POLICY AND STRATEGY FOR GROUNDWATER QUALITY MANAGEMENT IN SOUTH AFRICA

Department of Water Affairs and Forestry
Republic of South Africa

First Edition 2000

water quality: waste management subseries

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WATER QUALITY: WASTE MANAGEMENT SUBSERIES

This document is the first in a series of documents in the W-Subseries (Water Quality: Waste Management Subseries) dealing with issues related to water quality management.

W.1.0 Policy and Strategy for Groundwater Quality Management in South Africa

W.2.0 Summary of National Policy and Strategy for Groundwater Quality Management in South Africa

W.3.0 Waste Generation in South Africa

W.4.0 Community Waste and Litter in South Africa

W.5.0 Disposal Sites for Hazardous and General Wastes in South Africa

W.6.0 Towards Formulation of a Waste Management Strategy for South Africa

W.7.0 Situation Analysis Based on Baseline Studies Regarding Waste Management in South Africa

PREFACE

With the coming of the Reconstruction and Development Programme, groundwater has been accorded a completely new importance in South Africa. Indeed, throughout the world, local groundwater resources are the preferred domestic water supply.

Traditionally, groundwater has been the only source of water supply in most of South Africa's rural areas making up about 65 per cent of our total supply. It will, however, be impossible to meet - in a cost-effective way and using water from dams and piped surface water supplies - the needs of eight million people in approximately 15000 settlements. In recognition of its new-found importance in South Africa, groundwater has been brought into the public trust domain by way of the new National Water Act, 1998 (Act 36 of 1998).

However, we have to act fast and decisively. The hidden nature of groundwater makes it prone to a lot of misunderstanding and mismanagement. Already increasing levels of development, urbanisation, agriculture, mining and industrialisation pose a severe threat to the quality of the resource, both because of over-abstraction and contamination. Millions of rands are spent every year on control and remediation measures. Remediation of polluted groundwater is very difficult, very costly, and often impossible.

In a country where eight million people do not have adequate access to a potable water supply - a basic need of the highest priority - groundwater will, in many cases, be the most cost-effective source.

To this day, South Africa has had no policy or strategy to manage the quality of this all-important resource. Whereas systems for the management of surface water quality are well established, there is still a dire lack of knowledge about groundwater, not only about exactly where it occurs, but also about how to manage it so that its quality does not deteriorate to unacceptable levels.

As a result, the Department of Water Affairs and Forestry has already in 1994 initiated the development of a policy and strategy for the management of groundwater quality in South Africa, marked by extensive stakeholder consultation, and recently supported by the provisions of the National Water Act.

This document now represents the First Edition of my Department's Policy and Strategy for the Groundwater Quality Management in South Africa. It represents a strategy which is practical, affordable and easily implemented. It takes its guiding principles from the White Paper on A National Water Policy for South Africa, and it integrates the management of the quality of surface and groundwater. To this end, it will help to ensure efficient management of both resources.

The Policy and Strategy for Groundwater Quality Management will serve as a decisive input to the formulation of South Africa's National Water Resource Strategy as required in terms of section 5 of the National Water Act. In this regard I invite you to submit your written comments to the Director: Water Quality Management, Department of Water Affairs and Forestry, Private Bag X313, Pretoria, 0001.

More remains to be done before the Strategy will be fully developed. We cannot, however, wait until all the details have been resolved. In the interim, whilst the National Water Resource Strategy is being developed, the Department intends proceeding with the implementation of the strategy set out in this document.

We are indebted to our stakeholders who, over the three years that the Policy and Strategy were being developed, gave of their time and energy to contribute to this important task. Numbered among them are those who rely on groundwater as their source of water, those who impact upon it, those who irrigate their lands with it and those who provided scientific and technical advice.

RONNIE KASRILS, MP
MINISTER OF WATER AFFAIRS AND FORESTRY

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EXECUTIVE SUMMARY

INTRODUCTION

The National Water Act, 1998 (Act 36 of 1998) provides the necessary framework within which to protect, use, develop, conserve, manage and control our water resources. The Act needs to be underpinned by implementation-level policy and a structured management strategy. Integrated management of groundwater and surface water is required in order to provide for adequate protection of the resource.

The Department of Water Affairs and Forestry already in 1994 initiated, with extensive stakeholder consultation, the development of a strategy for the management of groundwater quality. Comment on this first edition will be appreciated.

The groundwater quality management strategy will form part of the Department's National Water Resource Strategy.

South Africa's water resources under stress
South Africa's water resources are very unevenly distributed across the country, and in arid or water-scarce areas, water supply is a constraint to social and economic development.

The value and vulnerability of groundwater represent a strategic component of the water resources of South Africa. Groundwater occurs widely and, geographically, almost two thirds of South Africa's population depends on it for their domestic water needs. Security of groundwater supplies is thus essential and protection of groundwater has become a national priority.

It is common for groundwater to be poorly managed. It takes a long time to detect that it has become polluted and groundwater has only limited ability to purify itself. It is difficult, often impossible, and also very expensive to restore polluted groundwater. The major reason for poor management of groundwater resources, however, has been a lack of a structured approach to management and a lack of knowledge and information about groundwater.

Equity
The provision of safe drinking water has been recognised as a critical factor in breaking the cycle of poor living conditions. Equity in provision of water for basic needs, and sustainability, are thus now the most important principles of water resource management.

Purpose and context of this document
This document, as a starting point for implementation of groundwater quality management within the Department, specifies strategic objectives and broad functional strategies. It should be viewed as being dynamic and must be expected to evolve as other areas of strategy enabled by the National Water Act are developed.

What the Policy and Strategy document covers
The strategy provides the framework within which detailed management procedures can be developed and implemented and addresses the following key aspects:

- broad functional strategies (Sections 4, 5 and 6);
- institutional arrangements for groundwater quality management (Section 7);
- requirements for enabling implementation of the strategy (Section 8).

GROUNDWATER QUALITY MANAGEMENT FRAMEWORK

The National Water Act (1998)
National government is empowered - and empowers - through the National Water Act to fulfil obligations set out in the Act relating to the use, allocation and protection of, and access to, water resources.

The National Water Act thus provides the framework within which the Department can manage the protection, use, development, conservation and control of South Africa's water resources.

The eleven uses of water in accordance with the National Water Act are, in summary:

- taking water from a water resource
- storing of water
- impeding or diverting the flow of water in a watercourse
- engaging in stream flow reduction activities
- engaging in controlled activities
- discharging of waste water containing waste
- disposing of waste in a manner which may detrimentally impact on a water resource
- disposing of heated or waste water
- altering the bed, banks, course or characteristics of a water course
- removal of underground water
- using water for recreational purposes.

The eleven uses are not rights and may generally take place only in terms of an authorisation or licence.

In its implementation of the Act, the Department must take into account the following:

a) basic human needs of present and future generations;
b) the need for equitable access to water;
c) redressing the results of past racial and gender discrimination;
d) promoting the efficient, sustainable and beneficial use of water in the public interest;
e) facilitating social and economic development;
f) providing for growing demand for water use;
g) protecting aquatic and associated ecosystems and their biological diversity;
h) reducing and preventing pollution and degradation of water resources;

i) meeting international obligations;
j) promoting dam safety;
k) managing exposure to, and effects of, floods and droughts.

National government is empowered through the Act to establish suitable institutions and to ensure that they have appropriate community, racial and gender representation.

The Act will enable the Department to effectively implement its new policies regarding groundwater quality management. The following will be important:

- groundwater no longer enjoys the status of private water and is now subject to the same control measures as surface water;
- powers to monitor, assess, plan and audit performance of all water users have been provided for in the Act;
- the Department can within its available resources provide extension and support services and play a role in building capacity at community level; and
- the Department will be able to influence land-use-planning decisions, to regulate or prohibit land-based activities, to develop and implement Best Practice standards and to implement source controls where necessary. Implementation of Best Practice standards as conditions of authorisation managed by other organs of state will be particularly important.

Policy principles
Sustainability and equity are recognised as central guiding principles in the protection, use, development, conservation, management and control of water resources. These guiding principles recognise the basic human needs of present and future generations: the need to protect water resources, the need to share water resources with other countries, the need to promote social and economic development through the use of water and the need to establish suitable institutions in order to achieve the purpose of the Act.

The special nature of groundwater must be recognised in implementing policy. Impacts on groundwater are often long term and irreversible. The precautionary principle must therefore be strictly applied when making decisions about groundwater.

The Department as Trustee
National Government, acting through the Minister, is the public trustee of the country's water resources. The Minister, through the Department, is responsible for implementing the National Water Act. Surface and groundwater quality management are both important parts of this responsibility.

The strategy for groundwater quality management must, therefore, ultimately be executed in the context of the Department's overall National Water Resource Strategy, and its water quality management strategy.

MISSION, GOALS AND APPROACHES

Water resource management mission
The Department's water resources management mission is:

To act as the public trustee of the nation's water resources to ensure that the country's water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner.

Groundwater quality management mission
The groundwater quality management mission is set in the context of the water resources mission and is as follows:

To manage groundwater quality in an integrated and sustainable manner within the context of the National Water Resource Strategy and thereby to provide an adequate level of protection to groundwater resources and secure the supply of water of acceptable quality.

Policy goals
The Department will achieve its mission through effecting three policy goals:

- to implement source-directed controls to prevent and minimise, at source, the impact of development on groundwater quality by imposing regulatory controls and by providing incentives (mainly Chapter 4 of the National Water Act);
- to implement resource-directed measures in order to manage such impacts as do inevitably occur in such a manner to protect the reserve and ensure suitability for beneficial purposes recognised by the Act (Chapter 3 of the National Water Act);
- to remedy groundwater quality where practicable to protect the reserve and ensure at least fitness for the purpose served by the remediation (Chapter 3 of the National Water Act).

How to effect the policy goals
The Department will effect its policy goals by:

- establishing an understanding of the vulnerability to pollution of the country's groundwater resources;
- establishing an understanding of the relationship between polluting activities (sources) and quality effects in the groundwater;
- the regulation and prohibition of land-based activities which may affect the quantity and quality of water (section 13 of the National Water Act), i.e. the location and nature of development in relation to its impact on groundwater quality;
- controlling practices and use measures to lessen the polluting effects of activities which threaten groundwater quality; and
- controlling the aggregate impact of certain prescribed activities.

Principles in practice
Principles that will guide the implementation of this strategy include subsidiarity and self-regulation, pollution prevention, integrated environmental management, equity, sustainability, the polluter pays, and public participation.

Precautionary approach
Groundwater protection will be based on a precautionary approach. All groundwater will therefore be assumed to be vulnerable to damage unless it can be shown otherwise. This approach to protection will be implemented for source-directed, resource-directed and remedial management measures.

Differentiated approach
In South Africa's situation of widespread and highly localised groundwater occurrence and use, it will be physically and economically impossible to protect all groundwater resources to the same degree. South Africa's water policy does not aim to prevent impacts to the water environment at all costs since this would not allow the country to achieve much-needed social and economic growth. For effective and focused intervention, a differentiated protection approach is necessary, based on the vulnerability - and regional, as well as local, importance - of aquifers.

Groundwater resources will be grouped into aquifers. Each aquifer will be assigned a management class on the basis of the importance of that aquifer. Importance will be based on the potential yield, as well as on the level to which communities depend on the aquifer. Aquifers that represent the sole source of water for communities will be afforded special status irrespective of the potential yield and will enjoy the highest level of protection.

Authorisations and the role of Best Practice
Source-directed pollution prevention has been enabled through the National Water Act in a number of ways. Of these, regulations, licences and general authorisations are the most direct and powerful. These instruments are based on standards of performance. Standards will be documented to provide both the Department and the regulated community with a clear understanding of what is expected of them.

Best Practice standards play an important role in providing norms against which to measure performance. The Department will assume the lead role in developing standards of practice. The Department will also promote the development of Best Practice standards by other agencies and will encourage the regulated community to develop its own standards conforming to those of the Department.

Co-ordination is key
Policy formulation, planning, monitoring, auditing, public participation and co-ordination are important elements of the policy and strategy for the management of groundwater quality management in the RSA. Co-ordinating these functions must be part of this national strategy. The Department will also co-ordinate resource planning, setting of standards, monitoring and auditing.

