifer were identified in Phase 1 and we are targeting the dolomite aquifer units. The specific study area is compartment 3 largely due to data availability and its transboundary nature. It is also currently in use and is an important supply for local villages.

In summary, GWET accounts for about 80% of total outflow while groundwater outflow across the model boundary accounts for 20%. Diffuse recharge is calculated at about 28 mm/a

The focused recharge from the river is the most uncertain parameter. The next steps are:

- Create a 3D hydrogeological transient model calibration and validation
- Select potential MAR sites based on the suitability mapping
- Determine soil infiltration rates of selected MAR sites
- Assess water resources availability for MAR, determine the source, quantity and period (months) where excess water for recharge is available
- Assess the quality of recharge water and apply geochemical modelling to predict chemical reactions of concern (e.g. PHREEQC)

***Ramotswa Information Management Systems*.** Geert-Jan Nijsten, IGRAC (Day 3)

RIMS began in July 2015 and by November 2016 it went public as a functional system with 80 map layers available in the public view, excel downloads for public view and password protected viewer for download of shapefiles . To ensure RIMS lasts, a set of short term and long term actions are needed.

Short term action plans:

- The two datasets we hoped to upload are not of good enough quality yet (sanitation and aquifer pollution vulnerability)
- A RIMS broacher will be created to promote the RIMS existence and expand the user group
- A user group study should be done
- Improve borehole database (bring in data from both sides and the old HG SADC database to have 1 clean file instead of 3)
- Improve RIMS managers through increasing uploading confidence. There is a big different in user capacity and therefore we need to get everyone to the same level through additional training for 10 people
- Add time series data to the system but there are maintenance complexities

For long terms action plans, it is about what is needed to keep the system alive after the project. Major challenges are:

- Keeping system updated; what content will exist in the future? Who decided this? How to ensure a quality control of the system?
- Knowing the users and promoting the use; how to expand? What users are targeted?
- Technical maintenance/hosting organization; software, map server, hardware, budget etc.

***Ag-Water Solutions*.** Manuel Magombeyi, IWMI (Day 3)

An initial assessment of agriculture preferences for both countries has been done. A report was produced: “Farmer needs and preferences for Agriculture Water Solutions in the Ramotswa Transboundary Aquifer Area” which reviews the agricultural context of Botswana and South Africa. In 2017 irrigation sites have been identified and selected and a situational analysis of the sites undertaken.

Planned activities for 2018:

- Farmer training on installation and operation of instruments
- Installation of water and nutrient monitoring instruments
- Installation of flow meters to measure the flow into the plots
- Installation of rain gauges at the selected sites
- Soil testing (before planting and after harvesting)
- Monitoring of soil moisture and nutrient losses by farmers and or farm managers for at least two cropping periods on each site
- Investigate factors (technical & socio-economic) that constrain the adoption of WFD and Chameleon

JSAP Overview. Jonathan Lautze, IWMI (Day 4)

Conceptualizing SAP vision and framework was done through consultation in South Africa and Botswana. A set of more than 100 actions that can improve water management has been identified through the following process:

1) Defining the objective: Aspirational objectives within SAP component (what you want to achieve - broad)
2) Selecting a target to clarify goals for achieving objectives (what you want to achieve - specific)
3) Choosing an action: broken down steps that will be taken to achieve each target (how you will achieve it)

Actions were listed in three broad categories: Managing water for sustainable use, availability and access, Enhancing institutions and capacity and Expanding research and knowledge

- A review of existing institutional frameworks shows that the identified actions are largely compatible with current institutions in both countries
- An exercise to filter and prioritise g actions; estimating cost and feasibility was done. About a third of the actions were considered “low hanging fruit” (actions that hold hope of implementation in the near-term at minimal expense. Half the actions were judged to be transboundary in nature. There were more short-term in two frameworks, namely; Institution and capacity and Expanding research knowledge

The next step is the consolidation and finalization of the JSAP; validation, endorsement and dissemination. A first draft was produced in March 2018.

