Report on the 3rd RAMOTSWA2 Joint Stakeholder Workshop

19-20 September 2018

Submitted by :

Implemented by:

In partenership 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 reflect the views of USAID or the United States Government.

Authors:

Resego Mokomela (IWMI)

Jonathan Lautze (IWMI)

Acknowledgements:

The authors would like to thank the participants of the RAMAOTSWA2 stakeholder workshop for their presentations and discussions that made the basis of the input in this report.

Acronyms and Abbreviations

DWA	Department of Water Affairs (Botswana)
DWS	Department of Water and Sanitation (South Africa)
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
ORASECOM	Orange-Senqu River Commission
RAMOTSWA	Ramotswa Aquifer Project
RBO	River Basin Organizations
RIMS	Ramotswa Information Management System
RTBAA	Ramotswa Transboundary Aquifer Area
SADC-GMI	Southern Africa Development Community Groundwater Management Institute
TBA	Transboundary Aquifer
TDA	Transboundary Diagnostic Analysis
USAID	United States Agency for International Development

Contents

1. Introduction

This report documents the presentations, discussions and recommendations of the 3rd RAMOTSWA2 workshop between stakeholders from Botswana and South Africa. The International Water Management Institute - Southern Africa (IWMI-SA) together with the International Groundwater Resource Assessment Center (IGRAC) convened a workshop which was held at the Farm Inn, Pretoria, South Africa for 1.5 days on the 19th and 20th of September, 2018. This was followed by an advanced Ramotswa information System (RIMS) training on the 20th and 21st of September, 2018 at the IWMI-SA office in Pretoria.

1.1 Workshop Objectives and Participants

The objective of the RAMOTSWA2 workshop was to present and review key progress that has been made on the Agricultural Water (Ag-Water) solutions component of the project, as well as progress on other project components including hydrological modelling, managed aquifer recharge (MAR), RIMS and the Joint Strategic Action Plan (JSAP).

Thirty-two (32) participants attended the RAMOTSWA2 workshop. The participants included representatives from; Department of Water Affairs (DWA-Botswana), Department of Water and Sanitation (DWS-South Africa), Water Utlilities Corporation (WUC-Botswana), IGRAC, Southern African Development Community - Groundwater Management Institute (SADC-GMI) and the project funders United States Agency for International Development (USAID). A complete list of the participants can be found in Annex 1.

1.2 Workshop Schedule

The RAMOTSWA2 workshop session was held for one and a half days, with an agenda that addressed all major project components (Annex 2). Day 1 of the workshop began with welcoming remarks from government of South Africa, the government of Botswana and USAID, the project funders. These introductions were followed by an introductory session, which included presentations about cooperation on transboundary aquifers in SADC and the project progress and future sustainability of Ramotswa Transboundary Aquifer Area (RTAA). The second session of the plenary covered presentations on current progress and possibilities for implementation of hydrogeological modelling and MAR. The third session of the plenary included presentations on progress-to-date on Ag-Water Solutions and experiences in the Motlhake scheme. The final session of the plenary included presentations on the sustainability of the RAMOTSWA project and linkages with key institutions to sustain efforts in the RTBAA.

Day two of the workshop contained two sessions. The first session of the plenary covered the RIMS to flag the highlights and lowlights of acquisition and management of data for the online database. The second session focused on the JSAP, focused on guiding participants to focus on the practical sustainability of actions and to identify actions that are low-cost and immediately implementable. This was followed by break out discussions to develop more detailed plans for development of project ideas that could be focused on for the next 8 months of the project. The workshops was concluded with remarks from the goverments of Botswana and South Africa and project partners.

2. DAY 1: Review of Presentations and Discussions in the RAMOTSWA Workshop

2.1 Welcome Remarks and Introduction

Welcome remarks were given by the South African government representative, Moloko Matlala, Acting Chief Director of Department of Water and Sanitation. He expressed his gratitude and support for the project, highlighting that the South African government believes in the importance of cooperative management of shared water resources as evidenced by their participation in the Joint Permanent Technical Committee (JPTC), the Orange Senqu River Commission (ORASECOM), and the Limpopo River Commission (LIMCOM). He added that the RAMOTSWA project, along with a similar project in the Strampriet Transboundary Aquifer Area, are key to future transboundary management projects. Additional welcome remarks came from Thato Setloboko, Director of Department of Water Affairs in Botswana, who was thankful for the invitation to the workshop and expressed interest from the Botswana government on the Ramotswa Transboundary Aquifer. He highlighted that the Botswana government supports cooperative management of the project and would like to implement sustainability measures beyond the project time frame, as this will improve livelihoods and food security in the Ramotswa area. Doreen Robinson from USAID provided further remarks, expressing that USAID has been privileged to fund the Ramotswa project from 2012 to 2019. She stated that she believes it was a good investment that will be key to future transboundary management projects within the SADC region. Introductions were then made by each participant in the workshop.