FUNCTIONAL STRATEGIES

The functional approach which the Department will adopt in order to achieve its policy goals is:

- a source-directed approach to impact prevention and minimisation;
- a resource-directed approach to groundwater quality management; and
- a site-specific, needs-based approach to remediation of degraded groundwater.

Source-directed strategies
Source-directed measures include:

- authorisations and licences;
- standards to regulate the quality of waste discharges to water resources (the so-called end-of-pipe quality);
- requirements for on-site management practices (e.g. to minimise waste at source and to control diffuse pollution);
- requirements to minimise impacts of water use generally, not just water quality aspects;
- requirements for clean-up and remediation of water resources that have already been polluted.

Other protection measures include both mandatory and voluntary demand management, and economic incentives to foster the development of low-waste and non-waste technologies, and to reduce pollution.

Resource-directed strategies
Resource-directed measures are directed at the water resource itself. They focus on the water resource as an ecosystem rather than simply on water itself as a commodity. The following resource-directed measures are specified by the Act (Chapter 3):

- a national classification system for water resources, including groundwater;
- determining a management class for each resource;
- determining the "Reserve," which includes the basic human needs reserve (water for drinking, food preparation and personal hygiene) and the ecological reserve, which must be determined for all or part of any significant water resource such as rivers, streams, wetlands, lakes, estuaries, as well as groundwater;
- setting resource-quality objectives which represent the desired level of protection of a water resource;
- in general, for the groundwater component of the national water resource, a mortality rate of one in 300 000 of the aquatic environment is deemed acceptable for the determination of the Reserve.

Remediation strategies
Remedial action is needed when contamination of groundwater is occurring, or has already occurred, and where the law cannot be applied to enforce clean-up, or where it is necessary to replenish the reserve. Remedial actions will be implemented on a site-specific needs basis. Remedial actions include:

- prioritisation and evaluation of priorities for remedial action;
- clean-up of abandoned sites; and
- emergency action procedures or plans for accidental spills.

Integration
Implementation of the three strategies (source-directed, resource-directed and remediation) must be integrated to achieve the overall objective of sustainable groundwater utilization.

REGULATORY INSTRUMENTS

Regulatory instruments
Regulatory instruments provide the government with the means to intervene and influence the behaviour of the community targeted for regulation. Intervention is intended to ensure that the policy goals are achieved by inducing the desired behaviour from polluters and potential polluters. The strategy includes three kinds of instruments:

- instruments of direct intervention;
- incentive programmes; and
- supportive programmes.

Direct intervention
Direct intervention occurs when the Department intervenes or commands certain behaviour or performance from the target community. These instruments put the Department in a position to pre-empt the need for reactive measures. The instruments at the Department's disposal include, for example:

- water use licences
- general authorisations
- compulsory licences
- controlled activities
- pollution remediation
- emergency action.

The above and other control instruments will be implemented within the context of procedural and technical guidelines.

Incentives
Incentives will give the regulated community some flexibility, but within a framework of prescribed objectives. The Department supports self-imposed discipline and will continue to do so whenever possible. Where the regulated community can mobilise itself to develop sectoral norms and standards, the Department will actively participate in the process. Charges for water resources management may be used as an instrument to encourage appropriate behaviour.

Support
The Department will seek to influence sectors that cannot be controlled by direct intervention or incentives. Protection of groundwater in rural and peri-urban areas cannot be achieved through the usual direct intervention or incentive-based instruments. For these sectors the Department will use the following instruments:

- research and development to build capacity, to advance knowledge and understanding and to develop new and better ways of improving groundwater quality;
- Best Practice guidelines to educate and build the capacity of the community to regulate itself;
- educational initiatives to raise the level of awareness and develop skills needed to empower communities to protect their groundwater supplies; and
- extension services to advise and assist communities to implement groundwater protection programmes.

The Department will need to co-operate with other authorities and non-governmental organisations currently dealing with the affected communities. The Department will, up front, become involved in land-use planning decisions in order to prevent pollution. Land-use planning guidance notes and educational literature will be used.

GROUNDWATER QUALITY MANAGEMENT PROGRAMMES

In order to implement the Policy and Strategy, the Department will launch a series of groundwater quality management programmes.

Each programme will have a clearly defined objective, action plan and time frame. The purpose of each programme will be to develop a component of the strategy and to oversee its implementation into the operational part of the regulatory system.

Each programme will contribute to the further evolution of the strategy and to continuous improvement in the regulatory system.

Programmes to be started
The following programmes will enjoy the highest priority:

- community water source protection;
- public participation;
- aquifer classification;
- aquifer management system development;
- impact consent procedural system development;
- facility level groundwater quality monitoring;
- national groundwater information system development;
- land-use planning;
- Best Practice;
- underground storage of contaminated water;
- resource level groundwater quality monitoring;
- reserve determination;
- identification of groundwater restoration priorities; and
- research and development needs and priorities.

The national groundwater quality programmes cannot all be started at the same time. The Department will prioritise the programmes according to need and importance.

INSTITUTIONAL ARRANGEMENTS

Water quality management and specifically groundwater quality management must take place within the framework provided by the National Water Act and within the Department's organisational and other relevant institutional structures.

The institutional parts and the players
The Department will assume the leading role for groundwater quality management at national level and will rely on the following additional roleplayers:
- other national government departments;
- provincial and local government;
- the research community;
- the affected community;
- the regulated community.

Organisational strategies
The Department's organisational approach is based on centralised planning and decentralised implementation at regional and catchment level. Decentralised implementation of source-directed, resource-directed and remediation measures will be implemented by Catchment Management Agencies as part of a catchment management strategy for each catchment. Groundwater quality management will be devolved incrementally to this level.

Restructuring
The process that will lead to restructuring of the Department in accordance with the National Water Act is in progress. The organisational arrangements that will be required to give effect to the groundwater quality management strategy will be addressed during the restructuring process.

In the interim, the Department intends proceeding with implementation of the groundwater quality management strategy. Implementation will, however, be done in such a manner as to accommodate changes in the structure.

Community participation in groundwater quality management
Community participation in water resource management, and more specifically in groundwater quality management, will be facilitated through formal structures such as Catchment Management Agencies and Water User Associations.

Research and development
The current focus of the Department's research and development is through the Institute of Water Quality Studies and the Water Research Commission. Other organisations, however, also play an important role in water-related research.

ENABLING THE GROUNDWATER QUALITY MANAGEMENT STRATEGY

Creating an enabling environment in the context of this strategy means placing the people who will implement the strategy and administer the groundwater management system in positions to carry out these tasks. It also means facilitating their planning and evaluating their decision-making.

The above depends on a structured environment in which the following have been clarified and implemented:
- water resources policy and strategy;
- mandates; and
- supporting legislation and regulations.

Legal framework
Once the structured environment referred to above is in place it will be necessary to develop those instruments and procedures that guide practical implementation of the strategy.

Enabling instruments needed
Three main enabling instruments are needed to implement the strategy. These are:
- operational guidelines and procedures;
- technical guidelines; and
- training and development.

These instruments will be augmented by extension services.

Operational guidelines and procedures
Operational guidelines are needed to assist officials to perform their responsibilities and to carry out their functions in a coherent and consistent way. Some have already been developed to implement core components of the management plan. Others are in the process of being developed.

Technical guidelines
Technical guidelines are needed where practice is inadequate or inconsistent. The Department's "minimum requirements" already provide a good basis for BATNEEC (best available technology not entailing excessive cost) guidelines for waste management in general. These documents need revision to cover waste from cradle to grave and to accommodate the Department's differentiated protection policies. Further guidelines will be developed to support the groundwater management strategy.

Training and development
Departmental staff involved in water quality management will receive the necessary in-house training to be able to fulfil their functions effectively

Legal instruments
The National Water Act will enable the Department to effectively implement the groundwater quality management strategy. Several additional laws will play an important part in supporting implementation, for example:
- Water Services Act (Act 108 of 1997);
- National Environmental Management Act (Act 107 of 1998);
- Minerals Act (Act 50 of 1991);
- Environment Conservation Act (Act 73 of 1989).

water quality: waste management subseries

Section 1
INTRODUCTION

The National Water Act, 1998 (Act 36 of 1998) provides the necessary framework within which to protect, use, develop, conserve, manage and control our water resources. The Act needs to be underpinned by implementation-level policy and a structured management strategy. Integrated management of groundwater and surface water is required in order to provide for adequate protection of the resource.

The Department of Water Affairs and Forestry has, as early as 1994, initiated the development of a policy and strategy for the management of groundwater quality. This will form part of its overall National Water Resource Strategy. Extensive stakeholder consultation marked the development of the strategy. This development is now well advanced and the Department is already making progress on aspects of its implementation, supported by the provisions of the National Water Act.

Effective management requires continuous review and adaptation of strategies. The strategy set out in this document provides a starting point for managing groundwater quality. It should therefore be viewed as being dynamic and must be expected to evolve as other areas of strategy enabled by the National Water Act are developed.

1.1 South Africa's water resources under stress

South Africa's water resources are very unevenly distributed across the country, and in arid or water-scarce areas, water supply is a constraint to social and economic development. At the present population level of around 42 million, there are just over 1 200 kilolitres per person per year of available fresh water. This places South Africa on the threshold of the internationally accepted definition of "water stress."

1.2 Equity

The provision of safe drinking water has been recognised as a critical factor in breaking the cycle of poverty and underdevelopment. The basic water provision as defined in the White Paper on Water Supply and Sanitation (1994) is 25 litres of water per person per day within 200 metres of their home.

1.3 Groundwater is valuable

Groundwater is a key component of the water resources of South Africa. As such it will provide much of the water required for basic needs, especially since the country's surface water resources are unevenly distributed and cannot cope with the growing demand for water. Groundwater is especially important because:

- it occurs widely, even in the drier two-thirds of the country where there is little or no surface water;
- almost two-thirds of South Africa's population depends on groundwater for their domestic water needs; and
- essential domestic needs can be met cost-effectively from groundwater sources.

Groundwater, in many parts of the country, provides the only means of satisfying basic human needs. Present coverage of water supply is estimated at around 68%. The target is full coverage to satisfy basic needs by 2007. As the country's people start depending more and more on groundwater, so the need grows to provide for the security of its supply. Protection of groundwater has, therefore, now become a national priority.

1.4 Groundwater is vulnerable

It is common for groundwater to be poorly managed. This is because of its invisible nature - it takes a long time to notice when it has become polluted and, unlike surface water, it has limited ability to purify itself. It is difficult, and often impossible, to restore polluted groundwater, and certainly very expensive.

The major reason for poor management of groundwater resources, however, is ignorance. Water managers lack knowledge and information about where it occurs, the importance of its protection, and how to protect it.

1.5 A structured approach

Water management must take into account political, social and environmental issues. Management plans must also be part of broader, regional development plans that include agricultural, mining, manufacturing, rural and urban development and ecological needs.

Protecting surface and groundwater in an integrated manner is central to successfully managing the country's limited water resources. The National Water Act provides the necessary framework within which to protect, use, develop, conserve, manage and control our water resources but needs to be underpinned by implementation level policy and a structured management system.

The structured approach to management of groundwater should be based on the fundamental water law and in the context of the following framework:

- a change from private to public status of all groundwater, as has been effected by the National Water Act (1998);
- transparency and freedom of access to information;
- integrated management of surface and groundwater quality and quantity; and

- restructuring of pollution control and waste management into an integrated regulatory system.

1.6 Water Law principles

Government policy and strategy are guided by seven water law principles contained in Appendix 2 of the Department's White Paper on a National Water Policy for South Africa. The three principles below are very important for groundwater:

Principle 2: *All water, wherever it occurs in the water cycle, is a resource common to all, the use of which shall be subject to national control. All water should have a consistent status in law, irrespective of where it occurs.*

Principle 3: *There shall be no ownership of water, but only a right to its use (for environmental and basic human needs) or an authorisation for its use. Any authorisation to use water in terms of the Water Law shall not be in perpetuity.*

Principle 5: *In a relatively arid country such as South Africa, it is necessary to recognise the unity of the water cycle and the interdependence of its elements, where evaporation, clouds and rainfall are linked to groundwater, rivers, lakes, wetlands and the sea, and where the basic hydrological unit is the catchment.*

1.7 Groundwater as part of the Department's national water resource strategy

Figure 1 illustrates the Department's overall functional structure for water resource management which is underpinned by water use regulation and water resource protection. Groundwater quality management involves both source-directed and resource-directed pollution prevention, as well as remediation measures. The groundwater quality management strategy addresses these aspects.

