25-29th September 2016
43rd IAH congress
Montpellier, France
CORUM CONFERENCE CENTER

Abstract # 1580

Towards Integrated Transboundary Groundwater Management in Southern Africa
The Case of the Ramotswa Aquifer Shared between South Africa and Botswana

Y. Altchenko[1,2,3], K.G. Villholth[1], N. Lefore[1], G.Y. Ebrahim[1], M. Hanjra[1], G.J. Nijsten[4], A. Genco[5], K. Pierce[5], P. Kenabatho[6], B. Mosetlhi[6], H. Masundire[7], T. Moyo[8], M. Gomo[9], S. Mndaweni[10], N.I. Tobani[11], K. Keetile[12]

1

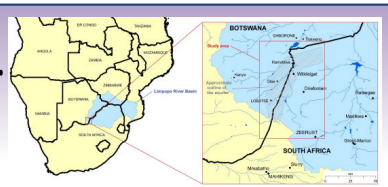
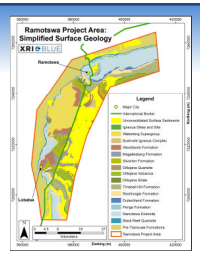


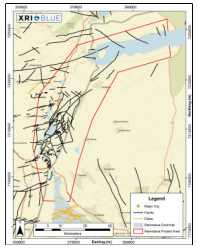
Figure1: Location RAMOTSWA Aquifer

The Ramotswa Transboundary Aquifer Area (RTBAA, 1,500km^2) located in the Upper Limpopo River Basin encompasses an aquifer shared between South Africa and Botswana. There is a growing interest to understand the role that the shared aquifer resources could play in addressing multiple-level water insecurity, drought and flood proneness and livelihood insecurity in the region. In this context, The Potential Role of the Transboundary Ramotswa Aquifer project funded by United States Agency for International Development (USAID-Southern Africa) under the Resilience in the Limpopo Basin (RESILIM) program and lead by IWMI, International Water Management Institute, was launched with the following objectives:

- ❑ To support a long-term joined vision and cooperation on the shared groundwater resources of the upper Limpopo region, where the member states share significant and valuable underground freshwater resources as well as space for enhanced subsurface water storage
- ❑ To facilitate and promote joint management and better groundwater governance focused on coordination, scientific knowledge, social redress and environmental sustainability, in order to reduce poverty and inequity, increase prosperity, and improve livelihoods and water and food security in the face of climate change and variability

2





The main aquifer in RTBAA is the Ramotswa Dolomite formation. Groundwater in the Ramotswa Dolomite is located in parts of the formation where karstification has occurred.

The Ramotswa Dolomite comprises five carbonate formations referred to as either "chert-free" or "chert-rich" dolomite, the latter being the most important water-bearing formations.

The aquifer is criss-crossed by impermeable dikes, which affect groundwater flow.

Figure 2: Simplified surface geology (Top). Dikes and faults (Bottom)

The project supported an airborne electromagnetic survey carried out in February 2016 in order to develop a 3D conceptual model of the aquifer for groundwater modelling and better management of the groundwater resources.

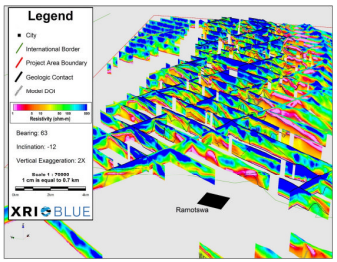


Figure 3: 3D Geological Model in the northern portion of the RTBAA

3

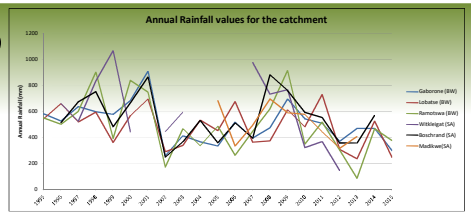


Figure 4: Annual rainfall time series in and around RTBAA for the period 1955-2015

Average annual rainfall (400-600 mm a^{-1}) is decreasing over time, while the temperature and evaporation data do not indicate significant temporal trends. Evaporation is about 2,000 mm a^{-1}. Annual evaporation from Gaborone Dam is higher than the water demand of Gaborone city.