2.2 Cooperation on transboundary aquifers in SADC- Karen Villholth, IWMI

Karen Villholth from IWMI provided a presentation addressing the broader context of transboundary aquifer management in SADC. She highlighted the potential for conjunctive cooperation in transboundary management in the SADC region. There is a need to reflect on existing platforms, review what has been achieved in transboundary aquifers to date, and focus on key issues of cooperation in transboundary water management. She stated there is an underlying misunderstanding between transboundary water management of surface water and the reality that many people equally rely on groundwater for their livelihoods. Transboundary maps showed that productive aquifers are largely transboundary and have high storage, leading to increased attention on TBA's over the years.

Karen also stated that knowledge about transboundary aquifers has been increasingly understood over time, including their locations, characterization and impact on local livelihoods. A 2011 report on the SADC region investigated the intersection of drought vulnerability and groundwater, mapping groundwater-dependent urban areas, thereby increasing understanding on environmental impacts, groundwater dependent ecosystems (GDEs) and groundwater quality in urban areas neighboring transboundary aquifers. The Shire transboundary aquifer, shared between Malawi and Mozambique is flagged as a priority area on the aquifer hotspot scale. She emphasized that the Shire River Basin and its shared aquifers highlights that zooming into different scales reveals the complexity of hydrological interactions and brings greater understanding on the dynamics and importance of TBAs.

Groundwater based infrastructure (GBI) is a new concept that is motivating a change from groundwater being viewed as a problem to groundwater being viewed constructively as an opportunity. Examples include MAR, river bank infiltration, and underground taming floods (UTF), which is diversion of flash flood waters from irrigation systems to the surrounding ponds, infiltration basins or building wells for storage and extraction during dry seasons. The UTF has potential in the Shire River-Aquifer System but more analysis needs to take place.

2.3 RAMOTSWA2: Project Progress and Future Sustainability- Jonathan Lautze

Jonathan Lautze provided an overview of the progress-to-date of the RAMOTSWA project. The second phase of the RAMOTSWA project sought to incorporate sustainability into the management of shared water resources through; 1) harnessing institutional capacity to house key elements of the project, and 2) continuing key project components after project close, thereby instilling ownership of project activities in national governments and local stakeholders. Jonathan emphasized that the presence of multiple River Basin Organizations (RBOs) in the SADC region (e.g. LIMCOM, JPTC, SADC-GMI, ORESCOM etc.) can help drive sustainability of the project.

RAMOTSWA project objectives are 1) to support a long term vision of cooperation on groundwater resources of the Upper Limpopo Basin using Ramotswa as a case study, and 2) to facilitate and promote joint management on groundwater governance with research and scientific knowledge being the key drivers of this project. These were the objectives from Phase 1, which have continued into Phase 2.

Jonathan stated that the plan of the workshop was to highlight progress and major components of Phase 2 which include 1) hydrogeological modelling and MAR potential, 2) Ag-Water solutions, 3) RIMS expansion, 4) the Joint Strategic Action Plan, and 5) gender impacts. There has been good progress on Ag-Water solutions in the last six months, led by Manuel Magombeyi. The objective was to provide water sensing and monitoring tools in irrigation schemes around the RTBAA to assess their impact on water productivity on small farms by decreasing water use and improving crop yields. The practices were implemented in three irrigation schemes in Motlhake (South Africa) and Glen Valley and Mogobani (Botswana).

Progress on hydrological modelling of the RTBAA has focused on recharge, discharge and storage capacity of the aquifer, with the aim to predict future effects on the aquifer from climate change. The MAR component focused on assessing the practical suitability of MAR in the Ramotswa through identifying suitable sites, storage capacity and potential water sources. This study of MAR potential was primarily informed by modelling activities. Various suitable sites where MAR can be implemented have been identified and some explorations have been done on the sites along with analysis of potential water sources for MAR techniques and infiltration testing.

The workshop objectives for the Ramotswa Information System (RIMS) aimed at updating the database with new information on hydrocensus and water quality data, dam maps or related water resource maps, topography etc. Jonathan stated that progress on this information system would be further elaborated during the workshop, followed by a RIMS GIS training.

There has been progress on the JSAP from initial conceptualization includes establishing a joint framework and shared vision and identification of targets and actions. The compatibility of these actions with the institutional capability of the two member states was assessed. In addition, action swere classified according to time frame, cost, and whether the action required national or transboundary cooperation. Final steps on the JSAP would be to move towards endorsement and approval of the SAP.