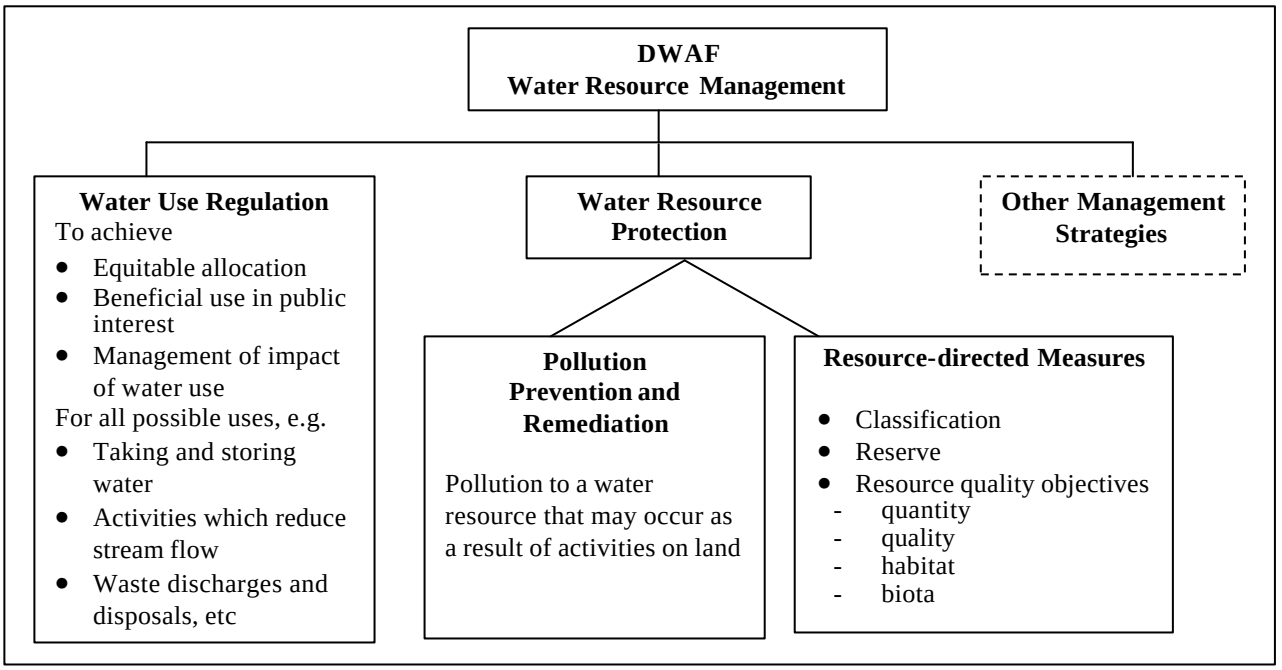

Figure 1. Functional Structure of the Department of Water Affairs and Forestry.

Section 2
GROUNDWATER QUALITY MANAGEMENT FRAMEWORK

This policy and strategy deal with groundwater quality management within the broader framework of the country's water policy, the National Water Act and the Water Services Act.

2.1 The National Water Act (1998)

The National Water Act provides the framework within which the Department can manage the protection, use, development, conservation and control of South Africa's water resources.

The eleven uses of water specified by the National Water Act (Section 2) are:

- taking water from a water resource
- storing of water
- impeding or diverting the flow of water in a watercourse
- engaging in a stream flow reduction activity
- engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1)
- discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit
- disposing of waste in a manner which may detrimentally impact on a water resource
- disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process
- altering the bed, banks, course or characteristics of a watercourse
- removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people, and
- using of water for recreational purposes.

The eleven uses are not rights and may generally take place only in terms of an authorisation or licence.

In implementation of the Act the Department must take into account the following (section 2 of the Act):

a) basic human needs of present and future generations
b) the need for equitable access to water
c) redressing the results of past racial and gender discrimination
d) promoting the efficient, sustainable and beneficial use of water in the public interest
e) facilitating social and economic development
f) providing for growing demand for water use
g) protecting aquatic and associated ecosystems and their biological diversity
h) reducing and preventing pollution and degradation of water resources
i) meeting international obligations
j) promoting dam safety
k) managing exposure to, and effects of, floods and droughts

National government is empowered through the Act to establish suitable institutions and to ensure that they have appropriate community, racial and gender representation.

The Act will enable the Department to effectively implement its new policies regarding groundwater quality management. The following will be important:

- groundwater no longer enjoys the status of private water and is now subject to the same control measures as surface water;
- powers to monitor, assess, plan and audit performance of all water users have been provided for in the Act;
- the Department can within its available resources provide extension and support services and play a role in building capacity at community level; and
- the Department will be able to influence land-use-planning decisions, to regulate or prohibit land-based activities, to develop and implement Best Practice standards and to implement source controls where necessary. Implementation of Best Practice standards as conditions of authorisation managed by other organs of state will be particularly important.

2.2 Policy principles

Sustainability and equity are recognised as central guiding principles in the protection, use, development, conservation, management and control of water resources.

These guiding principles recognise the basic human needs of present and future generations: the need to protect water resources, the need to share water resources with other countries, the need to promote social and economic development through the use of water and the need to establish suitable institutions in order to achieve the purposes of the Act.

The special nature of groundwater must be recognised in implementing policy. Impacts on groundwater are often long term and irreversible. The precautionary principle must therefore be strictly applied when making decisions about groundwater.

2.3 The Department as Trustee

National Government, acting through the Minister, is the public trustee of the country's water resources. The Minister, through the Department, is responsible for implementing the National Water Act (1998). Surface and groundwater quality management are both important parts of this responsibility.

The strategy for groundwater quality management must therefore be executed in the context of the Department's overall National Water Resource Strategy, and its water quality management strategy.

The Department is currently refining its water quality management strategy as a part of the National Water Resource Strategy provided for by the Act. Developing a strategy for groundwater quality management and creating the associated enabling context are part of this process.

Section 3
MISSION, GOALS, PRINCIPLES AND APPROACHES

A structured approach to the implementation of the Policy and Strategy for Groundwater Quality Management requires a clear mission, goals, guiding principles and approaches within the context of the Department's overall National Water Resource Strategy.

3.1 Water resource management mission

In the context of the National Water Act the Department's water resource management mission is:

To act as the public trustee of the nation's water resources to ensure that the country's water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner.

3.2 Groundwater quality management mission

The groundwater quality management mission is set in the context of the water resource mission and is as follows:

To manage groundwater quality in an integrated and sustainable manner within the context of the National Water Resource Strategy and thereby to provide an adequate level of protection to groundwater resources and secure the supply of water of acceptable quality.

3.3 Policy goals

The Department will achieve its mission through effecting three policy goals:

- to implement source-directed controls measures to prevent wherever possible and minimise, at source, the impact of development on groundwater quality by imposing regulatory controls and by providing incentives (mainly Chapter 4 of the National Water Act);
- to implement resource-directed measures in order to manage such impacts as do inevitably occur in such a manner to protect the reserve and ensure suitability for beneficial purposes recognised by the National Water Act (1998) (Chapter 3 of the National Water Act);
- to remediate groundwater quality where practicable to protect the reserve and ensure at least fitness for the purpose served by the remediation (Chapter 3 of the National Water Act).

3.4 How to effect the policy goals

The groundwater quality management mission will, in essence, be achieved by the Department through:

- the regulation and prohibition of land-based activities which may affect the quantity and quality of water (Section 13 of the National Water Act), i.e.;
- exercising control over the practices, measures and land-based activities which are implemented to lessen the polluting effects of activities which threaten groundwater quality;
- exerting control over the aggregate impact of certain prescribed activities and groups of activities;
- establishing an understanding of the importance and vulnerability to pollution of the country's groundwater resources; and
- establishing an understanding of the relationship between polluting activities (sources) and quality effects in the groundwater, i.e. understanding the origin of pollutants, the pathways which these pollutants could follow into the environment and the ultimate fate of these pollutants.

3.5 Principles in practice

Guiding principles provide the overall value system for approaching water quality management. Some of these principles require elaboration within the context of this document. Equity was described earlier.

3.5.1 Subsidiarity and self-regulation

The Department will promote the devolution of responsibility to the lowest level consistent with effective functioning of the system. The Department will, however, retain all powers in terms of the National Water Act enabling it to act in those instances where regulatory initiatives by other authorities or self-regulation fails to produce the required results.

3.5.2 Pollution prevention

Every effort will be made to prevent pollution through upfront intervention in any development activities which may impact on groundwater. Proponents will have to demonstrate that suitable processes and practices will be employed to prevent pollution and minimise waste. Prevention of land-use practices which threaten groundwater resources is central to implementation of this principle.

3.5.3 Integrated environmental management

The Department will promote integration by participating in the development and implementation of an integrated environmental management system and integrated pollution control system for South Africa.

3.5.4 Sustainability

Groundwater quality should be managed such that future generations have access to groundwater that is fit for use. It recognises that degradation of groundwater quality can cause irreversible effects.

3.5.5 Polluter pays

Those using resources, receiving a service or producing waste, should carry the costs and the responsibility for pollution arising from the use of such resources, from the use of the service and from the associated production of waste.

3.5.6 Public participation

Extensive provision has been made in the National Water Act for stakeholder consultation.

3.6 The integrated waste management hierarchy

The waste hierarchy is central to the groundwater strategy. The philosophy is that all waste management and pollution control implementation should follow a hierarchy of priorities.

The order of priority is:

- prevent waste production and pollution wherever possible;
- minimise unavoidable waste production by recycling and treatment; and
- dispose of waste that cannot be recycled or treated.

As a general strategy, the waste hierarchy must be applied to all decision-making processes and must be built into routine regulatory procedures including:

- enforcement (through licences or regulations);
- standard setting; and
- regulatory programmes.

3.7 The prevention approach

Development will always involve some environmental impacts, but these can be prevented in some individual cases. Wherever possible, the regulatory authorities must prevent waste production, prevent impacts and prevent risks to environmental resources. The strategy will be to:

- prevent development from taking place where the associated impact will cause unacceptable damage (Section 13 of the Act), or will pose an unacceptably high risk to the affected environmental resources;
- prevent the use of procedures, processes, activities or substances that pose an unacceptably high risk to the environment; and
- prevent discharges or emissions that pose an unacceptably high risk to the environment.

Prevention is better than cure. In practice the Department will apply this approach in the following ways:

- preventing development of a specified nature in sensitive environments, such as refusing to allow the construction of landfills in areas where groundwater resources may be important and highly vulnerable to pollution; and
- by implementing a differentiated approach to protection by applying stricter standards where the risk to the environment must be contained, such as specifying multiple liners and leak detection for landfills in areas where groundwater may be at risk.

Prevention must pervade the thinking, approach and action of all regulatory roleplayers, regarding groundwater quality management.

3.8 Precautionary approach

Groundwater protection will be based on a precautionary approach. All groundwater will therefore be assumed to be vulnerable to damage unless it can be shown otherwise. This approach to protection will be implemented for source-directed, resource-directed and remedial management measures.

3.9 Differentiated approach

In South Africa's situation of widespread and highly localised groundwater occurrence and use, it will be physically and economically impossible to protect all groundwater resources to the same degree. It is also important to note that South Africa's water policy does not aim to prevent impacts to the water environment at all costs since this would not allow the country to achieve much-needed social and economic growth. For effective and focused intervention, a differentiated protection approach is necessary, based on the vulnerability - and regional, as well as local importance - of aquifers.

The National Water Act (Chapter 3) provides for classification of water resources. Resource quality objectives must then be specified for different water resource classes. The required reserve must also be determined and will be a central consideration in determining the resource quality objectives and the management measures that will be required to protect the resource.

In general, for the groundwater component of the national water resource, a mortality rate of one in 300 000 of the aquatic environment is deemed acceptable for the determination of the Reserve. In specific circumstances (highly sensitive aquifers or aquifers with high natural background levels of certain chemicals), and if defensibly motivated, this rate can be adapted on the basis of a quantitative risk assessment.

