

Monitoring groundwater quality in South Africa: Development of a national strategy⁰

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Abstract

Little is known about the temporal distribution of groundwater quality on a national scale in South Africa. The effective management of the country's groundwater resources is thus difficult and a need exists for a national network for monitoring groundwater. A literature-based project was initiated with the aim of identifying practical strategies to be used in the establishment of the desired network. Prior to identifying possible strategies, a statement on monitoring network objectives was developed. Cognisance of special constraints and considerations such as responsibility and funding was also taken. Various approaches and strategies for establishing national or regional monitoring networks were evaluated, the most appropriate of which were proposed for use in the establishment of a South African network. The strategies considered aspects such as information needs, available resources, monitoring frequencies, funding and the use of a pilot-scale study to initiate the network. A network manager and a Review Committee should be appointed and be responsible for the establishment of the network. Some technical issues had to be considered owing to their impact on the strategies to be adopted. Empirical and hierarchical approaches to the development of the network were considered essential. Work on the network has subsequently started and many of the proposed strategies have been adopted.

Introduction

Knowledge concerning the spatial distribution of groundwater quality in South Africa on a national scale is still limited, with Bond (1946) remaining the major reference source. Although some progress has been made in this regard during the last five years (Cogho et al., 1992; Fleisher, 1990; Levin et al., 1989), much still remains to be done. The present initiatives of the Department of Water Affairs and Forestry (DWAF) will further enhance regional groundwater quality characterisation and improve our knowledge. However, almost no information is available concerning temporal changes in groundwater quality. This lack of information makes it difficult to effectively manage the country's groundwater resources. A need therefore exists for the establishment of a national program of groundwater quality monitoring.

The Water Research Commission (WRC) was approached to fund a one-year literature study in order to provide impetus to the establishment of a national network for groundwater quality monitoring. The objective of the research was to develop a practical strategy for monitoring groundwater quality on a national scale. The following were identified as important considerations:

- the purpose of a national monitoring program
- the cost and manpower available for the monitoring program
- the most important areas to be covered (major pollution sources, sole-source aquifers)
- the variable nature of groundwater over short distances (representativeness)
- methods of sampling and frequency, analysis, data storage and information reporting
- possible linkage to national networks for surface-water quality monitoring.

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At the outset it was recognised that practical strategies would be required if a national network is ever to be established in South Africa. Such strategies need to be aimed at conquering the many challenges and problems which will have to be overcome. These include the large areas involved, the high degree of spatial variability and the resources required to establish the network. Further, it was noted that no national effort will ever be perfect. An integrative, building approach and the adoption of positive philosophies are seen as ways of ensuring that a national monitoring network can become a reality.

Research approach

The approach to the design of monitoring networks has rapidly evolved over the last few years (Sanders et al., 1987). Networks are now designed on a systems approach, which provides a framework for a logical flow of information. The development of an objective statement is central in the whole process of network establishment and operation. Objective statements must be flexible and dynamic so that the statement can be modified or be allowed to evolve as circumstances and knowledge change. The following objective statement was proposed for the national network:

The objective of a national groundwater quality monitoring network is to provide ambient groundwater quality information on a national scale over the long term so that national water managers and planners have available to them general information pertaining to quality trends and status in both space and time for resource planning and management purposes.

Prior to addressing possible strategies, some special constraints and considerations were appraised. Although the responsibility for establishing and funding a national network rested with DWAF (DWAF, 1992), the state could delegate some of the responsibility for data collection to other organisations, such as Regional Services Councils and Municipalities. These major water users could also provide assistance and financial support to