Understanding gender issues for the government of the transboundary Ramotswa Transboundary Aquifer Stephanie Hawkins, University of Strathclyde (Day 4)

Hawkins discussed the gender issues that appear in the case of the Ramotswa TBA from a year long study of the aquifer area. A framework was used to analyse the results. It looks at:
Reach, Benefit and Empowerment. This was used against an analysis of laws and policies at multiple levels

Results show that in Botswana water source is mostly connected households to a supply but there are a large range of different uses. In terms of reach: 20-30% women were included in public consultation of water however, this is due to the high level forums that are used for this. Kgotla meetings tend to be gender sensitive but this is because of the different gender roles. Water utility (WUC) does not deal

with maintenance in good time. In terms of benefit: High level of disconnections resulting in benefit inequities due to a higher reliance on water vendors. Water quality is often not good in connected supplies (cloudy) leading to women relying more on vendors. In terms of empowerment: High tariffs; women often pay more limiting social development, water disconnections disproportionately impact women. Gender roles puts a burden of securing on women.

In South Africa water source is mainly though public boreholes but there are other sources such as private wells and distributed water systems. In terms of reach: There is unequal participation and lack of faith in water utilities due to a lack of communication. Women are represented but often gender issues are not. In terms of benefit: high levels of water shortage impact water use especially for domestic purposes. In terms of empowerment: borehole ownership speaks to empowerment and is preferred by woman due to the control they have over it. The only challenge with this is the cost of electricity. However, borehole ownership can create inequities within communities.

Conclusions included: i) Genders have different priorities of uses. By not taking into account both together, they impact each other, ii) there is a large gap between gender sensitive policy and implementation, iii) Water sources preferences and gender imbalance

***RIMS - Next Steps*.** RIMS Coordinators. (Day 4)

RIMS managers from both sides will collect and upload the data to the RIMS if owners agree for publication. The RIMS platform should be updated as new data comes in. Moving forward, they will aim to continue doing this. For example, by the end of March both countries will provide all of their inputs. A process for this however needs to be developed.

Moving forward, they are looking into more training for the RIMS personal alongside a brochure outlining in a simplified form what RIMS provides. GIS and uploading training is required for most and there is potential for support in this before June. Discussion on user and content issues identified that main targets are local governments, project members and national governments (departments not just related to water). Other users are students, consultants and LIMCOM. A range of technical data is required however social and economic/cadastral data could also be added. Outreach will be essential and this can be done is a variety of manners ad previously discussed. They will also be working on a RIMS Sustainability Plan to ensure the longevity of the platform.

Report Back on the First Advisory Committee Piet Kanabatho. University of Botswana (Day 4)

A meeting was held on Wednesday (8/3/18) and all members were represented (e.g., SADC-GMI, LIMCOM, IWMI). It went well and there is progress. The committee has given itself two weeks in which we should have completed the process of adopting the terms of reference. Any other issues will be discussed in subsequent meetings. In the long run, the project is likely to be housed within LIMCOM but there is a long way to go. In the mean-time it will go through JPTC.

Closing remarks (Day 4)

- The transition from project to program of sustainable cooperation needs to start as soon as possible since the Ramotswa project only has ~14 months left. However, there is positivity about this happening.

- On gender work, there has been a lot of work highlighting many issues on gender. How can these be practically included into other aspects of the projects as well as the results and recommendations?
- IGRAC has been mapping aquifer vulnerability to pollution. The map produced has been created from the SADC hydrogeological map and misses detailed information available from the two countries geological maps and the aquifer is in the wrong location. The rest of the geological maps are be needed to complete the study area, but they are not readily available

Closing remarks and meeting concluded.

4. Outcomes and Next Steps

The workshop fostered important progress in at least five key areas: First, key feedback on progress on both projects was shared with stakeholders – notably governments and funders. Second, valuable experiences were shared especially on the issue of collecting, storing and sharing groundwater data, challenges and options for including groundwater in RBOs and harnessing political support. Third, the workshop fostered important thought on how we can collectively take forward the lessons from the initial experiences in transboundary aquifer management in SADC. Fourth, an initial meeting of the Ramotswa Advisory Committee was held; the committee will play a key role as cooperation on the Ramotswa transitions from project-driven to country-driven. Fifth, the centrality of fostering greater ownership of activities in the RAMOTSWA project, and the need to begin handover to greater riparian management of activities, gained acceptance.

