Draft National Water Resource Strategy 2 (NWRS 2) :

Managing Water for an Equitable and Sustainable Future

Comprehensive July 2012

water affairs

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Executive Statement

Water is a critical natural strategic resource

Water is a critical strategic natural resource. It is essential for growth and development, the environment, health and wellbeing of the people of South Africa. Although this principle is generally accepted, it is not always well understood or appreciated. Despite the fact that South Africa is a naturally water stressed country, further challenged by the need to support growth and development as well as potential climate change impact, the resource is not receiving the priority status and attention it deserves. This situation is reflected in the manner by which this scarce resource is wasted (more than 37% water losses), polluted, degraded, inadequately financed and inappropriately strategically positioned. Paradoxically South Africa has a fairly well developed water management and infrastructure framework which has resulted in a perceived sense of water security (urban and growth areas), as well as a lack of appreciation and respect for a critical strategic resource.

Water is a complex business

South Africa is facing a number of water challenges and concerns, including security of supply, environmental degradation and resource pollution. The sustainability of our fresh water resources has reached a critical point and its associated management is now at a crossroads. It is now of paramount importance that the status of South Africa's water is elevated to the core of the public agenda and that advanced management practices are applied and implemented to address an increasingly complex business.

The NWRS is the primary mechanism to manage water resources

Management of this critical resource is governed by the National Water Act (Act 36 of 1998) and is given effect through the National Water Resource Strategy (NWRS). This Strategy is the legal instrument to plan, develop and manage water resources in an integrated and sustainable manner. It is the primary mechanism to manage water across all sectors towards achieving Government's development objectives.

NWRS1 remains an essential building block for water management

The first Edition of the NWRS (published in 2004) defined the fundamentals of integrated water resource management and presented a clear perspective of the water situation in South Africa and the critical interventions required. To date, effective and efficient water resource planning and new infrastructure development has contributed to the strengthening of the country's economy and social development. However, priority actions, such as implementation of water allocation reform, equity, water conservation and demand management, water

resource protection and interventions to improve water governance, still require urgent attention.

Water underpins the socio-economic development of South Africa

Water underpins the socio-economic development of South Africa. A reliable supply of water in sufficient quantities at the desired quality is critical to economic growth, social development and job creation. It is core to the majority of the South African macro-development strategies such as the National Development Plan, the New Growth Path and specific Outcomes. Given the limited availability of fresh water resources, it is unlikely that it will be economically feasible to meet all the demands that may arise. Unless new innovative approaches are adopted in order to reconcile demand and supply, particularly in the most water-stressed catchments and areas of development, South Africa's growth will be negatively impacted.

Appropriate and timeous interventions are urgently required

Thus far, South Africa's water managers have done well. An extensive water resource framework and bulk water supply network supports a strong economy and associated services. However, the water situation in South Africa has reached a stage where appropriate and timeous interventions are urgently required to sustain development and to avert future water deficits, with associated negative impacts on socio-economic development and ecosystems.

Further surface water resource development is limited

To date, South Africa's water security is mainly reliant on surface water and its development. Based on recent water reconciliation studies, it is clear that surface water availability and its remaining development potential will be insufficient to support the growing economy and associated needs in full. Although limited development potential still exists, serious challenges remain in many water management areas. To facilitate and enable new growth and development, South Africa must review its present approach towards water management and extend the definition of water resources.

South Africa has adequate water resource potential to serve its requirements

By having adopted a more holistic approach towards water management, its availability and its use, water resources have been re-defined in a much broader context. The inclusion of water losses, water use efficiency and demand management, improved water governance, optimisation of existing water resources including groundwater, rainwater harvesting and water systems management, re-use of water, resource protection and recharge, as well as the sea in the resource pool, results in South Africa having adequate water resource potential to serve its requirements. In saying this, however, spatial and local challenges remain, where the format (characteristics) of the resource, the

associated cost of supply (and associated use sector and scheme viability), user specific footprints, as well as competing demand, will dictate particular development solutions and allocation criteria.

This emerging approach has extensive implications for water resource management. By broadening the narrow traditional focus on resource development as the solution, a more inclusive business and systems management approach, including effective water use, use control and regulation, research and technology, as well as creative solutions, will be adopted.

The key challenge is to master the art and science of unlocking the potential water resources

In dealing with the business of ensuring water security, the following key management approaches should be applied:

- The first is the need to respond to specific socio-economic development drivers, each with its mandates and motives, associated water needs and water impacts. This requires effective integrated planning as well as appropriate water resource development and allocation criteria. Factors influencing decision-making include development and management costs, sectoral business viability, sector-specific water footprints, resource availability and competing demands with associated prioritisation.
- The second is the resource choice (mix of solutions), each with its specific spatial and unique context.
- The third is ensuring access to water by the timely translation of options into actions through effective pro-active organizing, financing and implementation arrangements.
- The fourth is ensuring sustainable service delivery through effective operations, maintenance and business management.
- The fifth is the sustainable management of the resource through effective protection and conservation, wise and effective use, and proficient governance.

The critical challenges: Implementation of options and associated sustainable management there of

South Africa, despite being a freshwater-scarce country, has sufficient water resources potential to meet its short to medium term requirements. But, the key challenge (and in order to avert a potential water crisis) is about mastering the art and science of unlocking the potential resources, ensuring timeous accessibility, facilitating sector and business viability (water cost and affordability), ensuring sustainable water delivery and management as well as effective water governance.

In addition to water security, various specific water challenges, concerns and factors increasing water stress, demand urgent attention and intervention. These include:

- Highly variable climate and associated run-off, flood and drought risks, and the need to respond to potential impacts of climate change;
- Deterioration of water resource quality and ecosystems due to pollution (eutrophication, salinisation, acid mine drainage and microbiological contamination) as well as developmental impacts on water habitats. These include challenges with regard to the implementation and application of the ecological portion of the Reserve; and,
- Focus on and application of sustainable water management including infrastructure asset and life cycle management.

Need to identify and address success, enabling and risk factors

It is imperative that the underlying causes and associated enabling factors dictating and influencing successful delivery, are identified and addressed in a holistic manner.

Critical factors that must receive priority attention are:

- Inadequate financial resources and operating in a stressed economic environment;
- Ever-rising costs of water resource management with associated implications;
- Inefficient governance, regulation, compliance monitoring and enforcement;
- Insufficient alignment with and appropriate responses to national development and growth strategies;
- Incomplete water management model and framework;
- Inadequate sector involvement and accountability;
- Skills shortage and limited institutional capacity;
- Deficient information and knowledge to manage a complex water business; and,
- Inadequate integrated water investment framework.

