



Department : Water Affairs
and Forestry

Integrated Water Resources Management



**Groundwater Management Strategy
Summary**



DEPARTMENT OF WATER AFFAIRS AND FORESTRY

INTEGRATED WATER RESOURCES MANAGEMENT

GROUNDWATER MANAGEMENT STRATEGY

SUMMARY

INTEGRATED WATER RESOURCE MANAGEMENT
STRATEGIES, GUIDELINES AND PILOT IMPLEMENTATION
IN THREE WATER MANAGEMENT AREAS, SOUTH AFRICA

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TITLE: GROUNDWATER MANAGEMENT STRATEGY:
SUMMARY

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PURPOSE: To present a suite of strategies with a wide scope including: management; protection and use; institutional arrangements; human resources and capacity building, for inclusion in the National Water Resource Strategy.

TARGET GROUP: DWAF, IWRM Project Consultants and implementers in three Water Management Areas.

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1 INTRODUCTION

South Africa is a developing country with limited water resources, where effective water resource management is critical. Because of past neglect and groundwater's private status under the previous Water Act (Act 54 of 1956), groundwater aspects have, up until now, not been an integral part of the development and management of the country's water resources. The Act clearly includes groundwater in the hydrological cycle and in the definition of a water resource. However, the characteristics of groundwater sometimes require it be considered or managed differently to other water resources. The aim of this document is to provide a summary of the groundwater management strategy for the country, which has been based on the characteristics of the resource, the requirements for integrated water resource management (IWRM) and the guiding principles of sustainability, equity and efficiency as recognised in the National Water Act (Act 36 of 1998).

2 BACKGROUND INFORMATION

Groundwater is a major source of water in South Africa and a powerful tool for creating a better life for many people in the country. About 98% of the groundwater resources are found in secondary fractured, hard rock aquifer systems that are difficult to manage and protect. Major primary aquifers are restricted to coastal sand deposits along the west and south coast of the Cape and along the KwaZulu Natal coast.

No definitive study has been undertaken to quantify groundwater use in South Africa, but it is estimated that groundwater accounts for approximately 13% of all water used in the country with about 320 towns and villages are dependant on groundwater to some degree.

Recent work by DWAF suggests that almost 60% of rural communities are groundwater dependent. It is estimated that less than 20% of South Africa's available groundwater resources are currently used.

Groundwater is the only viable means of supplying basic human water needs to millions of rural South Africans. Presently approximately 15 million rural people draw their drinking water from the ground. Thus groundwater plays an important role in the national government's initiative to supply potable water to the people and contribute to eradication of poverty.

At present, groundwater management is driven at a national level. The National Water Act (Act 36 of 1998) requires water management to be driven at a local level, which is more in keeping with the local nature of South Africa's aquifer systems. Although research and ambient monitoring of the country's groundwater resources could be managed at a national level, most groundwater management issues need to be dealt with locally, including: resource assessment; reserve determinations; setting resource quality objectives; development of catchment management plans; licensing and allocation; management and monitoring of groundwater abstraction schemes, and management and monitoring of groundwater contamination problems.

3 VISION

For groundwater to take its rightful place in the development and management of South Africa's water supply a paradigm-shift must occur and a new vision must take hold. This will create a context within which integrated water resource management, one of the tenets of the National Water Resource Strategy, can be properly implemented. The following is the vision towards which the strategies are focused:

VISION

GROUNDWATER IS ACKNOWLEDGED BY ALL WATER MANAGERS AS AN IMPORTANT AND INTEGRAL PART OF SOUTH AFRICA'S WATER RESOURCES, AND IS MANAGED AS SUCH.

INSTITUTIONS INVOLVED IN WATER RESOURCE MANAGEMENT WILL ABIDE BY IWRM PRINCIPLES, AND GIVE ADEQUATE ATTENTION TO THE ROLE OF GROUNDWATER IN THE ENVIRONMENT AND AS A STRATEGIC SOURCE FOR WATER SUPPLY.