2.4 Hydrological Modelling, MAR and water quality

2.4.1 Hydrogeological Modelling and Managed Aquifer Recharge - Girma Ebrahim

Girma Ebrahim presented progress on the hydrological model over recent months, reminding participants that a hydrogeological model is needed to understand the behaviour of the aquifer. The first steps involved developing a conceptual model to conceptualize where the water is coming from, how the river flows through the channel, how best to define boundary conditions, and define the role of dykes. This first step gave an idea on how the aquifer is characterised and the possible flow directions which can be used for the model. A few assumptions were made that had to be adjusted over time. The model was tested with available data to calibrate the model to the study potential in order to investigate the potential for MAR in the RTBAA. There are challenges of gaps in data from borehole monitoring in 2015 and 2016 which affect the uncertainty of predictions and the accuracy of the conceptual map. For recharge rates, only diffuse recharge was implemented and not focused recharge, due to the fact that the river bed has a low recharge rate. This low recharge rates means that the infiltration rate is low but there are areas where there is possible infiltration along the riverbed. With stream flow data analysis unavailable, it is difficult to predict if the river is a net gaining or net losing river. It was noted that this is still a work in progress to calibrate the model to best suit the study area and to incorporate the dolomite fractures and Lephalale formations within the model.

2.4.2 Water Quality characterization and risk assessment of mixing waters during MAR using geochemical modelling – Simon Trust

Groundwater component

Simon Trust presented his work on water quality characterization and risk assessment of mixing waters during MAR. The research objective was to analyze the available groundwater and surface water quality on spatial temporal trends of contaminants and to further review chemicals in Karst aquifers for potential MAR. Geochemical modelling was used to assess water quality due to mixing different waters in a MAR context. The groundwater characterisation was based on 39 boreholes in and around Ramotswa village. Many boreholes were inconsistent, therefore a selection of 7 representative boreholes was made based on the criteria of time, space and geology. The boreholes selected were evenly spread around the area and the available data was analyzed for pH, electrical conductivity, total dissolved solids, nitrates and total solids. Trace elements from 2001 to 2004 were analyzed, such as iron and maganese. More attention was placed on nitrates, due to the existence of pit latrines in the area .

The available data showed the dominance of magnesium and calcium bicarbonte, which is typical of dolomite groundwaters. The initial assumption was that the closer the borehole is to the river channel, the higher the concentration of these ions, due to the fact that it is more Karstified there. It was then assumed that there is more dissolution of dolomite and therefore higher concentration of these ions. However, this theory could not be confirmed because there were boreholes close to the river which were low in those ions and other boreholes far away which were also high in iron and magnesium bicarbonate.

The Ramotswa wastewater treatment plant is about a kilometer away from some of the borehole sites. This could be the reason for nitrate water contamination reaching 200µg/l where normally the concentration would be around 20 µg/l. It is well known that the concentration of nitrate has been high in the Ramotswa well field, and that this trend is associated with anthropogenic influence. This is supported by the fact that almost all the boreholes that have high nitrate concentration are inside the population of the Ramotswa catchment. This poses a very serious threat to MAR, because if the high levels

of nitrate are due to leakages, then if MAR causes water levels to rise further, the stored water may come in contact with pit latrine leakages and increase nitrate concentrations.

Surface Water component

Assessing surface water quality was a challenge due to the fact that there was practically no water in the river channel. However, surface water data from the Pule project was used, which was an assessment of surface water quality in 2017 that contains a few data gaps. The data indicated that the river was dominated by magnesium, calcium and the samples showed relatively high levels of pH. Nevertheless, the river remains a more likely injection water source for MAR. Threats of physical clogging will likely be a challenge due to high amounts of sediments in the dry eroded river beds, posing a threat to MAR techniques, particularly in the event of flash floods. This must be considered before MAR implementation. The Karst aquifer of Ramotswa has a fast transportation rate, therefore the residential time is relatively short for aquifer neutralisation of contaminants. When mixing two waters of different sources it is highly likely that the long term equilibrium in groundwater and the aquifer minerals will be disturbed. In Karst aquifers the most likely reactions are dissolution of the dolomite and oxidation issues related to manganese and calcite precipitation.

2.5 Agricultural Water Solutions

2.5.1 Agricultural water solutions – Manuel Magombeyi

Manuel Magombeyi presented on progress of the Ag-Water Solutions component of the project, which sought to test various tools to improve water productivity on smallholder farms in the RTBAA. There was a need to improve agricultural water usage in the Upper Limpopo Basin, so a solution was needed that would increase the groundwater use efficiency in the irrigation scheme. Many irrrigation schemes need to implement “crop per drop” which will use less water while simultaneously providing adequate yield for the intended purposes and to enhance food security and livelihoods.