Despite the fact that the development of the NWRS is a legal requirement, the main driver for an effective water strategy is the need to respond to actual development requirements and to address challenges facing the country in managing a complex water business.

Need to introduce "smart water management"

South Africa has reached the point where traditional water management approaches are insufficient to deal with a growing water demand and an

increasingly complex water business. A core objective of the revised NWRS is to introduce, facilitate and lead South Africa into a new era of "smart" water management. This will enable improved service delivery and ensure achievement of desired outcomes. "Smart" management concepts are:

- Raising the profile and importance of water and re-positioning its strategic role in the social and economic development environment;
- Extending the application of traditional engineering/ technology based management approach to also apply sound business and sustainable management approaches;
- Focus on the core objectives of water management (Section 1 of National Water Act);
- Apply the basic principles of business management and governance;
- Developing innovative solutions including harnessing of new technology with associated skills and capacity;
- Implementation of an integrated sector-based model with associated sector involvement, partnership and accountability;
- Improved water and integrated governance including investment in complex water management planning, institutional arrangements and coordination, effective regulation and water sector leadership;
- Introduction and application of new concepts such as "water footprint", "source to tap, tap to source" application and "multi-purpose development"; and,
- Development and application of advanced management tools and systems e.g. multi-parameter decision-making, complex system management, multi-lateral networking and coordination.

The vision underpinning this NWRS-2 is of:

- A democratic, people-centred nation with equitable social and economic development enabled through equitable, sustainable and effective water management;
- Water valued and recognized as a strategic national asset and fulfilling its central role in society and the economy;
- A prosperous society enjoying the benefits of clean water and hygienic sanitation services;
- A healthy, ecologically sustainable and protected water environment;
- A Department of Water Affairs and related water management institutions that serve the public effectively and loyally, meet their responsibilities with integrity, transparency, energy and compassion;
- A committed and dedicated water sector, actively co-operating and contributing towards sustainable water management and associated outcomes.

This vision reflects and builds upon the principles of equity, efficiency and environmental sustainability that underpin the National Water Policy and National Water Act. The policy and legislation are founded on the principles of integrated water resources management (IWRM). However, it is necessary to reinterpret these principles within the context of a developmental state, and recognising the linkages across the entire value chain from resource to tap and back to resource. This gives rise to the concept of developmental water management (DWM) which takes, as a central premise, that water plays a critical role in equitable social and economic development, and that the developmental state has a critical role in ensuring that this takes place.

To facilitate this vision and avert a potential water crisis, specific interventions must be achieved within the short- to medium-term. These interventions must be underpinned by the transformation of the sector into an effective and professional water business environment. The NWRS is the means by which this will be realised.

Overarching core strategies have been developed for the 2nd Edition of the NWRS to address the water resource concerns and to guide future water management and development. These core strategies include outcome, tactical, water business and governance strategies and they set out a different approach to water resources management. They form the framework and context for specific technical and enabling strategies. The core strategies are aligned with the purpose of the NWRS as stated in the National Water Act, namely, “to provide a framework for the protection, use, development, conservation, management and control of water resources for the whole country”.

Core strategies

- Implementation of Equity Policy;
- Putting water at the centre of integrated development planning and decision-making;
- Ensuring water for equitable growth and development;
- Contributing to a just and equitable South Africa;
- Prioritising and ensuring the implementation of water conservation and demand management;
- Optimizing and stretching of our available water resources (groundwater, water re-use, desalination (including seawater), water systems optimization and rainwater harvesting);
- Committing to the protection of our water resources and ecosystems;
- Achieving effective and smarter water governance;
- Embedding sustainable business principles and practices in water resources and systems management;
- Implementing a water sector investment framework for infrastructure, human resource capacity and institutions;
- Engaging the private and water use sectors.

These core strategies are supported by technical and enabling strategies. All these strategies are further supported by the development of more detailed operational strategies and plans. Some of them include the Water Investment Framework and Plan, the extended groundwater strategy, the Institutional Realignment and Reform Strategy, the development of a financing model, reconciliation strategies, All Towns study, etc.

The National Water Resource Strategy 2 in Perspective

"We know that political freedom alone is still not enough if you lack clean water. Freedom alone is not enough without light to read at night, without time or access to water to irrigate your farm, without the ability to catch fish to feed your family. For this reason, the struggle for sustainable development nearly equals the struggle for political freedom. They can grow together or they can unravel each other. Threats to our governments in the century ahead will come from poverty, if anything."

Nelson Mandela, 2000

Context

Water is a critical and strategic natural resource, which is essential for growth and development, for the environment, as well as for the health and wellbeing of the people of South Africa. It is of paramount importance that South Africa's water sector is properly regulated to ensure effective and efficient sustainable use and management of the country's scarce water resources.

The National Water Act (Act 36 of 1998) (1), and the Water Services Act (Act 108 of 1997), as the legal instruments to manage water resources and water services, have been successfully utilized to ensure access to basic water supply and sanitation services for millions of South Africans who did not have access to these services prior to 1994. The number of households with basic water supply increased from 59% in 1994 to 94.7% in 2012 (2). The Department of Water Affairs (DWA) continues to provide effective water resource planning and also operates large and complex bulk water supply schemes which have allowed economic growth in areas where growth would otherwise not have been possible. Irrigated agriculture, the largest user of water, substantially contributes to South Africa's food security and also to foreign exchange earnings through wine and fruit exports.

Water underpins the socio-economic development of South Africa. Reliable supply of water in sufficient quantities and at the desired quality, is critical to economic growth and job creation and forms the basis of many South African macro-strategies such as the National Development Plan (NDP) and the New Growth Path (NGP). South Africa's growing economy and social development, however, is giving rise to growing demands for water. Given the limited water

resources available, it is likely that it will not be economically feasible to meet all the demands that may arise. Hence new approaches will have to be adopted to balance demand and supply, particularly in the most-stressed inland catchments where much of South Africa's economic growth and social development is taking place.