4 STRATEGIES

CORE GROUNDWATER MANAGEMENT STRATEGIES

The Groundwater Strategy recognises the need for a paradigm shift so that groundwater is given recognition as a vital, strategic resource, which should form an integral part of water resource management. Twenty-nine strategies have been developed to ensure the optimal development and management of groundwater resources in South Africa. However, five core strategies are identified as the most important with regard to initiating the required change:

- **INTEGRATION:** Integrate groundwater into the management of water resources for the benefit of all of South Africa's peoples;
- **AWARENESS:** Promote groundwater so that water resource managers, water users and the public are more aware of the role, occurrence and value of groundwater;
- **HUMAN RESOURCES – LINKING:** Encourage and enable hydrogeologists to work outside their line function, and be integrated into the broader water resource planning and management functions;
- **SKILL BASE:** Develop a larger, skilled and experienced specialist hydrogeological workforce, and
- **MONITORING – INFORMATION:** Develop a groundwater monitoring network and a hydrogeological information system to assist in the provision of data to those who need it.

4.1 Preamble

If groundwater is to be integrated successfully in water resource management in South Africa, a suite of practical, feasible and affordable strategies must be developed and implemented. The strategies presented below focus on including groundwater in the National Water Resource Strategy based on the principals of, and a framework for, IWRM. It is believed that by doing so, groundwater will be managed at all levels in a sustainable manner for the benefit of all South Africans.

Strategies need to take cognisance of the fact that groundwater is now a public resource; resource management will be decentralised, and IWRM will form the cornerstone of future resource management.

Management and protection strategies are supported by several enabling strategies in areas such as institutional structures, human resources, research, data- and information management and groundwater promotion.

To provide impetus to the adoption and implementation of the proposed strategies, implementation plans are proposed with each strategy.

4.2 Groundwater Management

4.2.1 Background

While it is recognised that the national government is the public trustee of the nation's water resources, water resource management in the future will be at regional or catchment levels. A key element of the NWRS is the establishment of decentralised catchment management agencies (CMAs), within 19 water management areas. All CMAs will be required to develop and implement catchment management strategies, which will include groundwater management.

Groundwater plays a crucial role in catchment systems by: providing baseflow to rivers; supporting aquatic ecosystems, as well as riparian and terrestrial vegetation and maintaining a geochemical balance. It is imperative that the National Water Resource Strategy adequately recognises the role that groundwater plays in catchment management (as well as it being a strategic resource). The nature of aquifer systems requires that groundwater management remain essentially a local issue.

4.2.2 Strategy

- Base all water resource management at national, catchment and local levels on the principles of IWRM.
- Recognise groundwater as an integral part of a catchment's water resources, and manage it properly according to sound scientific assessments and participative planning.
- Require each CMA to include a groundwater management plan as part of the catchment management framework.
- Require each CMA to have sufficient groundwater specialists available to oversee sustainable development, monitoring and management of groundwater resources. Such specialists can be either employed by the CMA or by local service providers.

4.2.3 Implementation plans

- Water user associations must be established and encouraged to assist CMAs with joint management of communal aquifers.
- Guidelines for adequate aquifer management should be established and distributed by DWAF. Guidelines should cover, among others, sustainable use, abstraction scheduling, pump settings and monitoring requirements.
- The number of Reserve determinations being undertaken should be increased. This will reduce or eliminate the current backlog in Reserve determinations, which is retarding the issuing of licenses for groundwater use.
- A clearer definition of bulk water supply should be developed, possibly at CMA level, after consultation with environmental authorities.
- Guidelines related to environmental impact assessments for groundwater must be formulated as educational tools for both the groundwater and environmental management communities.
- Research related to the impact of groundwater abstraction on ecosystems, together with the identification of groundwater dependant ecosystems, must be undertaken.

- DWAF and CMAs should proactively participate in the decision process related to land-use planning. In general, the aim should be to place high-risk activities in areas with no or little groundwater potential.

4.3 Groundwater Protection

4.3.1 Background

Groundwater protection and conservation are essential components of groundwater management, and relate to both quantity and quality issues. Pollution of groundwater resources affects both groundwater and surface water quality in streams fed by baseflow. Remediation of polluted aquifers is expensive and technically difficult. As a result, groundwater quality management and protection should be proactive. As protection of all aquifers is considered impossible in South Africa, a differentiated protection policy, where priority is given to important and vulnerable aquifers, has been proposed as the optimum solution.