Different criteria will be used in the classification of different kinds of water resources. Groundwater resources will be grouped into aquifers. Each aquifer will be assigned a management class on the basis of the importance of that aquifer. The importance accorded will be based on the potential yield as well as the level to which communities depend on the aquifer. Aquifers which represent the sole source of water for communities will be afforded special status irrespective of their potential yield and will enjoy the highest level of protection.

3.10 Authorisations and the role of Best Practice

The regulated community must implement some form of Best Practice to protect the environment from unnecessary damage. This is a minimum requirement and makes Best Practice standards the basis of responsible source control.

The regulatory authorities must ensure that Best Practice is clearly defined for those procedures, processes, activities and substances that are a potential threat to the environment.

Source-directed pollution prevention has been enabled through the National Water Act in a number of ways. Of these, regulations, licences and general authorisations are the most direct and powerful. These instruments are based on standards of performance which need to be documented to provide the Department and the regulated community with a clear understanding of what is expected of them.

The Department will assume the lead role in developing standards of practice. The Department will also support the development of Best Practice standards by other agencies and will encourage the regulated community to develop their own standards that will be acceptable to the Department.

3.11 The decision-making framework

Measures to avoid waste and impacts often benefit one part of the environment more than others. In some instances, waste treatment measures that benefit one environmental aspect may increase discharges or emissions to another. Therefore, Best Practice is best implemented by considering the environment as a whole.

The Best Practicable Environmental Option (BPEO) provides a decision-making framework to consider the impacts of different waste discharge and disposal options on the receiving environment. In some cases this may involve systematic processes to identify the best option; in others, experience may indicate the choice between options.

All regulatory processes must adopt systematic thinking to select the best practicable environmental option. Standards should also be set using the BPEO framework.

3.12 General approach to arranging functions

The Department will rely on three main approaches to the grouping of regulatory functions. These will provide the desired level of flexibility to facilitate transfer of functions to its regional offices, the water management institutions to be established in terms of the National Water Act, or other spheres of government in an ordered and efficient manner. They are:

- grouping of main functions around a “like mission” or common purpose;
- grouping of subordinate functions (within main functions) around specific tasks to make up semi-independent regulatory programmes; and
- grouping of integration functions together to facilitate effective co-ordination.

Policy formulation, planning, monitoring, auditing, public participation and co-ordination are all-important elements of the groundwater quality management strategies. Co-ordination of these functions must thus be integrated into the national strategy during implementation. Co-ordination is thus emerging as one of the most important national functions.

The Department will co-ordinate resource planning, setting of standards, monitoring and auditing and will concentrate on:

- the refinement of the national groundwater policy and strategy;
- building provincial and local government capacity to assume responsibility for implementation of national groundwater quality management and enforcement programmes;
- co-ordination of programme implementation;
- development of standardised approaches for addressing sources of pollution and converting these to implement programmes;
- management of the groundwater resource; and
- promotion and co-ordination of research and development with particular reference to cleaner technology and the understanding of the relationships between sources of pollution and impacts on groundwater.

Grouping of functions around a common purpose is the first step in ordering the regulatory system. The Department has elected to group functions around the three policy goals. This will have the following advantages:

- it will facilitate the grouping of like tasks or functions which require similar skills and training; and
- it will ensure that work in each grouping can be directly related to the objective for that grouping.

3.13 Three main functional groups

Figure 2 illustrates the three main strategies which will be adopted to meet the policy needs, and the functional groups will be formed around these three strategies. A fourth group will be required to integrate the work of the three shown in the figure.

The integration functions will serve the purpose of co-ordinating regulatory action as well as providing the fibre which binds the three functional groupings together.

3.14 Source-directed strategies

3.14.1 Prevention and minimisation of impacts and the production of waste through source control

Source-directed measures and the associated performance are often prescribed by legislation other than the National Water Act. Other regulatory authorities assume responsibility for the administration of these Acts. Thus, even though the Department may be in a position to impose controls on these activities it will not necessarily do so through the National Water Act until possibilities to achieve the desired level of control through the other Acts have been considered by applying the principle of co-operative governance.

The desired level of control of sources of pollution which threaten the groundwater resource may thus be achieved by one or other of the following means, or by a combination thereof:

- direct statutory controls through the National Water Act and regulations promulgated thereunder;
- inclusion by the Department of conditions imposed through permits and authorisations issued by other authorities; and
- Best Practice guidelines published by the Department, other authorities, or the regulated community itself in co-operation with the Department.

The Department intends implementing a differentiated approach to source-directed measures. This will mean that the relative stringency and risk levels which will be required to be managed will be based on the importance and vulnerability of the groundwater which is at risk.

Best Practice guidelines will form the basis for the national standards which will apply to the different classes of groundwater. Classes of groundwater will be established by a national aquifer classification system.

Special standards and protection measures may be required in addition to Best Practice. These will be part of the special requirements of a catchment or aquifer management plan.

3.15 Resource-directed strategies

In order to manage groundwater quality effectively the Department will develop a good understanding of the relationship between the causes of groundwater damage and the effect on the resource. The Department will also develop a good understanding of groundwater quality status, and the ability to anticipate threats. With this understanding, the Department will make use of the regulatory instruments at its disposal to impose on sources of pollution timeously.

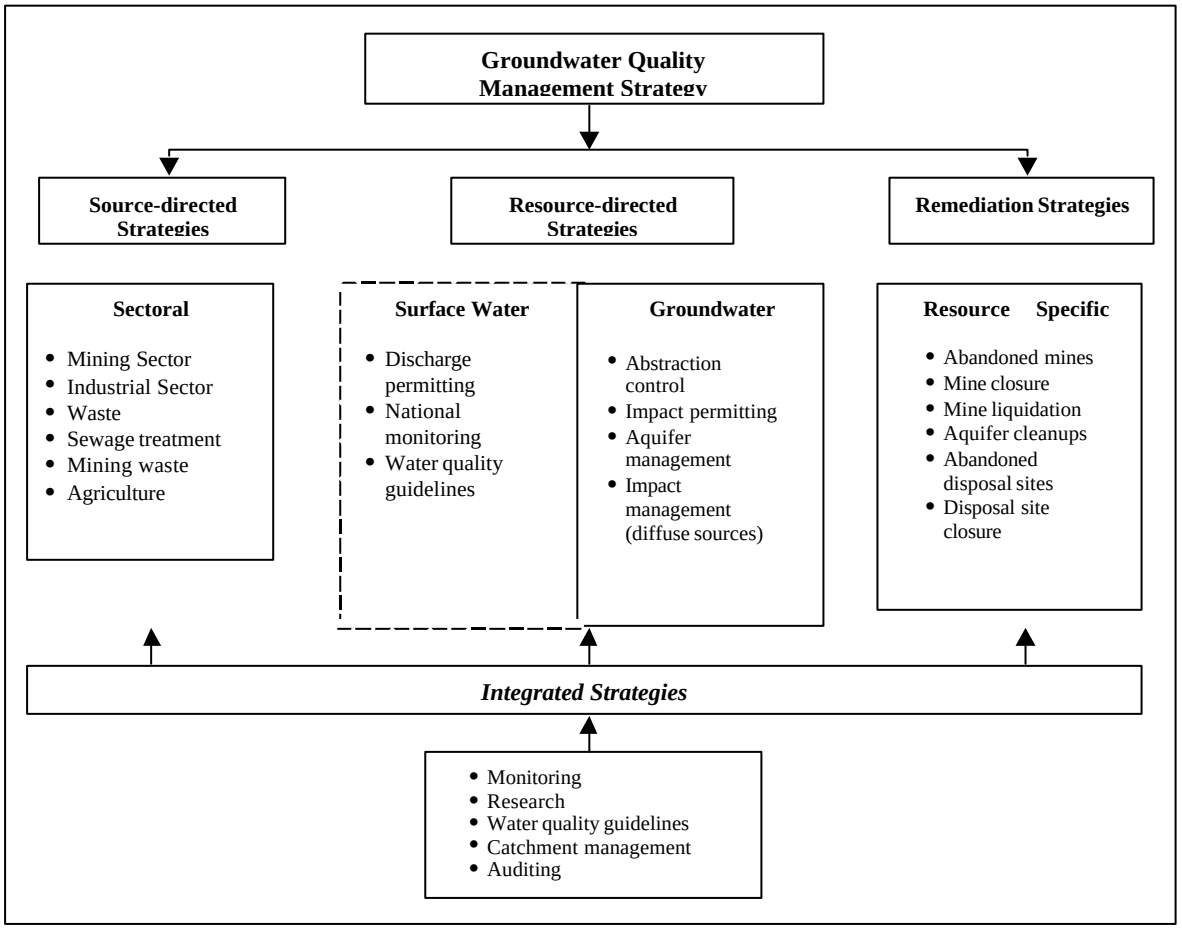

Figure 2. Relationship between the three main strategies and the functional groups around each.

The essence of groundwater quality management is to be able to choose and deploy those source controls or remediation measures which would be most effective in protecting the resource.

Groundwater quality can best be managed on an aquifer basis. The above mentioned functions will thus generally be integrated through aquifer management strategies. Aquifer management strategies will, however, be required only for large and continuous aquifers. Localised and poorly defined aquifers will generally be taken care of as part of a catchment management strategy.

However, national groundwater resource management also requires that functions other than those specific to particular aquifers be performed. These functions include:

- Ambient quality standards (water quality guidelines);
- National protocols and procedures;
- Performance auditing; and
- National information.

3.16 Remediation strategies

Remediation involves restoration of areas that historically have had unacceptable impacts and of underground water resources or areas where impacts on such resources have become unacceptable.

The Department will identify where remediation is necessary. The Department should then intervene only as a last resort and should, as its highest priority, ensure that remedial action is taken by those responsible in accordance with the principle that "the polluter should pay".

The identification and prioritisation of remedial action will take place at catchment level on a needs basis.

3.17 Integration of groundwater quality management

The Department's policies form part of a network of policies, strategies, laws and regulations at national, provincial and local level. The Department relies upon this network in order to achieve the national mission of sustainable utilisation of groundwater resources. Policy and lawmaking are thus an important integrating instrument but cannot alone achieve the required degree of integration.

The three functional groups (source-directed, resource-directed and remediation functions) must be integrated in order to achieve the overall objective of sustainable utilisation of the groundwater resource. The integration functions serve the purpose of co-ordinating regulatory action, as well as providing the fibre which binds the three functional groupings together.

The Department recognises that integration is a necessary function in its own right. Integration functions serve to:

- co-ordinate the Department's initiatives to develop Best Practice guidelines. Internal co-ordination will achieve the required level of integration between surface and groundwater requirements (see Figure 2 earlier). External liaison will, however, also be required with other regulatory authorities;
- co-ordination of the Department's inputs into policy and lawmaking initiatives within and outside of the Department;
- initiation, prioritisation and co-ordination of national groundwater quality programmes (see Section 6 later);
- implementation of outcome of national programmes; and
- co-ordination of research initiatives for groundwater and surface water.

Planning and national programmes will be integrated at national level by organisational restructuring. At the operational level, integration will be achieved through the function of catchment management.

3.18 Key success factors

Factors that will have a major influence as regards a successful approach in the implementation of the strategy are set out below.

3.18.1 Departmental factors

Factors at departmental level that will contribute to successful implementation include:

- strategic reorientation of the Department to a catchment management-based structure. This is central to successful implementation of this strategy;
- adequate funding, especially to develop the necessary management instruments to address future needs proactively;
- human resources, especially attracting, developing and maintaining the disciplines and skills required to implement water quality management functions at all levels in a consistent and balanced manner; and
- prioritising to ensure that the water quality management function is implemented with conviction at all levels.

3.18.2 Other factors

Factors outside the direct control of the regulatory system of the Department, but within its ambit, and that will contribute to successful implementation include:

- Co-operation with other government Departments to:
  - Streamline authorisations and ensure speedy processing of development proposals by adopting a one-window approach; and
  - retain sufficient control to ensure that the Department is able to fulfil its responsibilities with regard to the management of the water resource;

- co-operation with other organs of state, industry and civil society in developing best management practices and research.

3.18.3 External factors

External factors will also play an important role in facilitating successful implementation of the groundwater quality management strategy. Some of these factors are:

- community participation in and support for source protection and for an integrated catchment/aquifer-based approach to water resource management;
- improved levels of awareness regarding the nature and importance of groundwater as a valuable community resource; and
- mutual co-operation between the Department and sectors in promoting the development of better and cleaner technology.