The first objective of the Ag-Water Solutions component was to assess the impact of simple water and nutrient-saving tools (chameleon sensor, wetting front detector and electrical conductivity meter) to achieve improved soil-water-nutrient-salt management for improved yield and water productivity for smallholder irrigation farms in Ramotswa area. The second objective was to assist farmers to monitor the benefits of adopting new practices worthy of protecting the environment

Progress has been made on assessing the impact of using soil-water, nutrient and salt monitoring tools in smallholder irrigation in Ramotswa Aquifer area. Three simple tools were introduced, the Chameleon Soil Moisture Sensor, the FullStop Wetting Front Detector and Electrical Conductivity meter, which represent different levels of soil moisture, nitrate and salt in the soil by displaying different colours. These tools form the basis of an experiential learning system for smallholder irrigators.

The data criteria for irrigation farm selection around Ramotswa area were based on the follow: farm size (> 2ha), purpose for production, presence of smallholder farmers and baseline information of farms. Preliminary field visits were done in June (South Africa) and October (Botswana) in 2017. The tools were then installed in three irrigation schemes, the Motlhake Scheme in South Africa and the Mogobane and Glen Valley irrigation schemes in Botswana. Interviews with farmers were conducted after every harvest to understand the challenges and preferences of male and female farmers or farm managers on the use of these tools. The process was monitored by data analysis indicators to determine whether the impact was achieved by comparing trial and control plots. The indicators monitored were: water use and

fequency of irrigation, nutrient loss beyond root zone, soil salinity levels, labour, crop yield, water productivity and crop production income

There has been significant irrigation water and nutrient savings since the installation of the tools and improved yield and water productivity under smallholder farming. The monitoring tools reduced over and under watering, reduced crop stress, improved fertilizer uptake, optimized salinity management, reduced energy use and saved costs. These monitoring tools can reduce water and nutrient loss applied at plot and scheme scales in diverse environments, resulting in energy and labour savings as well. Increased productivity and profitability through improved management of water and nutrients; sustainable water and salinity management; and improved return on investment from irrigation infrastructure, thereby increasing food security. The monitoring tools showed areas that needed improved management in smallholder irrigated areas and the famers noted that sometimes they were unknowingly over irrigating and washing nutrients beyond crop root zone.

2.5.2 The experience in the Motlhake Scheme – Thabang Sebogodi

Thabang Sebogodi, a farmer involved with the trials, shared his experiences on using monitoring tools in smallholder irrigation scheme of Motlhake, Zeerust in South Africa. The monitoring process had the control and trial plot activities in the irrigation farms. In the control plot the farmers irrigated using their normal irrigation methods. In the trial plot the irrigation methods were informed by the monitoring tools. For example, if the soil moisture sensor was blue, it indicated that there was no need to irrigate the field. Since the implementation of the monitoring tools, the number of irrigations per week has reduced, the nitrate loss has reduced, labour for irrigation has reduced as well as reduction in herbicides. However, although the monitoring tools have good implications there is a challenge on distributing water evenly across the field. Thabang suggested that these practices could be sustained by sharing results with the Department of Agriculture and implementing a database for farmers to review water saving and nutrient loss tips and view demonstrations on how to use these monitoring tools.

2.6 Sustainability of the RAMOTSWA project: Linking with key institutions

2.6.1 SADC-Groundwater Management Institute – Brighton Munyai

Brighton Munyai from SADC-GMI presented on the need to integrate project results from RAMOTSWA into key institutions. He stated there is need to implement priority actions in the work-programme for groundwater in the SADC Regional Strategic Action Plan for Integrated Water Resources Management (RSAP IV, 2016–2020). The necessity for cooperation on shared aquifers in the region is stated as related to alignment with the *Revised SADC Protocol on Shared Watercourses* of (2000) and river basin agreements across the region. The SADC member states often share similar groundwater challenges within the estimated 30 shared aquifer systems identified across the region. The project componets for SADC-GMI incorporate transboundary cooperation to facilitate integration and harmonisation of groundwater practices at national and basin levels and to support transboundary aquifer management in Member States. This must be in collaboration with relevant stakeholders to find solutions to challenges and to contribute to the sustainable and equitable development of the RTBAA through consensus building on priority activities and investments in the use and development of the transboundary Ramotswa Aquifer and related resources.

Brighton clarified the institutional structures for making progress with the JSAP. The RAMOTSWA project SAP framework contains three components; 1) Managing water for sustainable use, availability and access; 2) Enhancing institutions and capacity, and 3) Expanding research and knowledge . The Joint

implementation of SAP need to be anchored within and supported by existing institutions for natural resource management in the RTBAA. The Limpopo Watercourse Commission (LIMCOM), Joint Permanent Technical Committee (JPTC) and SADC-GMI. However the Proposed institutional arrangements for nesting the RTBA project is the JPTC. The JPTC will be anchored in LIMCOM and the JPTC will establishes a Sub-Committee on TBAs and include all the TBAs in the Limpopo River Basin**.**

2.6.2 Embedding transboundary aquifer cooperation into an RBO: Learning from ORASECOM – Thato Setloboko

Thato Setloboko from ORASECOM shared his experiences with embedding transboundary aquifer cooperation within an RBO. The Orange-Senqu River Basin area is approximately 1 million km^2 and is shared among Botswana, Lesotho, Namibia and South Africa. The Orange-Senqu River Basin Commission (ORASECOM) was established in 2000 between the four countries and aligned with the Revised Protocol for Shared Watercourse Systems of SADC. The Council is the highest body of ORASECOM and serves as advisor to the parties on matters related to development, utilisation and conservation of the water resources in the river system.

