

Rationale for an ecological risk approach for South African water resource management

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Abstract

The principle of ecosystem protection in the South African Water Act requires that water resource management tools for a multiple stressor environment be tailored to the characteristics of the aquatic ecosystem. The requirements of the Act, the characteristics of aquatic ecosystems as well as co-occurrence of diverse stressors are considered. Although single substance criteria have a useful role, they are not sufficient for resource management within the context of the ecological reserve. It is proposed that an effect-likelihood approach has the potential to address the variability and uncertainty in management of a surface water body subject to multiple stressors. An in-stream receiving water risk objective approach might be considered.

Glossary

ERA	Ecological risk assessment
Hazardous	Having the potential to cause an (undesired) effect.
IFR	In-stream flow requirement
SAWQG	South African Water Quality Guidelines
Stressor	An anthropogenic substance, form of energy or circumstance that may cause a loss of sustainable ecosystem function.

Introduction

The South African national water policy considers the aquatic ecosystem to be an integral part of the resource base from which water is derived for human and environmental use, but "only that water required to meet basic human needs and maintain environmental sustainability will be guaranteed as a right. This will be known as the Reserve" (DWAF, 1997). This concept was also embodied in the National Water Act (NWA, 1998). The environmental or ecological aspect of the reserve has been identified in such a way that it must ensure water quantity and water quality which are appropriate to meet these needs. The term resource quality "is used to include the health of all parts of the water resource, which together make up an 'ecosystem', including plant and animal communities and their habitats" (DWAF, 1997).

This paper presents a rationale for the use of ecological risk in water resource management in South Africa within the context of the NWA.

Background

Two distinct philosophical approaches that can be applied to water resource quality management are summarised in Table 1.

While the approaches in Table 1 are presented as extremes in philosophy, there is a growing appreciation for the need for, and a movement toward, a holistic, integrative approach in environmental management generally and water resource management in particular

(e.g. Foran and Fink, 1993; EEC, 1994; Schneiders, et al., 1996; USEPA, 1997). Such a holistic approach to water resource management strongly features sustainability linked to some ecological entity (or objective) (e.g. CUWVO, 1988; Wils et al., 1994; Schneiders et al., 1995; USEPA, 1997). The ecological objectives then become either directly or indirectly the basis of, for example, water quality criteria. Ecological risk methodology can be applied to both extremes and an integrated approach and does not stand in contrast to any of these approaches.

A proposal for the application of ecological risk to the ecological reserve is shown in Fig. 1. The rationale of using ecological risk concepts in water resource management is based on three observations:

- the implications of aspects of the NWA as indicated above,
- the "diverse stressor problem" and
- the inherent characteristics of aquatic ecosystems.

Implications of the NWA

It is implicitly recognised that use of the resource is not only allowed, but is also necessary for the well-being of the country and that this use needs to be managed in a way that will ensure sustainability. In this context it is noted that:

- The terms "use" refers not only to consumption and recreational use, but also to discharge of anything that may affect, *inter alia*, the sustainability of use.
- The NWA makes provision for protective measures for the water resource which includes classification of the resource and setting resource quality objectives that will give effect to the reserve set for that class.
- The ecological component of the reserve refers to a quantity and quality of water that will ensure ecologically sustainable development of the resource.
- Resource quality includes the quantity, pattern, timing, water level and assurance of in-stream flow, the physical, chemical and biological characteristics of the water, the character and condition of the in-stream and riparian habitat as well as the characteristics, condition and distribution of the aquatic biota.

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