Processes involved in aquifer depletion and pollution, and related aquifer protection and conservation, are complex and require specialist input for correct management. IWRM is considered essential therefore, to protect the country's groundwater resources.

4.3.2 Strategy

- Improve public awareness and involvement as a guard against degradation of groundwater resources. Empower the public to understand groundwater issues and appreciate the value of the resource.
- Protect water resources using instruments such as land-use zoning, classification of aquifers, environmental management plans and environmental impact assessments.
- Involve groundwater institutions and specialists in the debate and decision-making processes regarding South Africa's resources and environment.

4.3.3 Implementation plan

- Information about pollution, as well as pollution prevention must be included in a general awareness campaign regarding water use and water resources.
- National aquifer classification and Reserve determinations should be used by CMAs to identify important areas requiring more detailed classification. Special attention must be paid to sole-source aquifers (aquifers that are the only source of water supply) and those where groundwater is important for aquatic and terrestrial ecosystems.
- Water and land-use licensing should be enforced vigorously, particularly in areas underlain by important or vulnerable aquifers.
- The regional offices of DWAF and the CMAs should, in a proactive manner and in co-operation with other authorities, track all new developments in areas underlain by important or vulnerable aquifers. They should participate in the evaluation of environmental impact assessments and intervene when impact assessments identify the potential for neglect or damage.
- DWAF, CMAs and groundwater specialists should pro-actively participate in land-use planning and strive to influence the planning so activities with a high groundwater pollution risk are placed in areas with low or no groundwater potential.

- Compulsory environmental management plans (including groundwater) must be provided for potentially polluting enterprises such as heavy industry, mining, waste disposal and waste water treatment.

4.4 Monitoring

4.4.1 Background

Without knowledge of the resource you cannot manage the resource, and therefore monitoring and information systems are critical for successful resource management. Efficient and sustainable use of a catchment's groundwater resources cannot take place without adequate monitoring. Groundwater monitoring in South Africa is limited. This has been one of the major reasons for unsustainable groundwater use and failure of groundwater supply schemes. Further, lack of national-scale monitoring has made it difficult to identify emergent trends.

4.4.2 Strategy

- Implement an ambient hydrogeological monitoring network at a catchment level, with data storage and management co-ordinated and facilitated by the central authority.
- Drive the monitoring of aquifer response to abstraction and potential pollution by means of licensing and permitting, with the CMA responsible for implementation.
- Provide central authority guidance regarding monitoring protocols and requirements, and audit monitoring undertaken at a local scale.

4.4.3 Implementation Plan

- DWAF must establish guidelines for developing catchment level groundwater monitoring networks.
- An integrated water resource monitoring programme should be implemented, allowing for rationalisation of monitoring activities.
- Each CMA must develop and implement a regional aquifer monitoring system.
- Water service development plans must address management and monitoring required for sustainable groundwater use.
- All water use licenses, including bulk water supply, must require groundwater users to monitor static groundwater levels as well as monthly abstraction, and provide the collected data to CMAs on a quarterly basis.
- An annual aquifer status report should be compiled by the CMA.
- Monitored data should be readily available to all stakeholders.

4.5 Data and Information Management

4.5.1 Background

Information is an important element of the new water policy and legislation. Availability of timely, adequate, relevant and valid hydrogeological information will be crucial for the future management of South Africa's groundwater resources. It is imperative that collection of new hydrogeological and monitored data (Section 4.4) be accompanied by the development of powerful and robust information tools such as databases, information systems, maps, reports and booklets. These are to be used to convey hydrogeological information to specialists, water resource managers, decision makers and the public. They can also assist in supporting groundwater awareness and promotion campaigns.

It is a matter of some urgency that a hydrogeological information system be implemented and used. Once an information system has been developed and is being used to capture, exchange and interpret data, the focus could shift to providing hydrogeological information to a wider range of stakeholders. These could include water supply managers, agriculturalists, education institutions and the public.

4.5.2 Strategy

- Develop and implement a national hydrogeological information system urgently.
- Foster widespread promotion and use of the information system amongst the hydrogeological community, so that hydrogeological data and information exchange can be readily achieved.