ORASECOM exchanges information and enables free flow of data to provide equitable understanding of the system. The RBO is involoved in significant projects in the basin and advises national governments of its member countries. A basin-wide Integrated Water Resource Management Plan (IWRMP) has been developed for the basin. ORASECOM also actively engages with other RBOS in the SADC region. The challenges within the basin are water scarcity, which is compounded by climate change, defining equitable sharing and benefit sharing with limited available water resources, managing stakeholder expectations (e.g. the role of ORASECOM in meeting MDG / SDG targets and development of strategic infrastructure) and clearly defining various roles and relationships with bilateral institutions.

2.6.3 Joint Permanent Technical Committee- Benny Sithole

Benny Sithole presented on the role of the JPTC in transboundary water issues between Botswana and South Africa. The objective of the JPTC is to act as technical advisor to member countries on issues related to 1) measures that can be implemented by one or both countries to alleviate short term problems resulting from water shortages during periods of drought, 2) the joint or separate investigation by countries of the development of any water resource of common interest including construction, operation and maintenance of any water work, and 3) the monitoring of exchange of relevant information and other relevant data, including timely exchange of information needed for the implementation of alleviating measures during drought periods and for flood forecasting and warning systems as well as the control of the quality of water resources and the prevention of pollution and soil erosion.

Benny described that the RAMOTSWA project is set to support a long-term joint vision and cooperation on the shared groundwater resources of the Upper Limpopo region, where Botswana and South Africa potentially share significant groundwater resources. The project will report to the JPTC by virtue of the Ramotswa Aquifer is located in the upper Limpopo basin, and is shared between Botswana and South Africa. However, both countries will report progress on Ramotswa to the Limpopo Watercourse Commission (LIMCOM) as an institution responsible for the overall strategic planning and management of the Limpopo Basin. If there are any future projects emanating from the Ramotswa Project, the two countries will explore the possibilities of entering into an agreement provided such projects are not

covered by the existing agreement. The housing of the Ramotswa project is likely to be within the JPTC or LIMCOM.

2.7 Discussions: Towards Sustainability

To conclude the RAMOTSWA2 workshop for the day, participants were split into 4 groups regarding 1) Ag-Water solutions, 2) MAR, 3) RIMS and 4) JSAP to identify practical actions and discuss:

1. What is the plan for the next 8 months of the project?
2. What actions can be taken now to foster sustainability?
3. What contributions can your organizations make?
4. Are there key elements of your activities that can be "migrated" to a relevant regional platform (e.g. LIMCOM, JPTC, SADC)?

The groups were given an hour to discuss and present their findings as follows:

Discussions from Group 1: Managed Aquifer Recharge

The model has been calibrated and validated and infiltrations tests have been done in South Africa. Reporting of water budget analysis and sensitivity (river drain), boundary conditions have been reassessed with the aim of improving and establishing the recharge zone of the aquifer.

Sensitisation of stakeholders is key so getting buy in and agreeing on assumptions, capacity building and eventually handing over of the project to interested stakeholders for further and future monitoring of the transboundary aquifer by agreeing on data gathering and sharing platforms. The Ramotswa wellfields operational tools, can be nested within the JPTC and/or LIMCOM for effectiveness.

The main challenges for MAR is identifying the source of water, interpreting correctly the local geology in the dolomite aquifer and the scenarios which occur because they are mostly seasonal to no impacts on the river-aquifer system. The area receives about 460mm/y rainfall with seasonal flash floods. The ideal MAR techniques which can be implemented from the scenarios explained are; Injection wells, infiltration ponds and sedimentation dams.

Discussions from Group 2: Agricultural Water Solutions

To enhance Ag-water solutions and ensure that the monitoring practices are incorporated, identification of additional stakeholders (farmers) is needed including further training on use of the monitoring tools as well as agro-business dynamics. The Agricultural Board needs to establish a forum for users of the tools to share experiences including cross-border exchange visits. A second, season impact evaluation on the use of the tools is needed if possible to validate the usefulness of the monitoring tools.

Moving forward the monitoring tools must be mainstreamed within the Department of Agriculture or Department of Irrigation. The Departments would then request long-term commitment from suppliers of tools on supplying and providing technical support to farmers (including maintenance). Participation of farmers is important to the successful introduction of these monitoring hence the coordination role of the responsible Departments would be required (Departments of Agriculture, Irrigation, Water & Sanitation). There is scope to expand use of these monitoring tools across the SADC region through transboundary basin projects.