The water situation in South Africa has reached a stage where appropriate and timeous interventions are urgently needed to avert water deficits and associated impacts on socio-economic development and ecosystems. The quality of water resources is generally deteriorating, in particular through marked increases in nutrients and microbiological contaminants and is also threatened by acid mine drainage. The ecological component of the Reserve that specifies the quantity and quality of water required for the protection of aquatic ecosystems is not yet fully implemented in most water management areas. Surface water resources have been mostly developed and utilised and opportunities for siting new and economically viable dams are few. Groundwater resources have not been developed to the same level as surface water resources. Furthermore, treatment of return flows from irrigation, mining, urban and bulk industrial water use could be improved and re-use could be enhanced as a means to increase the availability of water.

Policy and legislative framework for water resources management in South Africa

The National Government has put in place a policy and legislative framework that emphasises human rights and environmental sustainability. Table 1 below presents the key policies and acts that provide a policy and legislative framework for water resources management in South Africa.

Table 1: Policy and legislative framework for water resources management

Policy and legislation	Description
Constitution of SA (1996)	The Constitution guarantees everyone a right to have access to sufficient food and water and it also guarantees everyone a right to an environment that is not harmful to health or well-being.
National Water Policy (1997)	The National Water Policy is underpinned by three fundamental principles for managing water resources: equity,

Policy and legislation	Description
	(environmental) sustainability and efficiency.
National Water Act (1998)	The purpose of the National Water Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled. It defines the content of the NWRS.
Water Services Act (1997)	Water Services Act provides the regulatory framework for the provision of water services by the Water Services Authorities and Water Services Providers.
National Environmental Management Act (NEMA) (1998)	The National Environmental Management Act makes provision for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that promote cooperative governance and procedures for co-ordinating environmental functions exercised by organs of state.

The National Water Policy of 1997 (3) and the National Water Act (Act 36 of 1998) brought about a major shift in water resources management. The new approach recognises the important role of stakeholder participation in water management and it promotes the decentralisation of water management to the lowest appropriate level. The National Water Act makes provision for the establishment of Catchment Management Agencies (CMAs) governed by boards that represent major water users within respective Water Management Areas.

Mandate of the National Water Resource Strategy (NWRS)

The NWRS is the legal instrument for implementing or operationalizing the National Water Act. It is crucial that the NWRS is recognized as the primary mechanism to manage water across all sectors towards achieving national government's development objectives.

- *In terms of the National Water Act (5), the NWRS sets out the strategies, objectives, plans, guidelines and procedures of the Minister and institutional arrangements relating to the protection, use, development, conservation, management and control of water resources.*
- *The NWRS is about putting the policy and law about water resources into practice.*
- *It is about making sure that everyone has fair – equitable access to water.*
- *It is also about looking after water and making sure that it is used so that our people, our society and our economy [can grow without compromising environmental sustainability].* (4)

Building on the progress achieved with the implementation of the NWRS 1

The NWRS 1 (5) is a comprehensive strategy that defined the fundamentals of integrated water management and presented a clear perspective of the water situation in South Africa with associated critical interventions required. The NWRS 2 builds upon the progress achieved with the implementation of the NWRS 1. Table 2 highlights successes and weaknesses in the implementation of the NWRS 1. The summaries of the implementation strategies present additional information on the progress made in the implementation of the NWRS 1 since 2004.

Table 2: Progress with the implementation of the NWRS 1

Successes in implementation	Weaknesses in implementation
• Sustaining reliable supplies • Development of water resources infrastructure • Improved insights in future water demands and supplies • Increases in environmental flows	• Limited implementation of Water Conservation and Demand Management • Limited implementation of Water Allocation Reform to redress past racial and gender imbalances in access to water for productive uses • Inadequate establishment of water management institutions and decentralisation of water management • Inadequate regulation of Water Resources and compliance monitoring enforcement • Shortage of technical and management skills to implement the National Water Act • Poor integration of monitoring and information management

Effective and efficient water resource planning and new infrastructure development has since contributed to the strengthening of the country's economy and social development. Other interventions that were planned, such as implementation of water allocation reform, water conservation and demand management, water resource protection and interventions to improve water governance require urgent attention.

National Water Resource Strategy 2 (NWRS 2) – a mindset change

The NWRS 2 is building onto the NWRS 1. Key principles and processes have been clearly articulated in NWRS 1 and are not repeated in the revised Strategy.

The first edition focussed mainly on 9 technical and operational strategies such as development, water use efficiency and water quality management. In designing the framework and approach of NWRS 2, and based on the lack of implementation of specific strategies reflected in NWRS 1, major attention was also given to enabling actions critical to the successful implementation (or not) thereof. These are new additions to the Strategy.

What also became apparent was the lack of focus on the role and purpose of water management as reflected and required in section 1 of the National Water Act. Although this was addressed in the Water for Growth and Development (WfG&D) initiative, this issue and approach have thus far not been fully applied and reflected in national development planning and national strategies. The need to address the critical role and centrality of water in growth and development was responded to by including social and economic development aspects as core strategies.

In addressing the outcome based core strategies, key principles and approaches have been reconfirmed or introduced. These include the need for integrated planning, a sector based approach and strategy, viability and financial issues, as well as strategic decision making in terms of development planning, decision making and water allocation. A key example is the need to define strategic use, with associated priority allocation policy, examples in case are energy and food security versus social development.

These higher order strategies demands sector- and tactical debate. The draft NWRS 2 therefore only presents the key challenges and issues with the intent to facilitate sector participation and input with associated outcome over the next three months.

Another dimension added to the strategy is the role and involvement of water use, impact and facilitating sectors in water management. The majority of sectors have agreed to commit to develop sector based water strategies and footprints as part of the as part of the NWRS 2. Some institutions such as Eskom has already initiated the development of a comprehensive water use strategy and footprint.

The majority of institutions and sectors are still in the process of developing their footprints and water strategies. The intent is that these strategies will be developed over the next three months and be included in the final version of NWRS 2.

NWRS 2 also proposes an extended approach to water resource management including improved water governance and professional business management.

A key challenge was the need to provide detailed updated information per water management area. This detailed information was not available in appropriate format and location and could not be reflected. However, extensive work has been done in terms of specific growth and development areas, which provides sufficient information to plan specific development as well as to present strategic perspectives on development requirements. This data is available as per the internal strategic perspectives and reconciliation studies and will be included as reference information on the DWA Internet website. This detail as per reconciliation study are actively developed, discussed and managed at the relevant planning and oversight committees (Reconciliation Strategy Committees).