Section 4
FUNCTIONAL STRATEGIES

The functional strategies which the Department will adopt to meet its policy goals are addressed in this section. Each group requires its own strategies for implementation, based on the nature of the problems concerned and the mission which the function serves. The functional strategies for each of the three groups are described below, followed by the integration functions to co-ordinate the regulatory action.

4.1 Source-directed strategies

Source-directed measures include:

- authorisations and licences;
- standards to regulate the quality of waste discharges to water resources (the so-called end-of-pipe quality);
- requirements for on-site management practices (e.g. to minimise waste at source and to control diffuse pollution);
- requirements to minimise impacts of water use generally, not just water quality aspects;
- requirements for clean-up and remediation of water resources that have already been polluted.

Other protection measures include both mandatory and voluntary demand management, and economic incentives to foster the development of low-waste and non-waste technologies, and to reduce pollution.

The Department will seek to control, directly or indirectly, those activities which threaten the groundwater resources of South Africa. Source controls will be implemented on a differentiated basis. The differentiated approach will be based on the vulnerability and importance of the affected groundwater. The Department will also introduce a requirement for impact consents for the most polluting processes and activities such as mining and heavy industry. The following activities will be specifically targeted for control:

- groundwater abstraction de-watering and recharge;
- disturbance and damage to aquifers by mining and industrial activities;
- waste disposal and storage;
- diffuse sources of pollution associated with urban and rural development; and
- underground storage tanks.

Direct regulatory intervention is necessary insofar as other influences over sources of contamination are unsuccessful in reducing impacts to acceptable levels. The Department of Water Affairs and Forestry will thus always retain statutory powers to control groundwater contamination, but should rely on other means wherever possible.

The following hierarchy of intervention is thus advocated by the Department:

- encouragement of self-imposed discipline;
- ensuring that Best Practice and direct controls implemented by other organs of state such as the Department of Minerals and Energy for the mining industry satisfy the requirements of the National Water Act;
- regulatory control in terms of the National Water Act and the regulations promulgated thereunder; and
- development of Best Practice Guidelines which in instances may become a condition of water-use licences.

The influence which the Department may be able to have over Best Practice standards and statutory controls implemented by other organs of state will depend largely on the efficiency of the Integrated Pollution Control (IPC) regulatory system which is evolving for South Africa. Until such time as the IPC system is in place and functional, the Department will establish *ad hoc* understandings with other organs of state in order to achieve the required level of control.

4.1.1 Land-use planning and land-use allocation

Influence over and regulation or prohibition of land-based activities, and especially involvement in the planning and decision-making processes which lead to allocation of land for prescribed uses, are central to the control which the Department needs to exercise. Section 13 of the National Water Act makes provision for this.

The Department will thus proactively participate in land-use planning and will prescribe in legislation to land-use planning authorities the location of potentially polluting processes and facilities where aquifers are least vulnerable or where no exploitable groundwater exists. Where required, this will be preceded by consultation.

Best Practice guidelines and land-use planning guidance notes will provide the basis for influencing land-use decisions and regulating land-based activities. Special requirements may be contained in catchment management strategies and interfacing between the Department and land-use planners will take place through the officials responsible for operational catchment management.

4.1.2 Groundwater abstraction and de-watering

The Department assumes responsibility in terms of the National Water Act for the control of abstraction of groundwater in order to prevent:

- depletion or damage to the reserve;
- temporary or permanent loss of the use of aquifers through over-abstraction or unnecessary de-watering;
- loss of surface water base flow or damage to wetlands and riverine environments which depend on groundwater;

- deterioration of groundwater quality; and
- intrusion of saline or contaminated groundwater into otherwise uncontaminated aquifers.

The Department will intervene directly to control abstraction and de-watering where appropriate. The utilisation of groundwater for private domestic consumption and animal-watering purposes will, however, not specifically be controlled unless community interests are at stake.

Abstraction control for the purposes of water quality management will be integrated with the resource management regulatory controls.

4.1.3 Disturbance of aquifers by mining and related activities

The Department of Water Affairs and Forestry recognises that a variety of activities may impact adversely on aquifers or otherwise disturb them. The most significant activities which could disturb groundwater are:

- opencast mining and quarrying;
- underground mining;
- land drainage; and
- mine de-watering.

The Department recognises that disturbance and impact are an inevitable consequence of mining activities. It will, however, object to the approval of an Environment Management Programme (EMP), or the granting of a temporary authorisation to commence with mining prior to the approval of an EMP in terms of the Minerals Act, under the following circumstances:

- reduction in, or the total loss of, a groundwater resource which constitutes part of the reserve and sustains surface water base flow or environmental features such as wetlands and sensitive riverine ecology;
- reduction in, or total loss or contamination of, groundwater which is or could be exploited on adjoining properties to sustain land use which is consistent with the land capability; and
- permanent reduction or loss of groundwater on the mine property which will preclude the remediation of groundwater supplies to sustain the post-mining land use.

The Department will adopt a precautionary approach in its evaluation of applications for authorisations. The proponent will be required to ascertain the extent of the impact which will be associated with the mine and will implement appropriate mitigatory measures where necessary. The Department will permit the impact only if this and other required conditions have been met.

The measures required to protect the groundwater resource will depend on the importance and vulnerability of the resource being threatened.

Non-mining related activities may also result in disturbance of aquifers and storage such as urban development and agricultural activities which alter recharge. The impacts associated with these activities will be monitored and, if necessary, brought under appropriate regulatory control.

4.1.4 Damage to aquifers by waste disposal and related activities

The Department of Water Affairs and Forestry will follow a differentiated approach to the control of waste and wastewater disposal activities. Activities which will receive specific attention include:

- mining and industrial residue disposal (waste deposits);
- power generation ash disposal;
- irrigation with waste water, evaporation and storage of mining and industrial effluent and sludges;
- land-based disposal of sewage sludge;
- domestic waste landfills;
- stockpiles of potentially polluting substances;
- hazardous waste landfills;
- animal wastes and feedlots; and
- hydrocarbon storage tanks.

The Department will not issue licences in terms of Section 20 of the Environment Conservation Act unless land has been zoned for waste disposal. For the purposes of licencing of waste disposal sites the Department will base its regulatory response upon the importance and vulnerability of the aquifer which is threatened by waste disposal activities.

Major aquifers and vulnerable sole-source aquifers:
The Department will place a general ban on waste disposal and other polluting activities within 200 metres of the recharge zone for major aquifers and sole-source aquifers.

***Minor aquifers*:**
The Department will generally not object to licencing or authorisation of waste disposal within the recharge zone of minor aquifers provided that adequate pollution control measures will be implemented. Such measures as may be necessary for the most commonly practised waste disposal methods may be published by the Department in the form of Best Practice guidelines from time to time or may be published in regulations.

***Poor aquifers*:**
The Department will not normally object to waste disposal activities on areas which are underlain by poor aquifers. Minimum standards of Best Practice will nevertheless be a pre-requisite in these cases.

Monitoring and auditing:
Monitoring of performance of waste disposal facilities and their associated pollution prevention measures will be mandatory. Monitoring systems shall generally form part of the management systems which the waste facility operator must implement. Routine auditing may be prescribed as a licence condition, in terms of regulations or in the guidelines.

The Department will undertake periodic compliance audits. Facilities will be selected for audit on the basis of their performance and the quality of internal audits.

4.1.5 Diffuse sources

Diffuse pollution sources represent an ever-increasing threat to groundwater. The following diffuse sources will require specific attention:

- urban development;
- farming practices;
- peri-urban development; and
- spills and illegal dumping.

Rapid urbanisation and increasing density of residential development in rural environments pose a significant threat to groundwater quality in terms of:

- pit latrines, septic tanks and soakaways;
- leaking and overflowing sewers;
- domestic waste; and
- inappropriate land use around wellheads.

Diffuse source controls will be implemented by raising awareness and encouraging better and improved practices (e.g. cleaner technology for industries). The Department will rely on the line function government departments responsible for interfacing with the communities concerned to assist with advisory services and awareness creation. Specialist advice will be provided by the Department.

Sanitation and community waste disposal:

The Department will seek to promote the development and implementation of cleaner sanitation and waste disposal practices in rapidly developing areas. The use of pit latrines, septic tanks and soakaways will be discouraged in urban, peri-urban and high population density rural settlement situations. Guidelines regarding the siting and control of graveyards will also be developed by the Department.

Wellhead protection (source protection):

Inappropriate land use around wellheads will be discouraged and regulated or prohibited where necessary. The Department will develop guidelines to facilitate implementation of rational wellhead protection plans and will strive to make borehole users and owners aware of the consequences of inadequate protection of their groundwater supplies.

Farming practices:

Farming practices can lead to contamination of groundwater. Nitrates, herbicides and pesticides are the main water quality variables of concern.

The use of fertilisers, herbicides and pesticides will be restricted in the recharge zones of important aquifers and sole-source aquifers. Guidelines for the safe use of herbicides and pesticides will be published by the Department.

Underground storage tanks:

Leakage from underground storage tanks is an important source of contamination of groundwater.

4.1.6 Other sources of groundwater contamination

The following further sources of potential contamination will require more specific attention:

- industrial sources;
- power generation; and
- littering and illegal dumping.

It is expected that these sources will be included in the regulatory ambit of Integrated Pollution Control.

4.2 Resource-directed groundwater quality management strategies

Resource-directed measures are directed at the water resource itself. They focus on the water resource as an ecosystem rather than simply on water itself as a commodity. The following source-directed measures are specified by the Act (Chapter 3):

- a national classification system for water resources, including groundwater;
- determining a management class for each resource;
- determining the "Reserve," which includes the basic human needs reserve (water for drinking, food preparation and personal hygiene) and the ecological reserve, which must be determined for all or part of any significant water resource such as rivers, streams, wetlands, lakes, estuaries, as well as groundwater;
- setting resource-quality objectives which represent the desired level of protection of a water resource.

Groundwater quality management cannot be carried out without intimate knowledge of the nature, extent, potential yield and vulnerability of the resource. The relationship between groundwater and surface water must also be understood in order to facilitate effective management.

The logical unit for groundwater quality management is an aquifer. Since aquifers are, in general, contained within a surface water catchment, and since the surface water catchment represents the most logical surface management unit, the Department has adopted the catchment as the basic groundwater management unit. Catchments may, however, be subdivided into groundwater management areas for better resolution where appropriate.

Inter-catchment influences and interactions will be managed by exception. This will specifically apply to aquifers which transcend catchment boundaries.

4.2.1 Resource evaluation

Classification according to importance and vulnerability will serve as the basis for management of the country's groundwater resources from the perspective of quality. The classification system, however, must be integrated with the resource classification system. Table 1 shows the classes that will be differentiated for the purposes of groundwater quality management.

Fitness for designated beneficial uses remains the basis of water resource quality management. This will, in practice, be implemented for groundwater by preventing impacts on major aquifers and on those which provide a sole source of water supply. Impacts on minor aquifers will be controlled by impact assessments and impact consents where appropriate.

The Department will establish maps indicating the boundaries of the different classes. The scale and resolution will be dictated by needs. The highest priority at present will be for regional land-use planning.

Table 1. Classes that will be differentiated for groundwater quality management

AQUIFER TYPE	DESCRIPTION
Sole-source aquifer	An aquifer used to supply 50% or more of urban domestic water for a given area and for which there are no reasonably available alternative sources of water.
Major aquifer	A high-yield aquifer system of good quality water.
Minor aquifer	A moderate-yield aquifer system of variable water quality.
Poor aquifer	A low- to negligible-yield aquifer system of moderate to poor water quality.
Special aquifer	An aquifer system designated as such by the Minister of Water Affairs and Forestry, after due process.

4.4.2 Anticipation of threats to groundwater

The ability of the Department to anticipate threats will depend on an understanding of the relationship between potential causes and their impacts on the groundwater environment. The national groundwater information system will provide the Department with the key information required to anticipate threats. The information system will depend upon three main sources for the advance warning required in order to act timeously. These are:

- facility level monitoring (part of the source-based control requirements);
- regional and national monitoring; and
- investigations and research.

Facility level monitoring will normally be prescribed as a condition of the permission to operate a mine or facility with the potential to pollute the groundwater. The appropriate level of detail required for monitoring will be site specific and will depend on the classification of the aquifer at risk.