4.5.3 Implementation Plan

- Continue development and implementation of the National Groundwater Database and hydrogeological information systems. These should address national, catchment and local information needs, and promote exchange of data among organisations.
- Establish the information needs of practicing groundwater specialists as well as CMAs, WUAs and other stakeholders.
- Promote the widespread use of the information systems by distributing the software, presenting training courses and providing ongoing support.
- Develop an on-line information service to provide the public with hydrogeological data and information.
- Expand the existing aquifer classification to include regional hydrogeological maps and meet CMA requirements, including identification of priority aquifers and protection needs.
- Upgrade general authorisation maps on a CMA basis, taking into account local hydrogeological knowledge and a larger scale of delineation.

4.6 Priority Use of Groundwater

4.6.1 Background

The use of groundwater can have an advantage over the use of surface water. Supply of groundwater requires less infrastructure and less water treatment than surface water.

Abstraction of groundwater generally has less impact on the environment than development of surface waters, and rural water supply schemes in drier or inaccessible areas are best served by groundwater.

The use of groundwater, together with surface waters (conjunctive use) can maximise the efficient use of a catchment's resources. It provides promising opportunities to improve the security and future of South Africa's water supply system, particularly in the drier parts of the country, and to rural communities and small towns. Inclusion of artificial recharge could further enhance this approach.

4.6.2 Strategy

- Use groundwater in instances where comparison to surface water resources shows it to be economically and environmentally superior.
- Promote conjunctive use as a part of IWRM.

4.6.3 Implementation Plan

- Groundwater resources must be realistically assessed, evaluated and compared with other water sources in a catchment.
- Where appropriate, water management plans should promote conjunctive use of surface and groundwater resources.
- Assessment of the use of a catchment's surface or groundwater resources must compare the economic and environmental consequences of use for each resource and the best resource must be used.

4.7 Institutional Arrangements

4.7.1 Background

The National Water Act (Act 36 of 1998) provides for three levels of water management: national government; CMAs and water user associations acting co-operatively at a local level. Devolution of groundwater management functions to the lowest appropriate level should be encouraged, while retaining a strong central authority for management of the national water resources.

4.7.2 Strategy

- Integrate groundwater management with other activities of CMAs.
- Establish Groundwater Advisory Groups to provide assistance and guidance to CMAs or groups of CMAs.
- Deploy groundwater expertise within the appropriate line functions of the central authority.

4.7.3 Implementation Plan

- Restructuring of the DWAF Directorate of Geohydrology should be in accordance with the NWRS, with hydrogeological expertise being included in all aspects of water resource planning and management at national and catchment level.
- The central authority must facilitate establishment of groundwater advisory boards to provide assistance at catchment and local levels.
- Opportunities must be created for hydrogeologists to be appointed and promoted outside of their line function, either within DWAF, CMAs or other agencies responsible for water resource management.
- Water boards and CMAs should be encouraged to appoint hydrogeologists to their staff, while water user associations should liaise with hydrogeologists when required.

4.8 Human Resources

4.8.1 Background

Availability of sufficiently qualified and experienced hydrogeologists is an important requirement for proper implementation of the National Water Act (Act 36 of 1998) and related legislation. An informal survey was undertaken to try to quantify human resources in South Africa that are capable of undertaking groundwater investigations. Total groundwater expertise in the country comprises about 250 people, of which most are employed by DWAF. Most of the hydrogeologists are placed in the line function (Directorate of Geohydrology), which does not encourage understanding of groundwater management problems in other directorates. In essence there is insufficient hydrogeological expertise available for proper development and management of the nation's groundwater resources.

4.8.2 Strategy

- Ensure active participation of experienced hydrogeologists in the planning and management hierarchies of both DWAF and CMAs.
- Integrate at least three hydrogeologists into each CMA (senior professional, junior professional, senior technician), although these resources can be outsourced when required.

4.8.3 Implementation Plan

It is unlikely the above two strategies can be implemented in the short to medium term. Thus, the following shorter term action plan is proposed:

- Hold a strategic planning workshop with a view to attain the following: identify CMAs with the greatest need for hydrogeological expertise; evaluate human resources available for deployment to the CMAs; and consider methods of recruiting personnel with the required expertise and experience, so that priority human resource needs can be met.
- Give priority to education and training of a hydrogeological workforce (see Section 4.9). This will require financing and other support to tertiary institutions, which should be judged on the number and quality of postgraduate students produced.
- Develop, as a partnership between public, private and academic institutions, a national strategy with regard to human resource development in the water sector.

