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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

# Water resource protection: Considering the research and development needs for South Africa

*A recently completed Water Research Commission (WRC) study has developed a research strategy to tackle the knowledge gaps in water resource protection in South Africa.*

## Background

Water plays a significant role in the economies of the agricultural, business and industrial sectors. Expanding populations, economies and climate change have put pressure on the quality and availability of water resources in South Africa. Water resource protection therefore becomes increasingly important for sustainable water supply management.

Hence, a review of the state-of-the-art of water resource protection in South Africa has been undertaken. Gaps in scientific understanding and implementation regarding water resource protection have been identified through literature review and discussions with stakeholders and experts. Aiming to improve the water resource protection in South Africa, a research strategy has been developed to tackle the most relevant of the identified gaps.

## Literature Review

The literature was reviewed with a system of pillars and layers in mind. The three pillars of the various disciplines and human activities significantly affecting water resource quality and quantity are: legislative framework; implementation and management; and scientific complex systems understanding.

These pillars comprise government, society and science. The pillars are broken into layers that focus on resource-directed measures (RDM) for water resource protection, water use authorisation/source-directed controls (SDC), and land use/land care and its impact on water resource protection, based on the mandate and chapters in the National Water Act (NWA), Act 36 of 1998.

Various issues regarding implementing the NWA have been identified; for example, the classification procedure identified in Chapter 3 of the NWA is not applicable to aquifers; furthermore, once a water resource has been classified, it cannot be reclassified. As a result, changes to water resources because of climate change or usage are not considered regarding classification. The concept of a Groundwater Reserve is not implementable.

The Water Research Commission (WRC) has set out a roadmap for research, development, and innovation (WRC, 2015). The two main focus areas are water supply and water demand. Sub-sections under water supply are improving governance, planning and management; improving performance and infrastructure; managing water as an economical and sustainable business; using more resources and utilising these resources to their full potential. Under water demand, the focus is on improving governance, planning and management; reducing losses of water; and improving pricing, monitoring and metering.

## Gap Analysis

The identified gaps in knowledge and understanding of water resource protection processes and implementation of associated regulations for the different water resources can be grouped into several aspects that are common for all or most of the water resources:

- The standard methodology for determining RDM is not applicable to all water resources and is mostly carried out at a scale that is insufficient for effective water resource protection. The methodology must be updated to incorporate potential impacts of climate change, changing land use and changing demographics. The different elements of the RDM methodology need to be aligned.

- The behaviour of emergent contaminants in different water resources and their impact on water resources have not been determined yet. The research programme into emergent contaminants should be expanded in this regard.
- The role of different water resources and their sub-types in catchment functioning is crucial for the complex system understanding that is required for integrated catchment management to be implemented.
- There is an insufficient spatial and temporal distribution of monitoring networks for most water resources. There is no standard regarding *how*, *what* and *where* to monitor and the subsequent process of quality control, data analysis and decision-making.

The identified gaps in knowledge and understanding of water resource protection processes and implementation of associated regulations for the different activities and challenges, impacting on water resources, can be grouped into several aspects that are common for all or most of the activities:

- The responsibility for authorising activities impacting on water resources is often split between several departments; for example, mining activities are authorised by the Department of Mineral Resources and the Department of Water and Sanitation (DWS). In reality, there is no cooperative governance as required for integrated catchment management and water resource protection.
- There are no case studies regarding the success of rehabilitation and remediation actions with respect to complying to RDM limits.
- The diffuse discharge and uncontrolled discharge from a range of land use activities are not regulated and do not have limits or standards determined.
- There is an insufficient spatial and temporal distribution of monitoring networks for most water resources and relevant activities. Hence, compliance and enforcement are lacking. The crucial parameters for monitoring the impact of agricultural, industrial or urban activities need to be determined.

It is important to note that advances in knowledge and systems in one pillar or layer does not necessarily translate into advances in the other pillars or layers. Hence, emphasis should be placed on translating scientific understanding into regulations and implementation strategies. Similarly, advances in complex systems understanding and its meaning for integrated catchment management must feed into updates of the RDM methodology and permit limits on RDM and SDC.

## Research strategy

The objective and strategic intent of follow-up research studies is to build knowledge for enabling water resource protection through integrated catchment management that supports adaptation to climate and socio-economic change.

The gaps identified and their causes were turned into research questions and prioritised according to the following criteria:

- Possible short-term gain by changing implementation (Pillar Society).
- Possible medium-term gain by reviewing and updating legislation/regulations (Pillar Legislation).
- Initiating a structured, longer-term programme to build knowledge (Pillar Science).

The following five research studies or programmes were prioritised:

- Auditing the current status of RDM and SDC implementation and enforcement.
- Establishing “model catchments” on a sub-catchment and catchment scale.
- Implementing awareness campaigns and training programmes for social behaviour changes.
- Rolling out a cooperative governance framework ensuring cooperative governance across all sectors and all tiers of government, and enabling enforcement of compliance with rules and permits.
- Reviewing and updating existing tools and best practice guidelines.

## Recommendations

The currently initiated research studies for emerging contaminants and recommended catchment management need to be expanded into research programmes and linked to the research programmes listed below.

The following research studies or programmes should be initiated by the WRC or DWS within the next financial year:

- Doing a detailed audit of the current status of RDM and SDC implementation and enforcement with the aim of highlighting crucial shortcomings not identified yet.
- Initiating the improvement and further establishment of “model catchment” on a catchment scale to study and understand the complex relationships between different water resources and different land use activities.
- Developing and rolling out awareness campaigns and training programmes for social behaviour changes.

- Developing and rolling out a cooperative governance framework ensuring cooperative governance across all sectors and all tiers of government, and enabling enforcement.
- Reviewing and updating existing tools and best practice guidelines.

Further research studies and programmes should be initiated within the next five years. Each research programme should include an implementation or roll-out phase, which then needs to be evaluated regarding the effectiveness of changes towards improved water resource protection.

To achieve this, an independent monitoring network and national monitoring programme has to be installed, monitored and evaluated by the DWS and or relevant catchment management agencies.

#### Further reading:

To obtain the report, *Water resource protection: Research report. A review of the state-of-the-art and research and development needs for South Africa (WRC Report No: 2532/1/17)* contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: [orders@wrc.org.za](mailto:orders@wrc.org.za) or Visit: [www.wrc.org.za](http://www.wrc.org.za) to download a free copy.