Regional and national-scale monitoring will be undertaken by the Department and by other authorities contracted by the Department. This monitoring will provide a lower level of resolution than facility level monitoring, but will provide a basis for assessing macro trends in groundwater quality

Investigations and research form one of the cornerstones of the Department's anticipatory approach to water quality management. These functions serve to assess and quantify those threats which are identified as having potential to impact on groundwater quality in future. Examples of threats which have been identified and which require quantification and strategic assessment before further regulatory intervention is contemplated include:

- abandoned and operating non-hazardous landfills;
- acid mine drainage from closed mining operations;
- herbicides and pesticides;
- animal feedlots and kraals;
- fertilisers;
- urbanisation;
- pit latrines and soakaways; and
- leaking storage tanks.

4.2.3 Groundwater quality programmes

Development of regulatory initiatives and continuous improvement in the effectiveness of protection of groundwater will be achieved through national groundwater quality programmes (see Section 6 below). These programmes will be established with specific objectives and will usually lead to improvements and refinement of the regulatory system. The programmes component of the Department's functional strategy will serve a variety of purposes of which the following are considered to be the most important:

- development of new or more stringent Best Practices;
- development of better enforcement processes;
- identification of the need for and initiation of remedial action; and
- identification of areas of research and development of cleaner technologies.

A structured approach to the identification, prioritisation and implementation of national groundwater quality programmes will serve the important purpose of:

- co-ordinating roleplayers from different sectors and spheres of government towards a single objective; and
- securing funding on a sustainable basis for priority issues.

4.2.4 Groundwater status reporting

The national groundwater quality information system provided for in the National Water Act provides a basis for routine auditing of the state of the groundwater environment and for assessing the performance of the regulatory system. The Department will execute an annual audit on the status of the national groundwater resources and will publish this report.

4.2.5 National groundwater quality guidelines and objectives

National groundwater quality guidelines will be set and published by the Department. The water quality guidelines which have been developed for surface water will be adopted for groundwater.

Aquifer-specific water quality objectives will need to be set in those instances where water quality has already

deteriorated or is naturally poor. Groundwater management plans will be established for specific aquifers where there is a need for groundwater quality objectives which differ from the water quality guideline values.

Action limits, which specify the point at which intervention is necessary, may need to be set up for aquifers where degradation is anticipated. These action limits will become part of the aquifer management strategy.

The National Water Act allows for the implementation and enforcement of groundwater quality objectives. These objectives must be integrated into catchment management strategies.

4.2.6 Legal framework

The legal framework provided by the National Water Act and the regulations promulgated thereunder will have to be revised from time to time. Such revisions need to be driven by thoroughly researched initiatives based on national priorities. The Department must at all times maintain the capacity to identify needs for new legislation, as well as the capacity for implementation thereof.

4.2.7 Licencing of groundwater impacts

Normally groundwater impacts will not be permitted even where no specific rights or existing uses are to be affected. In some instances, however, groundwater quality deterioration is inevitable. Such instances include, for example, cases where mines locally depress groundwater levels or where industrial and commercial farming activities may affect quality by disturbing the natural equilibrium.

In order to ensure that such inevitable deterioration is managed in a responsible manner the Department will use its licencing system in terms of the Act for certain activities to make it possible to intervene in a proactive manner and to impose conditions aimed at preventing unnecessary, and perhaps irreversible, damage from occurring.

The Department will then allow such impacts only if the proponent has exhausted all reasonable options to avoid the impact and where the entitlements of other water users will not be unreasonably affected.

4.2.8 Aquifer management plans

Aquifer management plans will be required to protect the groundwater in specific areas where the nature and intensity of development dictates that some form of control would be in the interests of the affected community.

The Department has, through the National Water Act, obtained the power to control any aquifer and to prescribe special protection measures and groundwater quality objectives where required. Ample provision for either the assignment or delegation of powers to water management institutions to assist in executing control measures have been made in the Act.

Aquifer management plans will be integrated with catchment management strategies.

4.3 Remediation strategies

Remedial actions make up an important part of groundwater quality management functions. The remediation of the effects of pollution is provided for in section 19 of the National Water Act.

Remedial action is required where contamination of groundwater is occurring or has already occurred, where it is necessary to replenish the reserve and where it is not possible or practical to apply the law to enforce remediation. Remedial action is thus usually warranted where the responsible person or persons cannot be identified or where the responsible persons have failed to comply with the provisions of the law.

The following remedial actions have been identified:

- prioritisation and evaluation of priorities for remedial action;
- remediation of abandoned sites; and
- emergency action procedures/plans for accidental spills.

In instances where groundwater contamination has occurred, is occurring, or may occur - and where such contamination represents a threat to human health or to the environment - the Department may intervene to facilitate the required remediation.

Remediation will be implemented on a case-by-case basis depending on the relative hazard and risk levels. Remediation initiated by the Department will be financed from funds voted by Parliament for the specified purpose. In extreme cases a White Paper motivating the need for remediation will be tabled in Parliament.

Given the cost and technical constraints associated with groundwater remediation the State must prioritise the remediation sites according to actual and expected uses of the groundwater requiring remediation, as well as social and economic values.

Consultation with the public as well as key interested and affected persons will take place. In particular, the affected communities should be encouraged and assisted where necessary to participate in problem definition, in agreeing to the way in which the work will be executed, in setting the required standards and in formulating solutions.

Groundwater remediation may be initiated under a variety of circumstances. The most common situations are:

- groundwater has become, is becoming, or may in future become, contaminated by sources for which no responsible person(s) can be identified; and
- groundwater is threatened or has already been impacted upon, by neighbouring operations.

Groundwater remediation which can be achieved through enforcement of the National Water Act and other laws which the Department can rely on is considered to be part of conventional source-directed measures and does not constitute remedial action. In some instances the Department may, however, in the interests of affected third parties, initiate remedial action and later recover the costs from the responsible parties, also provided for by the Act (Chapter 3).

4.4 Integrated regulatory functions

The Department will achieve the policy goals through a variety of integrated regulatory actions which will include:

- Source-directed measures such as control of sources of potential contamination, including authorisations for mines, enforcement of regulations and best management practices;
- Resource-directed measures such as resource classification and setting of resource quality objectives
- national groundwater data acquisition analysis and data management;
- regulation or prohibition of land-use practices and involvement in planning decisions;
- control of water use;
- co-ordination of groundwater quality management activities and programmes;
- provision of extension services to rural and peri-urban communities and advice to the general public;
- dissemination of public information, awareness creation and capacity building;
- clean-up of contaminated soils and groundwater; and
- ensuring that effective enforcement takes place.

Note that the use of groundwater for reasonable domestic consumption and for animal drinking purposes will not specifically be controlled, unless community interests are at stake.

Section 5
REGULATORY INSTRUMENTS

The reason for regulatory intervention, irrespective of the tactics or instruments used, is to ensure that the policy goals are achieved. Interventions seek to induce desirable behaviour in polluters and potential polluters and are grouped into three categories:

- **Direct intervention** in which the Department commands certain behaviour or results from the regulated community. The Department's power is derived from the law. Instruments may be either reactive or proactive in nature and will usually focus on the source of pollution.

- **Incentive programmes** in which the regulated community is given some flexibility, within a defined framework, to meet prescribed objectives. The incentive to comply is derived from the preference for flexibility among responsible sectors in the regulated communities.

- **Supportive programmes** in which the Department, through its own resources and associated institutions, provides assistance to the regulated community to achieve the regulatory goals.

None of these categories are mutually exclusive. The regulatory system thus contains elements of each. The mix is determined by the nature of the pollution threat and the sector concerned.

5.1 Direct intervention relating to source control

Direct intervention may be reactive or proactive. Reactive, command-and-control instruments typically include laws, regulations and prosecutions. These instruments are the most common. The present command-and-control provisions relating to water quality include the following under the National Water Act:

- Chapter 3: Protection of water resources.
- Chapter 4: Use of water - which also includes the discharging of waste or water containing waste into a water resource in whatever manner, as well as disposing of waste which may detrimentally impact on a water resource.
- Regulation 287 of 20 February 1976 promulgated under the previous Water Act (1956). [Not yet repealed by National Water Act (1998)].

Section 26 of the National Water Act (1998) and Section 2 of the Environmental Conservation Act empower the Minister to make further regulations.

Further regulations are under consideration for the following:

- waste handling, transport, destruction and disposal;
- discharge and impact consents;
- underground storage tanks;
- irrigation of effluents; and
- land-based disposal of sewage sludge.

Proactive control instruments place the Department in a position to pre-empt the need for reactive response by providing a means for upfront involvement in planning processes. The essence of these instruments is that the proponent, authorities and other stakeholders resolve concerns through negotiation at the planning stage.

The instruments at the Department's disposal include:

- water use licences
- general authorisations
- compulsory licences
- controlled activities
- pollution remediation
- emergency action.

The regulatory instruments which facilitate upfront involvement are the provisions of:

- Section 12 of the Water Services Act, 1997 in connection with the submission of draft development plans relating to *inter alia* present and planned water uses.
- Section 22 of the National Water Act (1998), which makes all water uses - which are very widely defined in Section 21 - subject to control.
- Section 13 of the National Water Act (1998) which provides for the regulation or prohibition of land-based activities which may affect the quantity or quality of water.
- Section 37 of the National Water Act (1998), which makes it possible to regulate activities having a detrimental impact on water resources by declaring them to be controlled activities;
- Section 39 of the Minerals Act (1991) which requires approval of an EMP or the granting of temporary authority before a proponent can commence mining operations.
- Section 20 of the Environment Conservation Act (1989) which prevents anyone from operating a landfill site without a permit.
- Regulations in terms of Section 20 of the Environment Conservation Act (1989) which make Environmental Impact Assessments compulsory for prescribed processes and activities.

Other acts which provide the Department with an indirect means of influencing groundwater quality are:

- The Atmospheric Pollution Prevention Act, 1965
- The Conservation of Agricultural Resources Act, 1983
- The Development Facilitation Act, 1995
- The Fertilisers, Farm Feeds Agricultural Remedies Act, 1947
- The Hazardous Substances Act, 1973
- The Health Act, 1977
- The Physical Planning Act, 1991
- The National Environmental Management Act, 1998.

The above regulatory instruments are used to impose conditions of approval that minimise the adverse effects of the activity on the water environment. In particular, these instruments are used to ensure that Best Practice is implemented on a site-specific basis.

Further proactive intervention is required. The Department will use its influence to bring power generation and certain heavy industry under the control of an instrument similar to that provided for by Section 39 of the Minerals Act, 1991.

The Department will, through consultation and co-operation with other organs of state, also be implementing impact consents to regulate the impact of mining and industrial activities on groundwater. This is within the framework of the National Water Act. Those activities which are to be controlled in future will be identified through either the declaration thereof as controlled activities, or through the promulgation of regulations.

5.2 Incentive programmes

The Department supports, and will promote wherever possible, self-imposed discipline. Where the regulated community has the capacity to mobilise itself to develop sectoral norms and standards, the Department will actively participate in the process.

An example of an initiative which the Department views as having been successful in the past is the guidelines for the design, construction, operation and closure of mine residue deposits developed by the Chamber of Mines. Further improvement of these existing standards and the development of new standards of Best Practice will be promoted.

Charges for water resources management may be used as an instrument to encourage appropriate behaviour.

5.3 Supportive programmes

The Department will be expanding its support role in order to influence sectors which cannot be controlled by direct intervention or incentives. The protection of groundwater in rural and peri-urban areas is of great importance but cannot be achieved through conventional direct intervention or incentive-based instruments. For these sectors the Department will be deploying the following instruments:

- Research and development to build capacity, to advance knowledge and understanding and to develop new and better ways of improving groundwater quality;
- Best Practice guidelines to educate and build the capacity of the community to regulate itself;
- educational programmes to raise the level of awareness and develop skills required to empower communities to protect their groundwater supplies; and
- extension services to advise and assist communities in their implementation and operation of groundwater protection programmes.

The Department will need to co-operate extensively with other authorities and non-government organisations that are currently interfacing with communities which will benefit from the above regulatory initiatives.

Upfront involvement in land-use planning decisions and in establishing the conditions under which land may be used is central to the Department's pollution prevention strategy. Land-use planning guidance notes and educational literature will be used to give effect to this strategy.