- Second one experienced hydrogeologist to the Chief Directorate: Planning as a means of promoting integrated water resource management within DWAF, and
- Create a reliable database of available hydrogeological expertise in South Africa, which can be used as a basis for outsourcing.

4.9 Education and Training

4.9.1 Background

This section relates specifically to education and training of specialist hydrogeologists. Education and training are considered key to ensuring sustainable management of groundwater resources. However, specialist groundwater tertiary education is not widely offered in South Africa. Only the universities of the Orange Free State and Western Cape offer postgraduate hydrogeology courses. Some undergraduate and less specialised postgraduate training is offered at the University of Natal, University of the North, University of Pretoria, University of Venda and University of Zululand, but is included in general curricula related to geography, geology or hydrology. Only one technikon offers any formal groundwater training.

4.9.2 Strategy

- Develop and promote specialist groundwater education and training programmes, which include an IWRM component.
- Include principles of IWRM in all water related education and training curricula.

4.9.3 Implementation Plan

- Redesign groundwater education and training activities to include IWRM principles.
- Establish a Co-ordinating Committee for Groundwater Education and Training (CGET) to promote collaboration between education and training institutions.
- Establish a national discussion forum to assist with development of a consistent set of terms to be used for water resource management education and training at tertiary institutions.
- Develop and present continuing groundwater education and training programmes.
- Develop and promote links between the groundwater industry and tertiary education institutions with a view to establish internships for undergraduate and postgraduate students.

4.10 Capacity Building

4.10.1 Background

The term 'capacity building' has a wide range of meanings. In context of this report, it refers to development of non-specialist groundwater skills within the broader hydrological community and the public. Although groundwater training programmes are available at universities and technikons (Section 4.9) and through some industries, a concerted effort is required to develop tailored courses to enable capacity building among the broader hydrological community and stakeholders in general.

4.10.2 Strategy

- Enhance the capacity of non-specialists with respect to groundwater management as an integral part of IWRM.
- Enable institutions, including historically disadvantaged institutions, to sustain development of well-qualified water managers.

4.10.3 Implementation Plan

- Improve the capacity of non-specialists, through various education and training programmes with respect to groundwater management as part of IWRM.
- Develop guidelines to strengthen water research capabilities at various institutions, including the historically disadvantaged, consistent with national research needs and priorities.

4.11 Promotion of Groundwater

4.11.1 Background

There is a growing realisation that groundwater has a key role in the attainment of the country's RDP goals. Prominence of groundwater as an environmental issue has also increased in recent times, albeit often as a means of blocking a particular development. Awareness among the public is seen as the only permanent guard against degradation of groundwater. Although the role of groundwater is gradually being appreciated, the resource is still not effectively integrated into water resource management, environmental planning or land-use management.

A major multilevel groundwater promotion drive is required to empower people to use and protect groundwater resources, and to promote integrated water resource planning, development and management.

4.11.2 Strategy

- Initiate a multi-level information campaign to promote knowledge and awareness of groundwater. Popularise groundwater among the upper DWAF hierarchy.
- Establish a South African Groundwater Trust to develop and lead a multilevel awareness and education campaign, both inside and outside the public sectors.
- Disseminate information about successful groundwater schemes, while offering reasons for the failure of less successful projects.

- Encourage the hydrogeological fraternity to regularly present lectures and talks to schools, business organisations, learned societies, environmental societies etc.

A fifth strategy relating to inclusion of short courses on groundwater in engineering, hydrology, limnology, agriculture, environmental and related curricula is addressed in Section 4.9.