Discussions from Group 3: **Ramotswa Information Mangement System**

Several maps and borehole data information will be uploaded into the RIMS database. The agreement is that a template of the full database of boreholes from Botswana and South Africa will be shared in the RIMS protected viewer. A hydrocensus is will done on a monthly basis to quality control the template so it can eventually be in the public viewer section. Metadata can be used to warn users about the quality of the data.

The same protocol is to be followed for the uploading of small dams around Ramotswa area, authorization will be needed, and on-ground verification if those dams still exist as remote sensing displays. The RIMS database should feed from DWA and DWS frameworks and this can help with sustainability and less authorization processes on whether some information should be public or not. The overall RIMS ambition is to create a Ramotswa TBA area library for geo-data and documents, a tool for pre-feasibility analyses of groundwater development activities and a geo-database for resource monitoring and policy implementation. The Government will lead this database, define the extent of resource monitoring and incorporate into policy and management plan cycles.

Discussions from Group 4: Joint Strategic Action Plan

Some actions identified in the JSAP may be implemented by internal government departments, while others will require partnerships moving forward. Fostering practical sustainability requires clear identification of the actions for DWS and DWA to address individually and for joint initiatives to move from actions to well developed projects. There is a clear understanding among institutions of the growing interest in groundwater amoungst the SADC region, it should be highlighted that making a case for partnership and funding means demonstrating impact and aligning to the strategic goals of partners.

3. DAY 2: Review of presentations and discussions in the RAMOTSWA workshop

3.1 Ramotswa Information Management System (RIMS) progress- Geert-Jan Nijsten

By November 2016, 16 months after project inception, the project has managed to gather information from many different sources for hydrogeological and socio-economic assessment, formatted relevant data for upload into RIMS, Setup the RIMS and populate password protected viewer database and appoint RIMS managers. Phase1 of the project completed the following deliverables; a functional web-portal, more than 80 thematic map layers with public viewer access, excel downloads in public viewer, password protected viewer for download of shapefiles and appointed RIMS mangers with basic training.

There has been several ambitions for phase2 that have been highlighted and given a timeframe to be achieved the phase 2 components are; 1) Several additional preliminary data-sets to be uploaded into RIMS password-protected viewer (Vulnerability mapping, Contamination risks, MAR potential); 2) Improved background map with satellite images, 3) Incorporate RIMS in DWS data dashboard (NIWIS), 4)Formuate a RIMS brochure, 5) provide training for RIMS managers and additional staff and lastly 6) discussions on RIMS sustainability.

3.2 Practical challenges to data acquisition – Resego Mokomela

There has been little to no progress in adding or publishing new data on the database, there has been several delays in borehole data, compiling crucial groundwater datasets has proven to being a near impossible mission. Data is not shared easily and takes forever among member states, issues of communication amongst RIMS managers on deliverables regarding RIMS. There is sense that it will require

a lot of time and dedication before time series data can be shared because there is not many visible signs of initiative or ownership (other than with IGRAC).However through the RIMS trianing there was a positive commitment shared amongst the participants.Deliverables were shared with set dates to submit and upload to RIMS database.

3.3. RIMS sustainability in South Africa – Moses Mukota

To enhance awareness, RIMS Brochures and papers will be distributed at Conferences, Symposia, and relevant groundwater forums; Articles to be prepared for DWS Intranet and a link to NIWIS. The two member states need to agree on data sharing protocol (JSAP) and need to develop information requirements specifications from users and ensure that DWS-IWS forms part of the discussions to ensure that international protocols and norms are not violated. There is a need to also explore possibilities of integrating data from different TBA systems to create a country system on TBA. For the sustainability of RIMS, there is a need to formulate an action plan and identify key tasks that should be carried out and assign a task team.

3.4 Goals for the next 8 months and beyond- Geert-Jan Nijsten

There is a need to define concrete ambitions and agree on tasks until the end of the project (RIMS v2.0), link the RAMOTSWA project with one of the RBOs and an organisation which will be an official custodian of the RIMS and formally host the system, take initiatives to add new datasets and improve existing data. An organisation which Is in a position to execute quality controls on data and decide on publishing settings and has the capacity to do so, as well as the budget for the above activities. The overall question which needs to asked is that, is there a need for RIMS?, and who are the users of RIMS?