The different strategies reflected in NWRS 2 can be grouped into three categories:

- The first category includes strategic and core issues requiring intensive debate, sector involvement and ownership as well as tactical decision making.
- The second category includes technical and enabling strategies which reflects more detailed actions (refer part B). What must be noted is that these strategies are supported by detailed operational strategies. These include, amongst others, the Groundwater Strategy, Institutional Re-alignment and Reform, the Water Investment Framework and Disaster Management.
- The third category includes sector and spatial related strategies that are in the process of being developed.

All these must be viewed and applied in an integrated manner, with the operational strategies reflecting the implementation activities.

A principle decision was taken to present the strategy in a more user-friendly format, supported by more technical products. It is trusted that his will facilitate improved insight and ownership.

Relationship with the Water for Growth and Development framework

The Water for Growth and Development (WfGD) framework sets the foundation and provides the necessary pointers for the review of the NWRS. It provides a strategic guidance for supporting South Africa's requirements for economic growth and development. The WfGD Framework includes both water resources and water services. It puts emphasis on the challenge of ensuring access to adequate potable water for every person in South Africa. It focuses on social and economic growth dimensions of water management within the environmental sustainability paradigm.

Although the WfGD framework was approved by Cabinet, it was never finalised (gazetted). The revised NWRS (NWRS2), however, has incorporated aspects of the WfGD that pertain to water resources management, as key core strategies

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Table of Figures

Acknowledgements

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Input	Sector, names, institution	Extended
Specific theme leaders and champions	Oversight by DWA Top Management	Refer to extended **list 1**
Professional Service Providers	Nozi Mjoli, Kevin Pietersen and Marieke de Groen	refer to extended support **list 2**
Specific sector input through preliminary workshops and selected input	Energy Minerals Environment Organized Agriculture Water Sector leadership Group Civil Society and environmental care groups Theme workshops	DE, Eskom Chamber of Mines SANBI, CSIR, NRF, WRC, SA National Parks, WWF, DWA, DEA, specific experts DAFF, WRC, AgriSA, TLU, Agricultural Institutions
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Fred van Zyl	Strategic, core strategies, integrated planning, sector involvement, development framework, improved & smart governance, programme support
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List 2: The following people are acknowledged for their contribution as members and input providers of the appointed Professional Services Provider team:

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Acronyms

CMA – catchment management agency

DEA – Department of Environmental Affairs

DWA – Department of Water Affairs

DWM – developmental water management

GDP – gross domestic product

MAR – mean annual runoff

NGP – New Growth Plan

NWA – National Water Act (Act 36 of 1998)

NWRS-1 – National Water Resources Strategy (first edition, 2004)

NWRS-2 - National Water Resources Strategy (second edition 2012)

SADC – Southern African Development Community

WCWDM - water conservation and water demand management

WfGD – water for growth and development

WMA – water management area

WUA – water user association

Water for equitable growth and development

1. Introduction

This document presents a draft of the second edition of the National Water Resources Strategy (NWRS-2), as required under the National Water Act (Act 36 of 1998). The first edition of the (NWRS-1) was published in 2004 and set out the 'blueprint' for water resources management in the country for the first time.

This NWRS-2 sets out the strategic direction for water resources management in the country over the next 20 years, with a particular focus on priorities and objectives for the period 2013 – 2017. It provides the framework for the protection, use, development, conservation, management and control of water resources for South Africa, as well as the framework within which water must be managed at catchment level, in defined water management areas. It is binding on all authorities and institutions exercising powers or performing duties under the National Water Act (Act 36 of 1998).

The water sector has been in a state of major change since 1994, with substantial new policy and legislation which defines the framework for water management in the country.

While the policy and legislation have been globally recognised for their progressive response to water management, implementation has been slow, for a number of reasons. One of the key areas where the aims of the policy and the NWRS-1 have not been effectively achieved is in relation to equity and redress in access to water. While the provision of safe domestic water supplies has reached 95% of the population, showing remarkable strides since 1994, the allocation and reallocation of raw water to historically disadvantaged communities for productive purposes has not progressed as it should.

The NWRS 2 also addresses concerns that the socio-economic growth of South Africa potentially will be restricted if water security, resource quality and associated water management issues are not resolved in time. The NWRS 2 must ensure that water serves as an enabler for economic and social development and not a stumbling block.

The strong emphasis being placed on equity in access to water takes place in a context in which South Africa's water resources are under increasing pressure in terms of abstraction, habitat destruction and pollution. Climate change adds another dimension of stress to the pressure on our water resources. The effective management of our scarce water resources in this complex physical, social and economic matrix requires appropriate strategies, skills and capabilities. This NWRS-2 sets out the strategies for achieving such effective water resources management, with a particular, but not exclusive, focus on the role of the state, and specifically the Department of Water Affairs (as water sector leader), associated Sector Departments (impacting water resources and its management), Catchment Management Agencies, water services authorities, water boards, and other organs of state with a

responsibility for water management. It also focuses on the importance of water use sectors to become involved in and commit to effective water resource management.

A key issue is that this strategy is developed against the backdrop of South Africa being a water scarce country, and that water security and associated equity must be achieved within specific spatial, physical, technological, financial and governance constraints and challenges.

South Africa potentially has sufficient water resources, but this can only be secured through the effective and timeous implementation of extended and smart water management options. These options are, however, subject to spatial, economic and physical constraints.

Structure of the NWRS-2

This document is a draft NWRS-2, presenting key issues and proposed strategies to address the challenges and to ensure effective outcome. It is structured as follows:

Chapter 2 sets out some basic facts around the hydrological cycle, the South African water context, and the contribution of water to the South African economy. This is included to inform those who do not clearly understand the hydrological cycle, and how this underpins the management requirements for water resources, particularly in the South African context.

Chapter 3 focuses on the key strategic direction of water for human needs and equitable growth and development, alignment of the NWRS with national development strategies and making water available for growth and development by 'stretching' our water resources.

Chapter 4 deals with water economics, the value of water, and allocation priorities.

Chapter 5 sets out the new paradigm for water management in South Africa – Developmental Water Management (DWM).

Chapter 6 deals with water governance while chapter 7 deals with the core values underpinning the NWRS.

Chapter 8 sets out the core strategies of the NWRS-2.

Chapter 9 sets out the key strategic actions required to implement the core strategies.

Chapter 10 sets out the new water management area boundaries.

Chapter 11 deals with water resource assessment information.

Chapter 12 deal with implementing the NWRS-2, while chapter 13 deals with the key elements of the new paradigm.