4.11.3 Implementation Plan

- Universities and technikons should include water resource planning, integrated water resource management principles and communication skills (both written and verbal) in their curricula.
- Information packs and practical demonstrations should be prepared and distributed to high school teachers.
- A research project should be undertaken to quantify groundwater use in South Africa. This research should form the basis of a 'popular' document recording successful groundwater supply schemes in the country.
- Professional societies and employers should encourage and support efforts to disseminate information to the broader public. Some funding will be required to generate and distribute materials such as posters, booklets and other promotional material.
- Practitioners need to adopt a positive and proactive approach when interacting with other water resource managers. Both public and private sectors require a high level of commitment and passion if groundwater is to be promoted as a viable source of water.
- The American Groundwater Trust should be approached to help set up a similar organisation in South Africa. A suitable director will have to be appointed and funding secured to make this initiative viable.
- An investigation should be launched into the establishment of groundwater extension services in all (or priority) CMAs.

4.12 Research Needs

4.12.1 Background

Several research needs that are specific to integrating groundwater into the NWRS have been identified. These include:

- Development of hydrogeological handbooks and best practice guidelines;
- Quantification of groundwater use in South Africa;
- Investigation into the impact of groundwater abstraction on the broader environment;
- Development of interactive hydrogeological information systems, and
- Development and implementation of a national hydrogeological monitoring system.

Any research undertaken in South Africa must take cognisance of the need to accelerate development of hydrogeological skills within the country, as well as the need to develop groundwater capacity within the broader hydrological community. Further, research can play an important role in facilitating racial and gender transformation in the hydrological community in general, and the hydrogeological community in particular.

4.12.2 Strategy

- Promote relevant and applied groundwater-related research, so that practicing hydrogeologists have both knowledge and the appropriate tools to manage South Africa's groundwater resources in an integrated manner.
- Use research as a vehicle to accelerate education, capacity building, transformation and implementation of IWRM.

4.12.3 Implementation Plan

- Form integrated and collaborative research teams, and submit proposals to target different areas of research funding;
- Develop interactive database systems for easier access and exchange of information;
- Target other sources of funds, local and international, which traditionally do not support groundwater related projects, and
- Encourage CMAs to undertake collaborative research with universities.

5 CONCLUSION

The fact that groundwater is used as a source of water for more than 15-million South Africans clearly demonstrates the importance of the resource. To ensure effective IWRM, groundwater needs to be included in the water resources planning process and recognised as a valuable resource. Groundwater can only be properly incorporated into national- or catchment-scale water resource management when most, if not all, of the twenty-nine strategies described above have been addressed. Implementation of the strategies presented in this report, and particularly the five core strategies identified in this section, will provide a mechanism for attaining the required paradigm shift.

DOCUMENTS FOR OUTPUT 7: STRATEGIES, TOOLS AND SYSTEMS APPLIED WITHIN THE THREE SELECTED WMAS TO ACHIEVE SUSTAINABLE GROUNDWATER DEVELOPMENT AS AN INTEGRAL PART OF IWRM:

1. a. Groundwater Management Strategy for National Water Resource Strategy, DWAF/DANCED, 2001
 - b. Groundwater Management Strategy: Summary, DWAF/DANCED, 2002**
 - c. Groundwater Management Strategy: Executive Summary, DWAF/DANCED, 2002.

2. a. Guidelines for Groundwater Management in Water Management Areas, South Africa, Carl Bro a/s, IZNA Consortium, February 2002
 - b. Guidelines for Groundwater Management in Water Management Areas: Summary, South Africa, Carl Bro a/s, IZNA Consortium, February 2002
 - c. Guidelines for Groundwater Management in Water Management Areas: Executive Summary, South Africa, Carl Bro a/s, IZNA Consortium, February 2002

RELATED DOCUMENTS:

First Edition National Water Resource Strategy, DWAF 2002

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Guidelines for Stakeholder Participation in Integrated Water Resource Management in Water Management Areas in South Africa, Carl Bro a/s, March 2001.

Evaluation of the involvement of Previously Disadvantaged Individuals in the Catchment Management Agency Establishment Process the Three Water Management Areas.

Capacity Building Overview Assessment Vol.1, Carl Bro a/s, IZNA Consortium, October 2001.

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Capacity Building Implementation Plan, Carl Bro a/s, IZNA Consortium, April 2002.

Guideline on the Viability Study for the Establishment of a Catchment Management Agency, Carl Bro a/s, Pegasus Strategic Management, February 2002.