

Ecological reserve

Examining water quality compliance in a selected Lowveld River

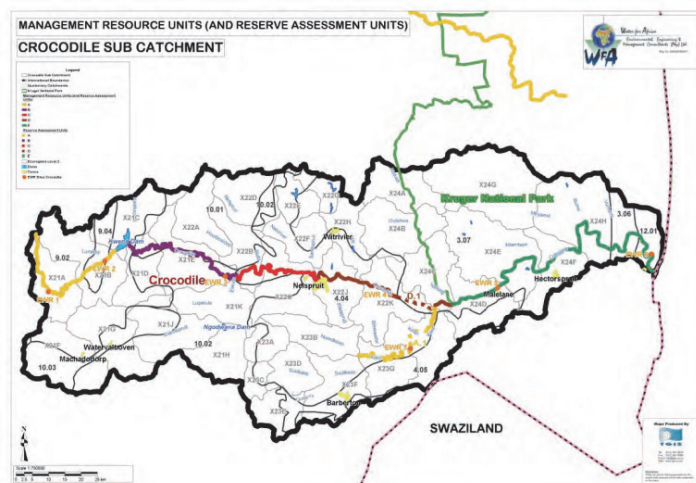
A completed WRC-funded study aimed to contribute to the effective use of knowledge in realising the goals of equity and sustainability in the practice of integrated water resource management in South Africa.

Challenges of achieving integrated water resource management

Despite excellent water research, policy and law in South Africa, barriers are still evident in the implementation of sustainable integrated water resource management (IWRM). One of the clearest failures is evidenced by the continuous decline in the quality of South African surface waters.

The National Water Act (NWA) of 1998 was founded on the principles of equity, sustainability and efficiency. The idea was to promote a balance between resource protection (using the processes of resource classification and setting resource quality objectives) and resource use (control and regulation through an administrative allocation and discharge system based on licensing and appropriate enforcement).

This has been challenging enough for flow, or water quantity, but has proved almost impossible for water quality, which covers the wide range of dissolved and suspended matter in water. In the period since promulgation, there has been little research-based investigation of the huge challenges posed by 'water quality' as a multivariate concept, and methods and processes for water quality to be integrated into guidelines and licensing in a manner that is scientifically sound and societally sensible are elusive. As a result, a diverse set of practices has emerged, where a range of guidelines are used to describe resource directed measures, and the criteria in discharge licenses are not always consistent or useful. Added to this, there is little understanding even within the Department of Water Affairs (DWA) of the implementation of resource protection measures.



Management resource units for the Crocodile catchment.

Shared Rivers Initiative

The Shared Rivers Initiative arose out of concerns that despite enabling legislative and institutional frameworks, the flows of rivers that flow eastwards from South Africa and are shared with neighbouring countries have not improved, while some have even degraded. Research arising out of the Shared Rivers Initiative focused largely on flow-related issues, and found for the most part that the rivers under study were not compliant with flow levels as set out in recent ecological Reserve studies.

This WRC-funded project aimed to assess aspects related to the water quality component of the ecological Reserve, using the Crocodile River in the Inkomati catchment as a case study. The Crocodile River was selected as it has been identified as water stressed, but has been receiving management attention of late. The Crocodile River is also one of the rivers that were assessed as part of the Shared Rivers Initiative.

Water quality and quantity in the Ecological Reserve

A comprehensive ecological Reserve study uses information on driving variables (hydrology, geomorphology and physico-chemistry) and response variables (fish, aquatic invertebrates and riparian vegetation) in setting a Reserve. This study contrasts approaches to the water quality and quantity aspects of the ecological Reserve. The focus is mainly on Reserve outputs and less on the Reserve processes. Some attention is also given to research assessing compliance with the water quantity Reserve, as a potential indicator of the likelihood of compliance with other aspects of the Reserve and of issues related to the assessment of compliance.

Review of methods for water quality aspects of the ecological Reserve

The research project also reviewed and critiqued the methods used to determine the water quality component of the ecological Reserve. A recent comprehensive Reserve study on the Crocodile River is used as an example of the methods used in determining the water-quality component of the ecological Reserve. The findings are presented as stages according to the eight-step Reserve process.

Compliance with water-quality aspects of the ecological Reserve

The study further assessed whether the test case selected is

compliant in terms of water physico-chemistry only, with the specifications laid out in the recent comprehensive Reserve study. Methods for water-quality monitoring have not been finalised, and as a result the project team in used the Reserve recommendations for monitoring.

Data sourced from the DWA Water Management System (WMS) were used in monitoring of compliance. Appropriate percentiles for all monitoring sites were derived from monitoring datasets (where data was available) and these compared with data in the Reserve documentation.

No data were available in WMS to assess compliance with physico-chemical aspects of the Reserve at the two furthest upstream monitoring sites, and it was therefore not possible to assess compliance at these sites. As a result, physico-chemical compliance along approximately 80 km of the upper Crocodile River is not known.

All remaining monitoring sites were non-compliant for at least two water quality parameters. Non-compliance increased downstream until peaking at Malelane (with 36% non-compliance with specifications in all datasets assessed). Levels of compliance improved slightly further downstream, but water at the most downstream of the monitoring sites (before the Crocodile River joins the Inkomati River and crosses the border of Mozambique) was not fully compliant with respect to water quality.

Other trends along the length of the river include elevated levels of plant nutrients (as phosphate or total inorganic nitrogen) leading to non-compliance at upstream sites, and elevated sodium chloride levels leading to non-compliance at downstream sites.

It is recommended that monitoring programmes at all sites be instituted or continued, and that such monitoring programmes should cover all water-quality parameters in the Reserve study (including e.g. toxic substances that have been found at high levels). Even if physico-chemical monitoring should not form part of a first level monitoring programme, the data need to be available should they be required.

Conclusions

The study concludes with a number of general conclusions and recommendations:

- The methodologies and approaches underlying the water-quality aspects of the ecological Reserve and those underlying the water quantity or flow aspects of the ecological Reserve would benefit from reassessment

and harmonisation. This would be facilitated by the development of better methods for water-quality modelling than are currently available.

- The existing documentation of a methodology for the determination of the water-quality aspects of the ecological Reserve needs to be revised.
- A monitoring and compliance process for the regulation and enforcement of the water-quality aspects of the ecological Reserve in relation to discharge licences and non-point source pollution needs to be developed in collaboration with users, managers and the regulator.
- The catchment participatory processes initiated in this project need to be followed up and developed in

cooperation with water users, the DWA and the Inkomati Catchment Management Agency into an integrated water-quality plan, first for the Crocodile River, and then extended into the broader Inkomati catchment area.

Further reading:

To order the report, *A preliminary examination of water quality compliance in a selected Lowveld river: Towards implementation of the Reserve*, (Report No. KV 306/12) contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za, or Visit: www.wrc.org.za to download a free copy.