Next steps for the RAMOTSWA project include:

- Ag-water solutions: monitoring water use (installing sensors), and the training of farmers to use the equipment
- MAR select potential MAR sites and assess water availability for MAR
- Hydrogeological Modelling: create 3d hydrogeological transient model calibration and validation
- RIMS: continue loading missing relevant data and handover the platform to the countries
- JSAP: validation, endorsement and dissemination of identified actions

Annex 1: Attendance Registers

3rd Regional Meeting on Tools for the Sustainable Management of Transboundary Aquifers.

6 March 2018. Cresta Hotel, Gaborone

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3rd Regional Meeting on Tools for the Sustainable Management of Transboundary Aquifers

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3rd Regional Meeting on Tools for the Sustainable Management of Transboundary Aquifers.

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Annex 2: Workshop Agenda

Agenda

DAY 1 • Tuesday 6 March 2018

08:00-08:30	**Registration**
08:30-10:15	**Opening of the meeting**

08:30-09:00	Welcome remarks and opening of the meeting by the Governments of Botswana, Namibia, and South Africa:
	• **Ministry of Minerals, Green Technology and Energy Security, Botswana**
	  ○ *Dr Obolokile Obakeng*
	• **Ministry of Agriculture, Water and Forestry, Namibia**
	  ○ *Mr Bertram Swartz*
	• **Department of Water and Sanitation (DWS), South Africa**
	  ○ *Ms Deborah Mochotlhi (tbc)*

09:00-09:30	Welcome remarks by UNESCO-IHP, IWMI and SADC-GMI:
	• **UNESCO-IHP,** Rationale of the Stampriet Transboundary Aquifer System (STAS) assessment and objectives of the meeting
	  ○ *Mr Tales Carvalho Resende, UNESCO-IHP*
	• **IWMI,** Rationale of the RAMOTSWA Project
	  ○ *Mr Jonathan Lautze, IWMI*
	• **SADC,** Rationale of the SADC Groundwater Management Institute
	  ○ *Mr James Sauramba*

09:30-9:40	Welcome remarks by Donors:
	• **Swiss Agency for Development and Cooperation**
	  ○ *Ms Stéphanie Piers de Raveschoot*
	• **USAID**
	  ○ *TBC*

9:40-10:15	Welcome remarks by RBOs:
	• **BUPUSA**
	  ○ *Zvikomborero Manyangadze*
	• **CICOS**
	  ○ *Georges Gulemvuga*
	• **Inkomati**
	  ○ *Sindy Mthimkhulu*
	• **Lake Tanganyika**
	  ○ *Gabriel Hakizimana*
	• **LIMCOM**
	  ○ *Sergio Sitoe*
	• **ORASECOM**
	  ○ *Rapule Pule*

	• **OMVS**
	  ○ *Papa Ndiouga Ndiaye*
	• **ZAMCOM**
	  ○ *Hasting Chibuye*
	
	Roundtable for the presentation of participants

10:15-10:30	**Tea and coffee break**
10:30-11:00	**Transboundary waters cooperation and the Sustainable Development Goals**
10:15-10:30 *10:30-11:00*	• Measuring transboundary water cooperation through the SDG 6.5.2 indicator: process and outcomes of the first reporting exercise • Preliminary results and experiences from the SDG 6.5.2 baseline data collection in the SADC region ○ *Mr Tales Carvalho Resende, UNESCO-IHP* • Discussion
11:00-12:30	**Cooperation over the Stampriet Transboundary Aquifer System (STAS)**

11:00-11:20
 	
11:20-11:40
 	
11:40-12:00
 	
12:00-12:30
	• Stampriet Transboundary Aquifer System (STAS) assessment: main findings and achievements
	  ○ *Prof Piet Kenabatho, University of Botswana, STAS Assessment Report Coordinator*
	• Institutionalizing cooperation over the STAS: nesting the STAS Multi-Country Cooperation Mechanism (MCCM) in ORASECOM
	  ○ *Mr Bertram Swartz, Ministry of Agriculture, Water and Forestry, Namibia*
	• Sharing the STAS experience in the SADC region
	  ○ *Ms Deborah Mochotlhi, Department of Water and Sanitation, South Africa*
	• Discussion

