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Implementing Integrated Catchment Management in the upper Limpopo River basin: A situational assessment

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ABSTRACT

A three-phase study was initiated as a way to promote Integrated Catchment Management approaches in the Limpopo River basin. This paper presents the situational assessment, which should enable De Beers to understand how their Venetia Mine operations are located within a broader and highly dynamic socio-economic and ecohydrological landscape as it pertains to water risks. The second phase, Risk assessment, aims to develop conservation interventions in the identified areas; the third phase will develop mechanisms for implementing water stewardship schemes to mitigate the shared water risks.

Analysis of the social-ecological system (hydrological, climatic, ecological, socio-economic and governance systems) of the Limpopo River basin indicates that the institutional arrangement of the Limpopo River basin is neither simple nor effective. The basin is rapidly approaching closure in the sense that almost all of the available supplies of water have already been allocated to existing water users. If the proposed ecological flow requirements were to be met for all of the tributaries, the basin would be 'closed'. On-going and projected land use changes and water resources developments in the upper reaches of the basin, coupled with projected rainfall reductions and temperature increases, and allocation of the flows for the ecological reserve, are likely to further reduce downstream river flows. The coupled increase in temperature and decrease in rainfall is of great concern for everyone in the basin, especially the poorer communities, who rely on rain-fed agriculture for their livelihoods. Increased temperatures also lead to increased evaporation from reservoirs and therefore result in a decrease in water availability. This will lead to increased abstraction of groundwater, especially from alluvial aquifers, and consequently an increase in river transmission losses and a decrease in river flows.

1. Introduction

The Limpopo River basin (LRB) covers an area of approximately 416,300 km^2 and the basin straddles portions of four southern African countries (Fig. 1): South Africa (45%), Botswana (19%), Mozambique (21%) and Zimbabwe (15%).

The basin is located in a summer rainfall region with a semi-arid climate. It is a low-lying region that lacks the orographic rainfall which induces a wet, subtropical climate along portions of the eastern escarpment to the north and south of the basin. Being a region that supports a large rural population which relies on rain-fed agriculture, the basin is thought to be highly vulnerable to the anticipated adverse impacts of induced climate change.

The project seeks to promote Integrated Catchment Management approaches in the LRB, in three phases: (1) Situational assessment, to develop a sound spatial understanding of the key ecohydrological areas of the basin; (2) Risk assessment, to develop suitable conservation interventions in the identified areas; and (3) Develop mechanisms for implementing water stewardship schemes to mitigate the shared water risks identified in phase II. Although there is no universal definition of Integrated Catchment Management, it is the coordinated planning and management of land, water and other environmental resources for their equitable, efficient and sustainable use at the catchment scale (Batchelor, 1999).

De Beers is uniquely placed to fill the leadership role, which is entirely lacking at the moment, and thereby take the lead in addressing the risks related to water scarcity in the basin. This is because De Beers relies heavily on water for its Venetia Mine