3.5 Joint Strategic Action Plan (JSAP) progress – Jonathan lautze

The strategic Action Plan initially started with a broader context which incleuded the following components:

- Conceptualizing SAP vision and framework
- Identifying and considering actions
- Reviewing compatibility of actions with existing institutional frameworks
- Estimating cost and time frame; prioritizing actions
- Consolidation of SAP, endorsement, dissemination , and implementation

Progress on the JSAP vision and frame work had mainly 3 components that was focused on the phase2 namely 1) Enhancing institutions and capacity 2) Expanding Research and Knowledge and 3) Managinging water for sustainable use, availability and access. There is notable regional cooperation in SADC, LIMCOM, JPTC as institutional structures and there are a number of common principles relevant to Botswana and South African laws and policies.

Moving forward with practical sustainability more than 100 actions that can improve water management in the RTBAA were identified and classified according to cost, time frame, national or transboundary and existing institutional framework compatible with these were determined however more than one-third of these actions were regarded as low hanging fruit – actions which hold hope of implementation in the near-term at minimal expense of these actions half of them were judged to be transboundary in nature and about 27 actions were prioritized to date.

4. JSAP Discussions-Towards Sustainability- Anita Lazurko

Concluding the RAMOTSWA2 workshop, participants were split into three groups. Each groups were assigned a theme of actions that emerged strongly from the JSAP. These themes included: 1) joint data monitoring, 2) future knowledge and assessments, and 3) institutional processes and structures.

The aim of the activity was to 1) differentiate between priority projects that can be funded and implemented internally by DWS/DWA, 2) identify and begin packaging joint projects for funders/partners, and 3) identify individuals from Botswana and South Africa to own next steps over the next 8 months. The groups were given one hour to discuss and present their findings. The findings of each group were as follows.

Group 1 : Joint Monitoring

Monitoring of boreholes should be done by government departments of both member states. Each department needs to review the adequacy of existing monitoring practices, databases and identify existing gaps. Monitoring of large groundwater abstractions should be done at a higher level. Alignment with existing frameworks of Botswana and RSA should emerge in quartely reviews and be merged with resilience to climate change vulnerability. The institutional structures in both countries have frameworks for such data-related projects, so there is no need for co-financing, and the national directorate of surface water and groundwater monitoring will have the responsibility to sustain the project objectives.

Group 2: Further Knowledge and Assessments

An action in the JSAP is to conduct a stakeholder assessment in the RTBAA, as currently, participants believed there had been no stakeholder analysis conducted in the region. Government departments implementing research on transboundary management were also identified as lacking. In Botswana, stakeholder engagement commonly occurs on a project basis. Expertise to conduct such assessments exists within the country, yet they may require additional partner funding. In RSA, the departments engage with local stakeholders and local water management institutions. Packaging such a stakeholder assessment into the language of the Sustainable Development Goals (SDG) and justifying with sub-components of livelihood and food security can help secure funding.

Group 3: Institutional Structures

Institutions need to agree on joint monitoring practices for harmonizing data collection and reducing data gaps. There needs to be a link with the JPTC for policy frameworks and project justification to funders. Establishing sub-commitees ideally promotes transboundary cooperation within the region.

5. Concluding Remarks

Participants gave a vote of thanks for being part of the RAMOTSWA2 workshop and acknowledged the beneficial learning platform that took place. Notably the DWS and DWA recommended that after such intriguing information, especially that of Managed Aquifer Recharge and risks of mixing waters, there is need to dedicate more time on such fundamentals, as they will ultimately be the key sources of the project moving forward in the region. IWMI also highlighted that there is a need to find institutional structures that will help further the RAMOTSWA project. Through securing financial resources and incorporation into governmental activities, sustainable structures for conjunctive management and conjunctive issues, may be attained. The need for more time to fully address key issues was highlighted by participants and noted.

Annexure1: Ramotswa2 Joint Workshop Agenda

Objectives: The third of four RAMOTSWA2 workshops will be held 19-20 September at the Farm Inn, Pretoria. The workshop will be followed by an advanced Ramotswa Information Management System (RIMS) training on 20-21 September at the IWMI-SA office in Pretoria, for RIMS managers and selected participants only. Overarching objectives of the workshop and training are to A) present progress and receive feedback on that progress, B) with the project advancing toward its completion, discuss ways to achieve sustainability, C) strengthen capacity in Geographic Information Systems (GIS) and ability to utilize the RIMS.

A. Present and review progress

Key progress has been made on the ag-water solutions component of the project, and progress has been made on other project components including hydrogeological modelling, Managed Aquifer Recharge (MAR), RIMS and the Joint Strategic Action Plan (JSAP). Progress on each of these components will be presented.

B. Sustainability

Sustainability can be interpreted one of two ways: i) sustainability at an institutional level, ii) sustainability of practical progress. Both are important. This workshop will give emphasis to both forms of sustainability.

Institutional Sustainability At an institutional-level, sustainability can be interpreted as "housing", "nesting", "handover" of key elements of project progress to an organization or organizations that will maintain and promote such progress.