Section 6
GROUNDWATER QUALITY MANAGEMENT PROGRAMMES

Rational groundwater quality management programmes will serve to develop the government's capacity to implement the groundwater strategy. These programmes are a cornerstone of the Department's capacity building initiative and are described in this section.

6.1 Groundwater quality management programmes

All the parts of a groundwater quality management system are not yet in place. Whilst some of the components are fully operational, others have been only partially implemented and some have yet to be started.

In order to develop and implement new components of the groundwater quality management system the Department will launch a series of groundwater quality management programmes.

These programmes will have a clearly defined policy goal, programme objectives, an action plan and a finite life span. The purpose of each programme will thus be to develop one or other component of the system and to oversee its implementation into the operational regulatory system.

Programmes provide the means to drive continuous improvement in the regulatory system. As such they are central to progress. The following programmes will enjoy the highest priority:

- community water source protection;
- public participation;
- aquifer classification;
- aquifer management system development;
- impact consent procedural system development;
- facility level groundwater quality monitoring;
- national groundwater information system development;
- land-use planning;
- Best Practice;
- underground storage of contaminated water;
- resource level groundwater quality monitoring;
- reserve determination;
- identification of groundwater restoration priorities; and
- research and development needs and priorities.

6.2 Programme for community water source protection

6.2.1 Policy

The Department of Water Affairs and Forestry will seek to ensure that all points from which groundwater is abstracted are adequately protected against potential pollution threats. Minimum requirements regarding borehole construction and wellhead zoning have been published and will be prescribed for general application. Where the aquifer requires a special level of protection, site-specific measures will be required.

6.2.2 Objectives

Many of the man-made pollution threats to groundwater resources, particularly in informal settlements, can be countered through proper siting, appropriate design and ongoing maintenance. These activities must be integrated with the planning and control of other activities such as:

- sewage disposal;
- waste disposal; and
- graveyards.

Activities which usually take place close to the water source (i.e. the borehole or spring) are of particular concern. These include:

- standing waste water;
- washing of clothes; and
- stock watering.

Approaches to protection of the area around a borehole or spring have already been developed extensively worldwide. The specific objective of these approaches is to provide for a buffer zone around the wellhead in which potentially polluting activities are not permitted. The community plays the central role in implementing such controls.

The wellhead protection programme requires further refinement. In this regard the Department needs to consult with interested and affected parties about the means of implementation, firm up on zoning rules and train officials to assist communities with on-site implementation.

6.2.3 Tools and support

Two tools are used to facilitate wellhead protection:

- minimum borehole construction standards; and
- wellhead zoning.

The minimum borehole construction requirements which have already been proposed by the Department are suitable for all production boreholes, ranging from hand pumps through to production boreholes in well fields.

Wellhead zoning can be a simple and effective means of protecting water sources. Zoning, which defines the area around the wellhead, is based on minimum setback distances. Setback distances are determined on the basis of travel times for pollutants.

Even though the use of travel time as a basis for defining setback distances is probably scientifically more appropriate and defendable, the use of a defined distance is more easily implementable. In special cases, where a higher level of protection is required, site-specific considerations are required.

Successful implementation of wellhead and source protection at informal settlements will depend on support from the community which it is supposed to serve. Extension services by the Department and training of the community and its leaders are therefore key success factors. An extension service and training programme thus has to be developed and implemented. Key components for such a programme include:

- community involvement;
- appropriate training and training aids;
- the effective use of all resources - including those outside of the Department (e.g. Department of Health, NGOs etc);
- ongoing and regular government and community interaction; and
- routine monitoring of groundwater sources.

This programme will require significant manpower resources. It could be incorporated into the rural water supply and sanitation initiatives.

6.3 Public participation

6.3.1 Policy

The Department of Water Affairs and Forestry will actively promote participation of the public in decision making regarding groundwater quality. Participation must be facilitated within a structured framework which *inter alia* establishes both the rights and obligations of participants.

6.3.2 Objective

The programme will put in place a guideline within which public participation prescribed by the National Water Act can take place, and will clarify the rights and obligations of participants.

6.3.3 Implementation

Public participation already takes place under a variety of circumstances and in a variety of ways. The Department will, through a consultative process, seek to establish norms and guidelines for participation. These will be elaborated on and used as guidelines for future processes.

6.4 Aquifer classification programme

6.4.1 Policy

South Africa's groundwater protection will be based on a differentiated approach, which distinguishes between aquifers on the basis of importance and vulnerability.

6.4.2 Objective

The implementation of the Groundwater Quality Management Strategy on the basis of a differentiated groundwater quality protection approach cannot be done without formal classification of aquifers.
Classification of South African aquifers needs to differentiate between those requiring extensive protection, those requiring protection based on best management practices and those not requiring specific protection. In particular, the classification system must recognise:

- the high value of sole-source aquifers in South Africa; and
- the need for a pragmatic approach which allows for site-specific factors to be considered.

Vulnerability of aquifers may also be taken into account in the choice of appropriate protection levels. This further refinement is best applied on a site-specific basis.

The aquifer classification programme requires further development in order to finalise mapping and classification, to develop rules for its implementation and maintenance and to train officials in its use. This forms part of the resource-directed measures for water resource protection currently being developed by the Department.

6.4.3 Implementation

The Department is responsible for characterisation and monitoring of groundwater resources of South Africa. Most geohydrological information is stored in the National Groundwater Database (managed by the Department).

The Department is currently in the process of producing a national 1:250 000-scale geohydrological map series. The groundwater database and the geohydrological map will be used as a basis for compiling an aquifer classification map of the country. The vulnerability information required for the groundwater quality management classification can be obtained from available 1:1 000 000-scale vulnerability maps.

A transparent classification process is to be used so that all concerned are informed as to how the classification was arrived at. It is expected that initial classification will be at a national and regional scale.

The classification is relatively course. A developer or landowner can therefore refine the classification on the basis of available information and/or further investigation. Similarly, other parties (individuals, farmers, local authorities, non-governmental organisations, etc) may also initiate refinement of the classification assigned to a particular aquifer system.

In those instances where application or recommendation is made for granting a special status to an aquifer, a comprehensive environmental impact assessment will be required. The final decision in this regard will be taken by the Minister of Water Affairs and Forestry.

Reclassification procedures will be implemented by the Department. It is expected that as more geohydrological data becomes available, the classification will be refined. Further, as the classification is partially based on the concept of beneficial use, it may be required that aquifers be reclassified from time to time.

6.5 Aquifer management programme

6.5.1 Policy

The Department will be adopting integrated catchment management for the operational implementation of water resource management. The basic management unit will be a catchment.

Aquifer management will similarly follow an approach which requires consideration of the whole aquifer system. The management unit best suited to a systems approach is an aquifer.

In order to rationalise and integrate surface and groundwater resource management, catchment and aquifer management must be integrated. The Department will therefore include aquifer management within the ambit of catchment management. The institutional structures which are put in place for catchment management will therefore also be used for aquifer management.

6.5.2 Objective

Aquifer management plans will be required for designated aquifers. These strategies will serve to achieve the following objectives:

- identify and initiate protection of groundwater quality from degradation;
- facilitate collection and management of groundwater quality data;
- identify areas of poor quality groundwater;
- identify and facilitate implementation of remedial action; and
- prescribe yield limits.

Where aquifers are not designated as requiring an aquifer management plan, routine groundwater quality protection will be implemented through the catchment management plan.

6.5.3 Tools and support

Successful implementation of an aquifer management plan will depend *inter alia* on:

- the legal and institutional framework within which the plan is to be implemented;
- access to adequate groundwater resources and demographic data;
- effective public involvement and co-operation;
- national water quality guidelines;
- an effective enforcement authority; and
- national Best Practice guidelines for sources of pollution.

The institutional framework within which aquifer management plans can be established and implemented has still to be set up. The National Water Act provides for the establishment by the Minister of Catchment Management Agencies for Water Management Areas. This will be done in a phased and progressive manner. Until these are in place, the functions that they are intended to fulfil will be handled by the Department.

6.5.4 Implementation

The action plans which will be required to achieve the above objectives will be set up by the Catchment Management Agency and will, as a minimum, detail:

- aquifer boundaries;
- aquifer characteristics in terms of distribution, quality, potential yield and vulnerability;
- demographic characteristics;
- inventories and projections of water demand;
- objectives in relation to quality, quantity and beneficial uses;
- management measures and actions;
- special land-use restrictions; and
- special source controls and remedial action;

The responsibilities of the Catchment Management Agency implementing the aquifer management strategy will include:

- resource monitoring and dissemination of groundwater data;
- preparation of groundwater resource status reports;
- development and maintenance of memorandums of understanding with other authorities responsible for land-use allocation and source controls;
- evaluation of applications and issuing of licences;
- dissemination of public information;
- public education and assistance;
- implementation of remedial action;
- co-operation with the authorities responsible for source-based control to control the introduction of contaminants into aquifers;
- control of groundwater abstraction to provide for sustainable utilisation and to prevent or minimise the migration or intrusion of poor quality groundwater;
- defining source areas and implementing the national wellhead protection programme;
- co-ordinating of related activities of water users and of Water Management Institutions within a Water Management area; and
- promoting of co-ordination of its implementation with the implementation of any applicable development plan established under the Water Services Act, 1997.

The timeframe for implementation of aquifer management will depend on the implementation of integrated catchment management frameworks and infrastructure. The aquifer management programme will need to be closely co-ordinated with the integrated catchment management programme. In the interim, the programme will focus on the development of the required national framework and standards for aquifer management plans.

In some instances the urgency of the situation will require implementation of aquifer management plans before the legal framework and infrastructure - which will enable implementation of catchment management plans - is in place. Aquifer management plans may thus be developed for special designated aquifers before catchment management plans are implemented.

6.6 Impact authorisations programme

6.6.1 Policy

The Department of Water Affairs and Forestry is required, from time to time, to assess and approve of a variety of activities such as mining, industrial development and agriculture, which impact on groundwater. The Department will proceed to formalise the assessment and approval process.

6.6.2 Objective

Groundwater impacts are inevitably associated with some forms of development. These impacts can in many instances be identified and quantified before the development proceeds. This programme will serve to put in place guidelines - and prescriptions if necessary - for impact assessments and impact management measures which will be required for prescribed types of activities. This will enable the Department to bring groundwater impacts within its span of control.

6.6.3 Implementation

Impact authorisations must be given within the context of the National Water Act. It requires a licensing process which allows for public consultation and an appeal process. This programme should serve to put in place applicable regulations in terms of the National Water Act and to develop suitable departmental procedures for processing licence applications.

6.7 Programmes for facility-level groundwater quality monitoring

6.7.1 Policy

The Department of Water Affairs and Forestry requires that groundwater monitoring take place at those facilities and installations which pose a potential threat to groundwater quality. The level of monitoring required by the Department should be based on the classification of the potentially affected aquifer system.

6.7.2 Objectives

The essential purpose of monitoring at facilities is to check that the impact management measures which have been implemented are achieving the agreed groundwater objectives. To do this, monitoring is performed to detect contamination and track the movement of contaminants over time. The results of monitoring are then compared to groundwater quality objectives, standards or trigger levels. Groundwater quality monitoring is also used to check the performance of impact management measures. The monitoring system may thus also need to confirm that certain critical components of the impact management measures (e.g. liners) are functioning adequately.

The minimum requirements for the monitoring of landfill sites - already published by the Department - provides the basis for Best Practice. Some refinement is required in order to implement the Department's differentiated protection approach.

The Department has to ensure that its officers have the skills and ability to evaluate groundwater-monitoring networks. Appropriate training and continuing education for operational staff must thus be implemented.

6.7.3 Tools and support

Graded monitoring guidelines form the basis of monitoring requirements. The present guidelines need to be modified such that the intensity of monitoring is appropriate for the level of protection required and the anticipated threat posed by the facility. Aspects that need to be addressed include:

- number of boreholes;
- frequency of monitoring;
- variables of concern; and
- reporting format.

A lesser, but still important, tool to be used by the Department as part of the Groundwater Quality Management Strategy is to facilitate a general awareness regarding an appropriate monitoring practice. This will require the Department to publish short articles in popular and sector-specific journals and magazines and to give presentations to various groups as a means of making people aware of the need for facility monitoring and the difficulties associated with such activities.

Groundwater quality guidelines and trigger levels will need to be defined. Two types of trigger levels are envisaged:

- contamination detection limits; and
- remediation intervention limits.