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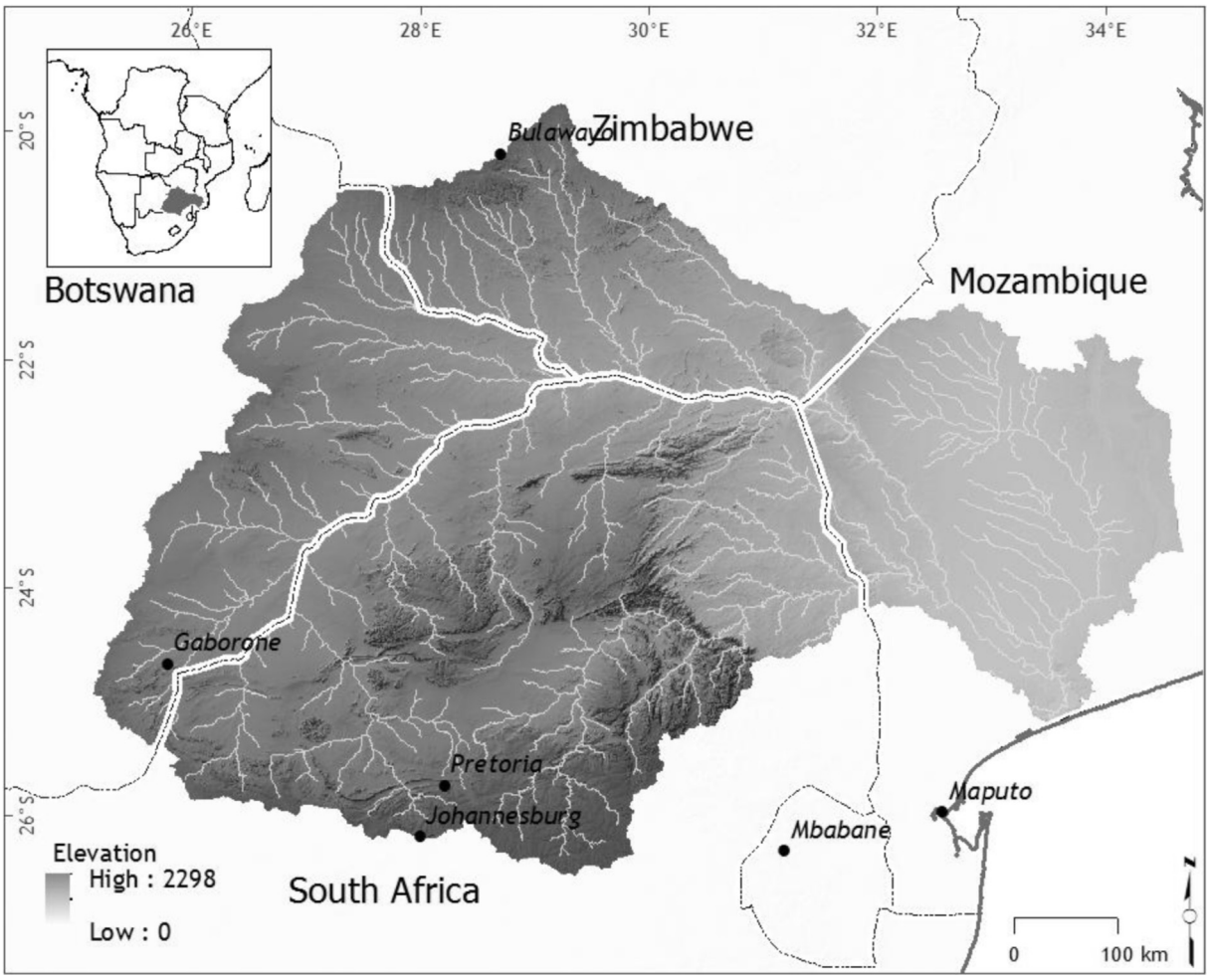

Fig. 1. Map of the Limpopo River basin. The higher elevation areas of the river basin are the Waterberg, Strydpoort Mountains and the northern portion of the Drakensberg range, with elevations reaching over 2000 m above sea level (m.a.s.l.) in the far south of the river basin. The lower elevation areas are the eastern coastal plains in Mozambique, with elevations below 7 m.a.s.l. (Inset shows the position of the LRB in southern Africa).

operations and is fully cognizant of the impact these activities have on the basin's water resources, and that a reduction in water availability will pose a major business risk to its operations. Thus, the situational assessment presented in this paper will enable De Beers to understand clearly how the operations of the Venetia Mine are located within a broader and dynamic socio-economic and ecohydrological landscape in terms of water risks. Furthermore, the lessons learnt in this initiative will offer useful insights that will enable the development of specific interventions in the areas surrounding the Venetia Mine operations, as well as for implementation in other southern African countries where De Beers operates.

2. De Beers Venetia Mine

Venetia, South Africa's largest diamond mine is located in the A63E sub-catchment and has an off-channel reservoir located in the A71L sub-catchment (Fig. 2). Both sub-catchments are have an arid to semi-arid climate with a high evaporative demand and a mean annual precipitation that is less than half of the world's average annual rainfall. The Mine is situated in the Central Zone of the Limpopo Belt where a large variety of rock types, quartzites, dolomitic marbles, magnetite rich quartzites, etc. are developed (Morton and Müller, 2003).

The diamond bearing of the current open pit mining operations that was commissioned in 1992, are expected to be depleted by 2012. In order to extend the life of the mine, De Beers is currently investing over US$2 billion in converting the Venetia open pit mine in South Africa into an underground operation. This will extend production at the site to 2043, with the potential to deliver an estimated 96 million carats and employ. Currently, the production averages 3 million to 4 million carats a year. Venetia Mine has already created more than 2500 permanent jobs and benefits thousands more people in the community of the Limpopo Province and in the rest of the country (Cutifani, 2013). The mine will support more than 8000 jobs directly and 5000 through the supply chain, benefiting the South African economy.

To sustain its current mining operations, the mine abstracts water from two independent local aquifers (Greefswald and Schroda), that lie close to the confluence of the Limpopo and Shashe rivers, within the Mapungubwe National Park. Schroda Dam is a 4.08 Mm^3 off-channel storage dam that was built to store excess floodwater, mostly abstracted from the Greefswald porous alluvial deposit. Water abstracted from the Schroda alluvial-aquifer well field merely augments the supply from Greefswald (Brown and Erasmus, 2004).

It is estimated that the 4.2 Mm^3a^{-1} of water abstracted from the aquifer (Fig. 3) represents about 6.25% of the total water