Part B sets out specific supporting strategies of the NWRS-2.

Part C provides strategic perspectives for the proposed water management areas

The full NWRS-2 consists of eleven core strategies, supported by technical and enabling strategies. These strategies together address the different goals of the NWRS-2 and respond to the various challenges identified in water resources management in South Africa.

2. Understanding water resources

Effective water resources management is dependent on all water users and water managers playing their part. Government alone cannot do it.

In order to implement the NWRS-2, it is important that South Africans generally understand how the water cycle works, and how their actions create impacts in this cycle. It is equally important to understand the context of water resources in South Africa, and the specific challenges that we face as a country. This section, therefore, sets out some important facts about the water cycle and the specific water challenges in South Africa.

The water (hydrological) cycle

"…water is a scarce and unevenly distributed national resource which occurs in many different forms which are all part of a unitary, interdependent cycle" (National Water Act, Act No 36 of 1998).

Unlike oil, which is a non-renewable resource, water is a renewable resource which operates in a closed loop system (Figure 1). Heat results in water evaporation from the land and water resources. As the water vapour rises, it cools and condenses to form clouds. When conditions are appropriate, the water in the clouds is released as precipitation (rain, hail, snow or sleet). This precipitation evaporates back into the atmosphere, infiltrates the ground to become soil moisture or groundwater or runs off into surface water resources such as rivers, estuaries and wetlands. Plants take up water from the soil and transpirate some of it into the air, contributing to the return of moisture into the atmosphere, and back into the cycle of evapotranspiration and precipitation.

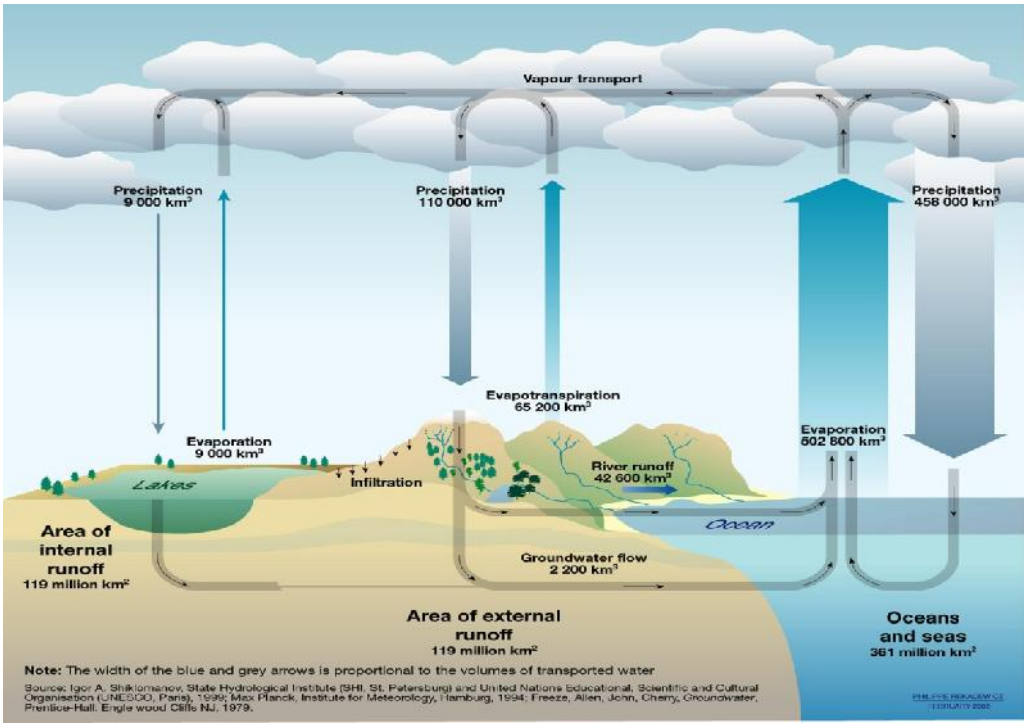


Figure 1: The water cycle (Source: Sarni, W.2011.Corporate Water Strategies. Earthscan LLC, Washington DC: 31.)

Groundwater either seeps (discharges) into streams, rivers, and oceans, or is released back into the atmosphere through plant transpiration.

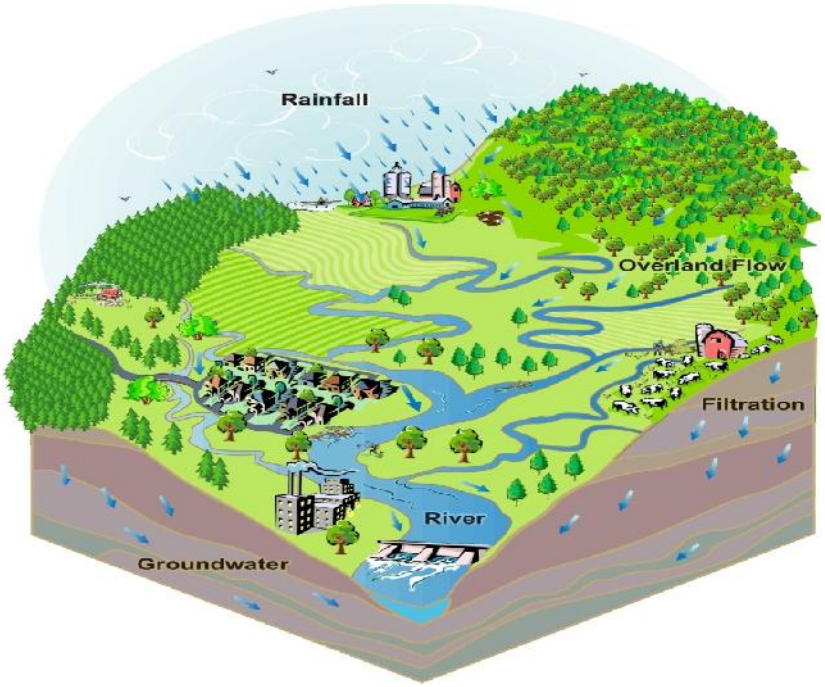


Figure 2: Diagram of a catchment area (Source: http://prairierivers.org/tag/watershed-planning)

Infrastructure, such as dams, enables the provision of a reliable supply of water, and to increase the amount of water available for use, by storing water that would otherwise run into the sea. Storage of water in dams enables a reliable supply of water even during a drought. Other technologies are also available for increasing water availability, such as desalination, although such technologies are still relatively expensive.