Practical Sustainability At a practical-level, sustainability can be interpreted as continued forward-movement on key components of the project. Continued activity on key elements of the project will in turn likely require institutions such as DWS and DWA – i.e., institutions that will remain active on the Ramotswa post-project – to own and advance Ramotswa-focused activities.

C. RIMS Training

This is a dedicated training for RIMS managers and selected participants who may be involved in the technical management and maintenance of the RIMS in the future. The training will consist of 3 components: i) Introduction to Geographical Information Systems, including hands-on exercises. ii) RIMS advanced modules and features for maintenance and updating of RIMS (introduction and hands-on exercises) and iii) Agree on workplan for remainder of the project period and for development of RIMS Sustainability Plan

Further details on the RIMS Training including the program have been provided separately to participants of the RIMS training.

DAY 1 • Wednesday 19 September 2018

08:00-09:00	**Registration**
09:00-10:00	**Opening of the meeting (Moderator: Selebaleng Gaebee, DWS)**
09:00-09:20	Introductions and welcome remarks by the Governments of South Africa, Botswana and USAID
09:20-9:45	Cooperation on transboundary Aquifers in SADC: Why, where, where to? (Karen Villholth, IWMI)
09:45-10:10	RAMOTSWA2: Project Progress and Future Sustainability (Jonathan Lautze, IWMI)
10:10-10:30	**Tea and coffee break**
10:30-12:00	**Hydrogeological Modelling and MAR (Moderator: Keetile Keodumetse, DWA)**
10:30-11:10	• Hydrogeological Modelling and Managed Aquifer Recharge (Girma Ebrahim, IWMI)
11:10-11:20	• Questions and Answer
11:20-11:45	• Water quality characterization and risk assessment of mixing waters during MAR using geochemical modelling (Simon Trust, IWMI)
11:45-12:00	• Questions and Answer
12:00-13:00	**Lunch**
13:00-14:00	**Agriculture-Water Solutions (Moderator: Charles Nkile, DWA)**
13:00-13:30	• Agricultural Water Solutions (Manuel Magombeyi, IWMI)
13:30-13:45	• The experience in the Motlhaka Scheme (Thabang Sebogodi, Farmer)
13:45-14:00	• Questions and Answer
14:00-15:20	**Sustainability of the RAMOTSWA Project: Linking with key Institutions (Moderator: Sakhile Mndaweni, DWS)**
14:00-14:20	• SADC Groundwater Management Institute (Brighton Munyai, SADC-GMI)
14:20-14:40	• Embedding transboundary aquifer cooperation into an RBO: Learning from ORASCOM (Thato Setloboko, DWA)
14:40-15:00	• Joint Permanent Technical Committee (Benny Sithole, DWS)
15:00-15:20	• Discussion (Achieving Institutional Sustainability)
15:20-15:40	**Tea and coffee break**
15:40-17:00	**Breakouts: Towards Sustainability (Moderator: Rachel Mpe, DWS)**

15:40-16:40	MAR and Modelling	Agriculture Water Solutions	RIMS	JSAP / Advisory Committee Planning
16:40-17:00	Report Back			

DAY 2 • Thursday 20 September 2018

08:30-10:00	**Ramotswa Information Management System (Moderator: Moses Moehedu, WUC)**
8:30 – 8:50	• RIMS Progress in RAMOTSWA 2: Highlights and Lowlights (Geert-Jan Nijsten, IGRAC)
8:50 – 9:00	• Practical Challenges to Data Acquisition (Resego Mokomela, IWMI)
9:00 – 9:15	• RIMS Sustainability in Botswana – Progress in the next 8 months as a first step (Boch Somolekae & Keetile Keodumetse, DWA)
9:15-9:30	• RIMS Sustainability in South Africa – Progress in next 8 months as a first step (Moses Mukota & Sakhile Mndaweni, DWS)
9:30-9:45	• Goals for the next 8 months and beyond (Geert-Jan Nijsten / Arnaud Sterckx, IGRAC)
9:45-10:00	• Discussion
10:00-10:20	**Tea and coffee break**
10:20-11.40	**Joint Strategic Action Plan (Moderator: Pius Selebogo, DWS)**
10:20-10:40	• Review of Progress (Jonathan Lautze, IWMI)
10:40-11:40	• Moving toward Practical Sustainability: Ownership and Action in the next 8 months (Anita Lazurko, IWMI)
11:40-12:00	**Concluding Remarks/Ways Forward (Moderator: Resego Mokomela, IWMI)**

	Concluding remarks
	• **DWS**
	  ○ *Mr Sakhile Mndaweni, DWS*
	• **DWA**
	  ○ *Mr Thato Setloboko, DWA*
	• **IWMI**
	  ○ *Mr Jonathan Lautze, IWMI*

12:00-13:00	**Lunch (+for participants RIMS training: transfer to IWMI office)**