Standard trigger levels cannot be used owing to the variability of groundwater quality throughout South Africa. The trigger levels should rather be based on the ambient water quality at the site of interest. In the absence of site-specific data, ambient groundwater quality standards could be based on the regional hydrogeological characterisation of the area (published 1:500 000-scale hydrogeological maps) and information from the national groundwater quality monitoring programme. Site-specific investigations will be required to fix trigger levels in most cases.

6.7.4 Implementation

Groundwater quality monitoring must be implemented as early as possible. It is therefore proposed that monitoring requirements and protocols be defined at the same time that the facility design and construction standards are set. Regular auditing of the monitoring results by the Department is required.

6.8 National information programmes

6.8.1 Policy

The Department of Water Affairs and Forestry will establish and maintain a national information system for groundwater in South Africa.

6.8.2 Objectives

The national information system must *inter alia* provide the basis for:

- establishing and tracking trends in groundwater quality;
- characterisation and classification of groundwater resources;
- monitoring utilisation of groundwater;
- prediction of macro impacts; and
- land-use planning guidance.

6.8.3 Implementation

The present management information system provides a good starting point. This system will, however, need to be updated to provide for better accessibility of data and for limited pre-processing. The management system must be upgraded to facilitate on-line access and updating by the Department's regional offices.

6.9 Land–use planning programme

6.9.1 Policy

The Department of Water Affairs and Forestry will seek to play an increasingly prominent role in influencing land-use planning processes and decisions in order to provide the best possible level of protection to groundwater resources in addition to its regulatory ability to regulate or prohibit land-based activities. Land development objectives (LDOs) will, in future, need to be set only after due consideration of impacts on groundwater.

The programme will serve to establish the legal and administrative framework within which the Department can exercise the appropriate level of influence over land-use planning decisions, and the regulation or prohibition of land-based activities

6.9.2 Implementation

The programme will establish a framework for capacity building of officials to enable them to inform decision-makers. Land-use planning guidance notes will be developed and distributed widely to all public and private sector institutions involved in planning.

6.10 Best practice programme

6.10.1 Policy

The Department of Water Affairs and Forestry assumes the responsibility for facilitating processes for the development of Best Practice guidelines which will serve to protect groundwater resources. The regulated community concerned will be encouraged to take the initiative in developing the required guidelines in accordance with the requirements of the National Water Act.

6.10.2 Objectives

Best Practice guidelines establish the norms for infrastructural development activities. These norms provide a standard against which to assess measures which are implemented to prevent or minimise groundwater impacts.

6.10.3 Implementation

The programme will serve to put in place a structured framework within which the Department can initiate and facilitate the development of guidelines. Guidelines which, for groundwater protection, require priority attention are:

- sanitation for semi-rural and urban settlements; and
- remediation of contamination from leaking underground storage tanks.

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Section 7
INSTITUTIONAL ARRANGEMENTS

Water quality management, and specifically groundwater quality management, must take place within the framework provided by the National Water Act and within the Department's organisational and other institutional structures.

7.1 The organisational parts and the players

The Department will assume the leading role for groundwater quality management at national level and will rely on the following additional roleplayers;

- Catchment Management Agencies
- Water User Associations
- Other national government departments;
- Provincial and local government departments;
- the research community;
- the affected community;
- the regulated community.

The institutional structure must be designed to facilitate co-operative governance. For this to be possible, organisational structures will be designed to promote communication between officials responsible for policy implementation as well as routine administration, e.g. authorisations and licences.

7.2 Organisational strategies

The Department's organisational approach is based on centralised planning and decentralised implementation at regional and catchment level. Decentralised implementation of source-directed, resource-directed and remediation measures will be implemented with a catchment level focus. Groundwater quality management will be devolved incrementally to this level.

Groundwater is best divided into aquifers for efficient management. However, since aquifers are usually contained within a catchment in South Africa, it has been decided to manage both surface and groundwater at regional and catchment level.

Devolution of management to catchment level will improve community participation in water related management functions. The Department's extension services will be deployed at this level.

7.3 Organisational restructuring

Restructuring of the Department will follow from introduction of institutional structures for integrated catchment management. The National Water Act requires the establishment of Catchment Management Agencies in a phased and progressive manner and to manage water resources on the basis of Water Management Areas, which will be catchment orientated. Until a Catchment Management Agency is established, all powers and duties of a Catchment Management Agency rest in the Minister (Section 72 of the Act).

In the interim and until national environmental policy has been clarified the Department will continue to operate within the current organisational structure.

Owing to the emphasis on surface water in the past, capactiy for groundwater quality management is limited. This will need attention during the restructuring stage.

7.4 Community participation in groundwater quality management

Community participation in water resource management and more specifically groundwater quality management will be facilitated by Catchment Management Agencies through formal structures. Water User Associations will be established wherever a need arises. These associations will assume responsibility for a range of water resource activities in the context of groundwater management, for their mutual benefit.

7.5 Research and development

The current focus of the Department's research and development is through the Institute of Water Quality Studies and the Water Research Commission. Other organisations, however, also play an important role in water related research. Representatives of the mining industry, of industry and of research organisations are expected to be involved in the departmental initiative in a more structured manner in future.

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Section 8
ENABLING THE GROUNDWATER QUALITY MANAGEMENT STRATEGY

Creating an enabling context involves placing the people who will implement the management strategy in a position to do so in a coherent and consistent manner. It also means facilitating planning by those involved in implementing the strategy and evaluating the consequences of their decision-making. The elements listed below are considered necessary pre-requisites for the creation of the enabling context.

Knowledge: Those implementing the strategy must know what the strategy entails and what must be done.

Skills: Those implementing the strategy must have the skills to do what is required of them. This includes managerial and technical skills to evaluate situations and make decisions.

Will: Institutions, organisations and individuals involved must have the motivation to do what is required. Where this will is not present, enforcement becomes necessary.

Mandates: People placed in positions of responsibility must have a mandate to act.

Developing the enabling context requires the drafting of supporting legislation, regulations, operational guidelines and procedures and staff training. The enabling environment that will be covered in the National Water Resource Strategy provided for in the National Water Act is not specifically dealt with here.

8.1 Instruments needed

The following sections focus on the role of the instruments listed below in creating the enabling environment with particular emphasis on the Department's own resources:

- operational guidelines and procedures;
- technical guidelines; and
- training and development.

8.2 Operational guidelines and procedures

Operational guidelines are required to assist the Department's officials in executing their work in a coherent and consistent manner. These guidelines prescribe how to carry out functions and allocate responsibilities for their implementation. Some technical guidance is also necessary to assist officials in making judgmental evaluations.

Operational guidelines have been developed to implement core components of the management plan.

Those dealing specifically with mining related issues form part of the Department's M-sub-series of the category Management Strategies and Instruments. To date, two guidelines have been produced:

- M 1.0: Control over the alteration in the course of a public stream; and
- M 2.0: Financial provision for the rehabilitation of land disturbed by mining activities.

Further guidelines which form part of the sectoral strategy for the mining industry are being developed for the evaluation and processing of EMPRs and for mine closures.

Further guidelines are proposed to augment the available set and to specifically focus on groundwater. The following are being developed or are under consideration:

- Determination of the reserve for groundwater resources
- Aquifer classification
- Evaluation of mining authorisations
- Evaluation of environmental impact assessments
- Requirements for impact consents.

8.3 Technical guidelines

Technical guidelines are required where the available best practice guidelines are not adequate. The Department's "minimum requirements" already provide a good basis for BATNEEC (best available technology not entailing excessive cost) guidelines for waste management in general. These documents require revision to cover waste from cradle to grave and to accommodate the Department's differentiated protection policies. The following technical guidelines are under consideration:

- Geohydrological investigations for potential sources of groundwater contamination
- Contaminated site assessment and restoration
- Contaminant modelling and risk assessment
- Community water source protection
- Land-use practices.

The regulated communities must be encouraged to support development of these guidelines. The Department must provide input into this process and ensure that its requirements are taken into account.

Where suitable guidelines do not exist and where the regulated community does not take the initiative to produce the required guidelines timeously, the Department will generate them. Although the emphasis of the guidelines will be on the protection of the water environment, other environmental aspects will also be included where appropriate.

8.4 Training and development

It is official Departmental policy (Personnel Circular 22 of 1989) to take responsibility for training and developing its staff. Departmental training programmes aim to satisfy general training needs of the Department and are the responsibility of the Sub-directorate Training.

Until recently, occupation specific training occurred mainly through an informal mentorship system. Occupation-specific training for staff involved in water quality management became a high priority when the Department changed its approach to water quality management in 1989. The successful implementation of this approach required staff involved in water quality management to understand the Department's water quality mission and goals, water quality strategy and the role and functions of water quality management within this strategy. Therefore advisory committees for occupation specific training were established within the Department in 1989.

The Department favours two overall methods of training:

- in-house; and
- externally by an academic institution.

Courses presented by universities and technicons only partly satisfy the current training needs of the Department. Therefore the Department is proceeding with the development of its in-house training programme.

In-house training should recognise the need for more on-the-ground training. A problem-solving approach is recommended, where trainees are encouraged to present case studies of actual problems being experienced in the field. Solutions can be workshopped and sanctioned by the responsible Director. This approach will assist in establishing consistent decision-making principles. Once a consistent framework is established, management will have greater confidence in extending the mandate of field personnel.

8.5 Extension services

Departmental officials in regional offices have, in the past, concentrated on enforcement functions. These functions will remain important but will be augmented by advisory extension services. This will involve training of officials to assist communities to protect their groundwater. These services may be combined with advisory services required for groundwater resource development and sanitation at community level.

8.6 Legal instruments

The National Water Act allows the Department to put the required procedures to deal with licence applications in place.

The following additional laws will play an important part in supporting implementation:

- Water Services Act (Act 108 of 1997);
- National Environmental Management Act (Act 107 of 1998);
- Minerals Act (Act 50 of 1991)
- Environmental Conservation Act (Act 73 of 1989).

Section 9
DEFINITIONS

Aquifer[1]
A geological formation which has structures or textures that hold water or permit appreciable water movement through them.

Catchment[1]
The basic geographic unit of water resource management. That is the area from which any rainfall will drain into a watercourse/s or part of a watercourse, through surface flow to a common point/s.

Functional strategy
Defines which functions will be performed and sets out the strategy for carrying out the tasks needed to implement a policy.

Impact consents
Form part of a water use licence and relate the extent of permissible groundwater impacts.

Groundwater
Water contained in an aquifer.

Policy
Sets out the guiding principles and course of action adopted or proposed by a government, business organisation or individual in order to meet specific objectives.

Policy objectives
Define the aims that a particular policy seeks to achieve.

Pollution[1]
The direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it:
a) less fit for any beneficial purpose for which it may reasonably be expected to be used; or
b) harmful or potentially harmful:
   (aa) to the welfare, health or safety of human beings;
   (bb) to the resource quality;
   (cc) to property.

Principle
A fundamental truth or law used as the basis of reasoning or action.

Remediation
Includes all actions required to restore the water resource. It includes management action and physical infrastructure and may, in the case of groundwater, involve purification or removal of contaminated soils.

Reserve [1]
The quantity and quality of water required:
(a) to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act, 1997 (Act No. 108 of 1997), for people who are now or who will, in the reasonably near future, be:
   (i) relying upon;
   (ii) taking water from; or
   (iii) being supplied from,
   the relevant water source; and
(b) to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.

Protection[1]
In relation to a water resource, means:
a) maintenance of the quality of the water resource to the extent that the water resource may be used in an ecologically sustainable way;
b) prevention of the degradation of the water resource; and
c) the rehabilitation of the water resource.

Source protection
Source protection and wellhead protection are used interchangeably in this document to refer to actions implemented in a zone designated to protect abstraction wells or a recharge area.

Strategy
Defines the organisational and functional approach, focus, resources and any other elements that will be used to carry out a course of action or policy in business or government. A strategy can be formulated only after policy goals have been determined. Strategy must be based on an accurate evaluation of the resources available to achieve the goals and the likely obstacles to be overcome.

Waste
Includes any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or in a water course in such a volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted.

Water resource[1]
Includes a watercourse, surface water, estuary or aquifer.

[1]Definitions taken from National Water Act (Act 36 of 1998).

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