12:30-13:45	**Lunch**
13:45-15:45	**Cooperation over the Ramotswa Transboundary Aquifer**

13:45-14:10
 	
14:10-14:35
 	
14:35-15:00
 	
15:00-15:15
	• RAMOTSWA 2 Project main findings and achievements
	  ○ *Mr Sakhile Mndaweni, Department of Water and Sanitation, South Africa*
	• RAMOTSWA 2 MAR and Modelling
	  ○ *Dr Girma Ebrahim, Hydrogeologist, IWMI*
	• RIMS – RAMOTSWA Information Management System
	  ○ *Mr Geert-Jan Nijsten, Senior Researcher, IGRAC*
	• RAMOTSWA 2 Joint Strategic Action Plan / Linkages to RBOs
	  ○ *Prof Piet Kenabatho, Associate Professor, University of Botswana*

15:15-15:45	• Discussion
15:30-15:45	**Tea and coffee break**
15:45-17:00	**Lessons learnt from the Stampriet and Ramotswa experience: implications to the SADC region**
15:45-17:00	• Lessons learnt on the in-depth assessment of the Stampriet and Ramotswa transboundary aquifers • Groundwater data management in the SADC region • Institutionalizing cooperation over transboundary aquifers in the SADC region: potential replication

DAY 2 • Wednesday 7 March 2018 (morning)

08:30-10:30	**The consideration of groundwater in RBOs (ctd.)**

	• Presentations of Needs Assessment and Consultation to Support Groundwater Management in African RBOs (from 2013)
	  ○ *Ms Karen Villholth, IWMI*
	
	• Presentations by RBOs representatives addressing the following issues:
	  ○ *Present governance framework (mandate, organogramme, etc…)*
	  ○ *The degree of legal formalization of GW issues (i.e. does the RBO have an explicit mandate to address GW issues?)*
	  ○ *On-going activities related to GW in the RBO*
	  ○ *Practices, experiences, and capacity for GW management in the RBO*
	  ○ *GW data sharing*
	  ○ *Main challenges encountered for raising awareness on GW in the RBO*
	
	• Q&A and Discussion

10:30-10:45	**Tea and coffee break**
10:45-12.30	**The consideration of groundwater in RBOs (ctd.)**
	• Group exercise: Identification and assessment of RBO's strengths, weaknesses, opportunities, threats (SWOT) in TBA management • Initialization of a process and learning alliance between a network of partners (institutions, experts, decision-makers, donors, and NGOs) for building and sustaining capacity for transboundary GW management in RBOs in the SADC region. • Agreeing on joint actions and ways forward
12:30-13:00	**Concluding Remarks**

	Concluding remarks by UNESCO-IHP, IWMI and SADC-GMI:
	• **SADC-GMI**
	  ○ *Mr James Sauramba, SADC-GMI*
	• **IWMI**
	  ○ *Mr Jonathan Lautze, IWMI*
	• **UNESCO-IHP**
	  ○ *Mr Tales Carvalho Resende, UNESCO-IHP*

	Concluding remarks by Donors:
	• **Swiss Agency for Development and Cooperation**
	  o *Ms Stéphanie Piers de Raveschoot*
	• **USAID**
	  o *TBC*
	
	Concluding remarks by RBOs:
	• **BUPUSA**
	  o *Zvikomborero Manyangadze*
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	  o *Papa Ndiouga Ndiaye*
	• **ORASECOM**
	  o *Rapule Pule*
	• **ZAMCOM**
	  o *Hasting Chibuye*
	
	Concluding remarks by the Governments of Botswana, Namibia and South Africa:
	• **Department of Water and Sanitation (DWS), South Africa**
	  o *Ms Deborah Mochotlhi (tbc)*
	• **Ministry of Agriculture, Water and Forestry, Namibia**
	  o *Mr Bertram Swartz*
	• **Ministry of Minerals, Green Technology and Energy Security, Botswana**
	  o *Dr Obolokile Obakeng*