The challenge is, however, that dams and general use of water for social and economic purposes have negative impacts on aquatic ecosystems, which provide important goods and services. The challenge, therefore, is how to balance the use of water with the protection of aquatic ecosystems. The NWRS-2 provides strategies that aim to achieve this.

Basic Facts about Water

Examining some of the facts about water use and scarcity in a global context helps to underpin the case why governments and companies are now addressing water as a strategic issue. This case becomes more compelling when one examines the specific water context in South Africa. This section sets out this picture as a context within which the NWRS is set.

More than one-third of the world's population – roughly 2.4 billion people – lives in water-stressed regions and this number is expected to rise. 3,6 billion people die each year from water-related disease and 98 per cent of water-related deaths occur in the developing world.

884 million people lack access to safe water supplies – approximately one in eight people. Poor people living in the slums often pay five to ten times more for water than wealthy people living in the same city.

Less than 1 per cent of the world's fresh water (or about 0.007 per cent of all water on earth) is readily accessible for direct human use. Figure 3 below shows the volume of all water on earth, relative to the size of the earth (large water drop), The middle size blue drop represents the volume of the world's liquid fresh water (including in swamps and groundwater), while the tiny bubble represents surface fresh water[1].

While water is the most abundant resource on Earth, 97.5 per cent of it is too salty for human consumption and crop production. Much of the fresh water, an estimated 35 million cubic kilometres, cannot be accessed for use since it is locked either in the ice cover of the Arctic or Antarctic or in deep aquifers. Thus, the physically accessible fresh water potential of the world is only 90 000 cubic km per year.

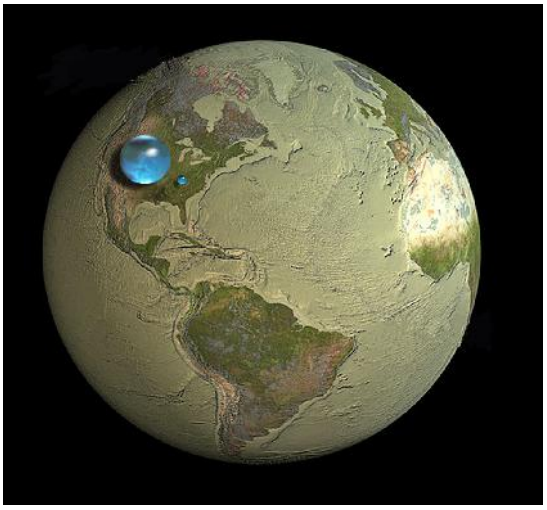


Figure 3: Volume of total water and freshwater relative to the size of the earth

Available water is described as blue water (water in rivers, dams, groundwater, etc) and greenwater (soil moisture). Greenwater is important in dryland agriculture. Not all blue water can be used due to economic, technological, and environmental limitations, spatial

[1] Credit: Howard Perlman, USGS; globe illustration by Jack Cook, Woods Hole Oceanographic Institution (©); Adam Nieman. Data source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources (Oxford University Press, New York).

and temporal mismatch between fresh water availability and demand, and pollution-induced quality deterioration.

Desalination and water recycling can increase water supply, but these options are relatively costly, and only relevant in specific contexts.

Improving water use efficiency is a promising avenue for supply augmentation in view of the extensiveness of water losses and resource underutilization. Since this option helps to realize hidden resource potential within the existing supply limits, it augments supply even in the absence of new water development projects and also prevents further ecological impacts arising from new infrastructure development or increased abstraction.

Water quality is a significant problem in most countries. Pollution-induced quality deterioration not only reduces the benefits of available supply but also leads to a harmful environmental and health hazards. Water-related natural disasters such as floods and droughts are potential threats to human life, both directly and indirectly. In addition to the human costs, there are also economic losses from crop and property damage

Facts about South African water

This section gives some key facts about the South African water context as background to the strategies put forward in the NWRS-2.

Understanding water scarcity

South Africa has low levels of rainfall relative to the world average with high variability as well as high levels of evaporation due to the hot climate, and increasing challenges from water pollution. All of these pose constraints on the amount of water available for use.

Rainfall is unevenly spread across the country's catchments leaving most of the northern and western parts dry (**Error! Reference source not found.**). Average rainfall ranges from < 100 mm/a to over 1 500 mm/a, with an average of approximately 450 mm/a. Linking this low rainfall rate to the high level of aridity results in a mean annual runoff (MAR) of less than 10% - a very low percentage when compared to countries with similar average rainfall. Rainfall patterns, and subsequent runoff, are highly seasonal (with short wet seasons and long dry seasons in many parts of the country) and variable from year to year. This inter- and intra-annual variability of the hydrological system complicates water resource management in South Africa.