More variability in spatial and temporal rainfall patterns is expected, as are increasing frequency and intensity of extreme climatic events like droughts and floods. 2015/2016 is already identified as a significant drought year.

4

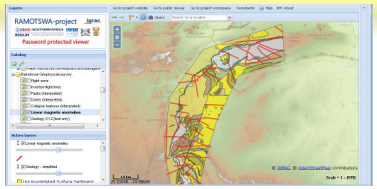


Figure 5: Ramotswa Information Management System (RIMS)

There is a mismatch between the water demand and the current local water availability in the RTBAA. The Botswana side is extremely dependent on water transfer from outside the area. While there is also a deficit on the South African side, an international water transfer operates from the Moladeti Dam in South Africa to Botswana.

Current abstraction from the Ramotswa Wellfield is less than 5% of water demand on the Botswana RTBAA side. Groundwater use is mainly for domestic and agricultural purposes. The rural population generally depends on groundwater. Within RTBAA, 82% of the population in South Africa lives in rural areas, while the corresponding proportion is only 9% in Botswana.

5

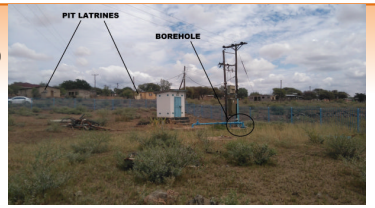


Figure 6: Ramotswa wellfield and its proximity to pit latrines

While groundwater from Ramotswa Wellfield is used for domestic purposes, groundwater in some wells do not reach potable standards for nitrate because of pollution from pit latrines. Thus, groundwater is blended with cleaner water from other water sources before supply. Pit latrine is the major sanitation system in South Africa and an important one in Botswana.

6 Conclusions

- Socio-economic and hydrogeological data have been collected, analysed and harmonized
- The baseline assessment highlights the key environmental and socio-economic issues and data gaps
- Water scarcity and groundwater pollution mainly from pit latrines is identified as priority threat
- Aquifer extent and surface geology have been mapped using airborne geophysical survey. This will serve as a basis for a conceptual hydrogeological model
- Ramotswa dolomite aquifer is identified as a key water-bearing unit, with water in karstic zones and along structural features being important
- RAMOTSWA Information Management System (RIMS) has been developed
- A Strategic Action plan (SAP) is in the process of development

7 References

Altchenko, Y.; Lefore, N.; Villholth, K.G.; Ebrahim, G.; Genco, A.; Pierce, K.; Woolf, R.; Mosetlhi, B.B.T.; Moyo, T.; Kenabatho, P. and Nijsten, G. (2016). Resilience in the Limpopo basin: the potential role of the transboundary Ramotswa aquifer. Baseline report. 15 June 2016.

Genco, A.; Pierce, K.; Woolf R. (2016) Conceptual Model, Hydraulic Properties, and Model Dataset Support Progress Report for the Development of Subsurface Mapping for the Transboundary Ramotswa Aquifer, that is part of the Limpopo River Basin, using Airborne Geophysics. XRI. August 2016

http://ramotswa.iwmi.org/

RIMS: https://ggis.un-igrac.org/ggis-viewer/viewer/ramotswa/public/default

(1) International Water Management Institute (IWMI), 141 Cresswell Street, Weavind Park, 0184, Pretoria, South Africa, y.altchenko@cgiar.org
(2) Ministère de l'Agriculture, de l'Agroalimentaire et de la Forêt, Paris, France
(3) Laboratoire METIS, UMR 7619 UPMC/CNRS, Université Pierre et Marie Curie, Paris, France
(4) International Groundwater Resources Assessment Centre (IGRAC), Delft, the Netherlands
(5) XRI Blue, 415 W Wall St, Suite 1300, Midland, TX 79701, USA
(6) Department of Environmental Sciences, University of Botswana, Botswana
(7) Department of Biological Sciences, University of Botswana, Botswana
(8) Postgraduate School of Agriculture and Rural Development, University of Pretoria, Pretoria, South Africa
(9) Institute for Groundwater Studies (IGS), University of the Free State, Bloemfontein, South Africa
(10) Department of Water and Sanitation, Directorate: Water Resource Planning Systems, Pretoria, South Africa
(11) Botswana Geoscience Institute (formerly Department Of Geological Survey), Lobatse, Botswana
(12) Department of Water Affairs, Gaborone, Botswana