13:00-14:00	**Lunch**

DAY 2 • Wednesday 7 March 2018 (afternoon)

14:00-17:00	**Parallel sessions**	
14:00-15:45	**Gender mainstreaming in groundwater governance**	**RAMOTSWA Phase 2 project**

	• Presentation of gender mainstreaming in groundwater governance:
	  ○ *Ms Michela Miletto, UNESCO-WWAP*
	
	• Presentation of gender consideration in groundwater-related policies in the SADC region
	  ○ *Ms Stephanie Hawkins, Univ. of Strathclyde*
	
	• Presentation by RBOs representatives addressing the following issues:
	  ○ *Presentation of gender strategy, plan (if any) and its state of implementation*
	  ○ *Main challenges encountered for raising awareness on gender mainstreaming*
	
	• Q&A and Discussion
		• RAMOTSWA 2 Progress and Status
		(Jonathan Lautze)
		14:00-14:50
		
		• Managed Aquifer Recharge Potential
		(Girma Ebrahim)
		14:50-15:45

15:45-16:00	**Tea and coffee break**	
16:00-17:00	**Gender mainstreaming in groundwater governance (ctd.)**	

	• Panel Presentation on the Gender Survey findings of the GGRETA 2 project: data collection; analysis; interpretation
	  ○ *Michela Miletto, WWAP-UNESCO*
	  ○ *Francesca Maria Burchi, WWAP-UNESCO*
	  ○ *Nelson Legketho, DWA Botswana*
	  ○ *Bothepha Mosetlhi, University of Botswana*
	
	• Q & A and Discussion
		• Hydrogeological Modelling in the Ramotswa Aquifer
		(Girma Ebrahim)

DAY 3 • Thursday 8 March 2018

Parallel sessions		
09:00-11:15	**Assessment of gender surveys in the STAS**	**Presentation of Ramotswa Phase 2 project**
	• Critical analysis of the data collected and processed of household surveys • Discussion	• Ramotswa Information Management System (Geert-Jan Nijsten)
11:15-11:30	**Tea and coffee break**	
11:30-12:45	**GGRETA Phase 2 workplan**	
	• Presentation of revised GGRETA Phase 2 workplan (March 2018 – December 2018) • Discussion	• Ag-Water Solutions (Manuel Magombeyi) • The Glen Valley Irrigation Project (Mr Bedi)
12:45-14:00	**Lunch**	
14:00-15:30	**Nesting of the STAS Multi-Country Cooperation Mechanism (MCCM) in ORASECOM**	**Field Trip to Well Fields and Wastewater Site**
	• Review of UNESCO and ORASECOM TORs for data migration to the Orange-Senqu Water Information System (WIS) • Assessment of the current capabilities of ORASECOM WIS and national information systems • Development of protocols for collection of data • Maintenance of databases • Training on operation and maintenance of databases	
15:30-15:45	**Tea and coffee break**	
15:45-17:30	**Nesting of the STAS MCCM in ORASECOM (ctd.)**	

DAY 4 • Friday 9 March 2018

Parallel sessions		
09:00-11:15	**Groundwater modelling for the STAS: challenges**	**RAMOTSWA Phase 2**
	• Calibration issues and review of workplan	Strategic Action Plan (SAP): Overview (Jonathan Lautze) 9:00-9:30 SAP: Group Activity (Davies Saruchera) 9:30-10:15 REMSAN Presentation (Harry Ylikangas) 10:15-45 Understanding gender issues for the governance of the transboundary Ramotswa Aquifer (Stephanie Hawkins) 10:45-11:15
11:15-11:30	**Tea and coffee break**	
11:30-12:45	**Groundwater modelling for the STAS: way forward**	**Looking Forward**
	• General discussion and feedback • Main decisions and way forward	SAP Ownership and Sustainability (Sakhile Mndaweni) 11:30-12:00 RIMS Next Steps (RIMS Coordinators) 12:00-12:20 Report Back on first advisory committee meeting (Piet Kenabatho) 12:20-12:35 Questions and Closing Thoughts 12:35-12:45
12:45-13:00	**Closing remarks**	
13:00-14:30	**Lunch**	