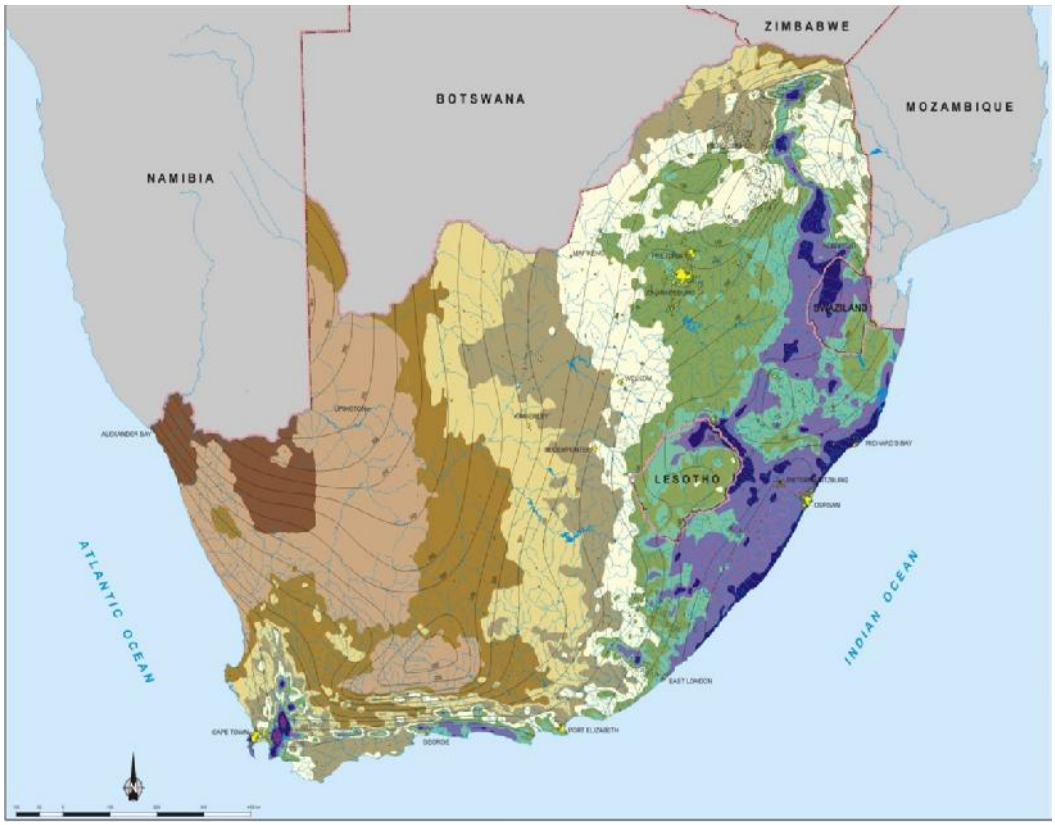


Figure 4: Rainfall and evaporation across South Africa (5).

Water is scarce

The low rainfall and high evaporation results in South Africa being the 30th driest country in the world. As an example, the Zambezi River carries more than ten times, and the Congo River more than a hundred times as much water as the Orange River, the largest river in South Africa. The amount of water that reaches and flows through our rivers is estimated in the region of 49 040 million cubic metres per annum (Mean Annual Runoff – MAR in Mm^3/a) (5). A portion of the MAR needs to remain in the rivers and estuaries to support ecological functioning of the catchments (5). In many water management areas, the ecological portion of the "*Reserve*", which specifies the quantity and quality of water required for the protection of aquatic ecosystems, is not yet fully implemented. The amount of water that can be abstracted at high assurance (the yield) from surface water resources is estimated at 10 240 Mm^3/a (5) which is approximately 20% of the MAR.

Another issue of concern is that invasive alien plants are estimated to currently reduce the yields of dams and run-off-river supply systems by about 695 Mm^3/a (8).

Water resources are unevenly spread across South Africa

The variable rainfall distribution and characteristics give raise to and unevenly run-off and distribution of water resources across the country, with more than 60% of the river flow arising from only 20% of the land area (9). To overcome the uneven spread of water resources and to manage floods and droughts, more than two thirds of the country's MAR is stored in dams. Most of the economically available yield from surface water resources has been fully developed and utilised, and opportunities for developing new and economic dams are few (10).

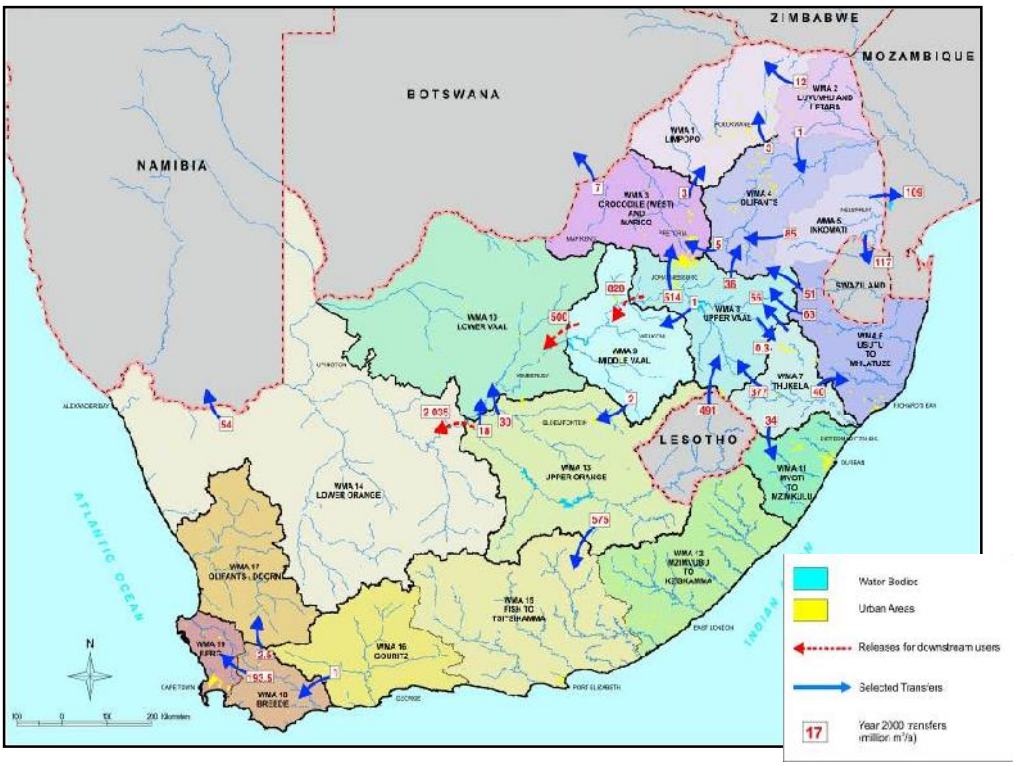


Figure 5: Water Management Areas of South Africa and inter-water management area transfers (5).

Where additional water is available, such as the uThukela, Mzimvubu and Pongola basins, it is located in relatively remote areas, far from existing centres of demand. Surface water from dams and direct abstraction from rivers accounts for 9 500 Mm^3/a, with a significant volume of the surface water yield moved via inter-basin transfers to areas in the country where water requirements exceed supply. An example is the Lesotho Highlands Water Scheme which supplies water to Gauteng through transfer from Katse and Mohale Dams in Lesotho to the Vaal WMA.

This high development and regulation of water resources has caused significant changes in the flow regimes of rivers resulting in negative impacts on the environment and loss of

ecosystem functioning. Furthermore, the outcome of poor land-use practices has also resulted in sedimentation of river channels, lakes and reservoirs, and changes in hydrology.

Fresh water and its development are at its limit

To date, South Africa's water security is mainly reliant on surface (fresh) water and its development. Based on water reconciliation studies, it is clear that surface water availability and its remaining development potential will be insufficient to support the growing economy and associated needs in full. Water development potential only exists in a limited few water management areas, whilst serious challenges remain in the majority of water management areas.

To meet growing demands, South Africa will need to exploit alternative resources.

Although the regulatory framework and the institutional arrangements have changed since the advent of democracy, one aspect remains constant: water scarcity – whether quantitative, qualitative or both – which originates as much from inefficient use and poor management as from real physical limits.. High variability of water flow is the norm, and the base flow varies from very low to zero. At present, there is a well-developed infrastructure, with more than 4 395 registered dams in South Africa, of which 2 528 are water supply related. Despite the good infrastructure, the occurrence of floods and droughts are part of the "normal" water cycle and water restrictions and flood management are a critical part of the water business. And despite the good infrastructure, the poor and marginalised experience water scarcity most intensely, particularly in under-developed rural areas and areas such as the former homelands.

In many parts of the country, we are fast approaching the point at which all of our easily accessible freshwater resources are fully utilised. All South Africans must recognise this situation so that necessary steps are taken to assess current and future demands for water. This will not be an easy task, but with the necessary resolve to plan and implement the required interventions, a secure water future can be achieved.

It is important to recognise, however, that there are very different experiences of water scarcity for different groups in South Africa. In particular, water scarcity is experienced on a daily basis by the rural poor, many of whom still do not have access to potable water supply, and who also do not have access to reliable water supply for productive purposes. These communities are also the most vulnerable to droughts and floods. When dealing with water scarcity, therefore, the plight of those who experience water scarcity most intensely must take priority.

The present water supply situation has created a false sense of water security within the privileged sectors of South African society. Marginalised and poor communities have, on the other hand, have always experienced high levels of water insecurity.

It must be noted that, as at 2012, South Africa has had 16 consecutive years of above-average rainfall in the majority of summer rainfall areas and in these areas the last major drought was more than two decades ago. This trend is unlikely to continue. Other areas such as the Western Cape and parts of the Eastern Cape suffered from drought. The potential for drought in other areas and the impacts of climate change place a particular imperative on the effective management of water resources, within the framework of this NWRS-2.

For the NWRS-1 in 2004 DWA undertook a number of studies to develop Internal Strategic Perspectives for each Water Management Area. Subsequent to this, a number of further studies have been done to update the information supporting the reconciliation of water requirements and the available resources. In this, DWA has taken a strategic approach to focus the updating of water situation assessments on the areas where this is most urgent. There have also been studies to assess the water situation in terms of quality (DWA, 2011).

The NWRS-1 showed that the majority of the water management areas (WMA) have water deficits (i.e. the water requirements exceed availability with current infrastructure) despite significant transfers from other catchments. Only a few selected WMAs such as parts of the Eastern Cape had surplus water. There were, already, concerns that more WMAs would have fresh water deficits by the year 2025. Most of the economically available yield from surface water resources over large parts of the country has been fully developed and utilised.. Where additional water is still available, such as in the uThukela, Mzimvubu and Pongola basins, it is located in relatively remote areas far from existing centres of demand. Opportunities for economically viable new dams are few and far between (DWA, 2010), and the costs of transfer of water per cubic metre to locations where water is needed are also rising with longer distances.

For the purpose of water planning, the Department of Water Affairs (DWA) plans with ‘available water’ and uses a 98% assurance of supply (DWAF, 2004). This means that water can be abstracted at the determined ‘yield’, 98 out of 100 years on average. There is about 10 000 million cubic metres per year available with this level of assurance. In most areas where there are water deficits or where the system is considered ‘in balance’, the probability is that water shortages are experienced more than 2 out of 100 years. Water shortages have become part of life in South Africa.

Approximately 25% of the mean annual runoff (MAR) of 49 000 million cubic meters per annum needs to remain in the rivers and estuaries to support ecological functioning of the catchments, depending on the specific river systems. In many water management areas the ecological portion of the Reserve is not yet fully implemented.

Many dams and associated water resources infrastructure were built more than 40 years ago. While the main structures may have an extremely long life, spillways, gates, pumps, pipelines and canals and associated infrastructure, need regular maintenance and occasional major rehabilitation to extend the lifespan of these assets for which funding is required. There are also considerable backlogs in the rehabilitation of water infrastructure owned by the municipalities.

Groundwater

Groundwater is a significant resource in many parts of the country although local yields are usually quite low. The most recent estimate of sustainable potential yield of groundwater resources at high assurance is 7 500 million cubic metres per annum, while current groundwater use is estimated at around 2 000 million cubic metres per annum. Allowing for an underestimation on groundwater use, potentially about 3 500 million cubic metres per annum is available for further development. This resource is, however, sparsely distributed and often not readily available at points of demand. This is exacerbated by the levels of knowledge and information on the groundwater resource.

Some of the most favourable areas/ aquifers regarding groundwater availability include: the Dolomites of the West and Far West Rand; Table Mountain Group Aquifers of the Western and Eastern Cape; Coastal sand aquifers in the Western and Eastern Cape, and northern KwaZulu-Natal. Other high yielding aquifers include basement granites in the Polokwane-Dendron-Coetzerdam area, alluvial deposits along sections of major rivers such as the Limpopo, and parts of the Karoo Sequence associated with dolerite dykes and ring structures.

Water resource quality

The quality of our water resources, both in terms of water quality, as well as river habitat and bio-diversity, is a major concern. The situation regarding acid mine drainage and municipal wastewater pollution has reached unacceptable levels. In terms of river health, almost 60% of river ecosystem types are threatened, with 25% of these critically endangered. Wetland ecosystem types are of even more concern with a 65% identified as threatened, including a staggering 48% critically endangered. This situation demands drastic intervention.

The DWA has conducted a national review of the water quality status (**Error! Reference source not found.**) and trends that measure, assess and report on the current state and appropriate temporal trends of selected groups of water quality indicators in South African surface water resources (11). Results of the review showed that the levels of nutrients in the country's water resources are of major concern. Only 10% of the monitoring sites showed compliance with the prescribed tolerable range RQO (>0.015 mg/l to <0.025mg/l) for phosphate (11). Levels of non-compliance at national scale are currently 88%. A key contributor to the deterioration of water quality of South Africa's water resources and the marked increase in nutrients and microbiological contaminants with associated health risks are the result of untreated or partially treated municipal wastewater discharges from sewage treatment works (11). The resulting eutrophication in major dams has caused health threats to livestock and humans downstream, apart from damaging the ecosystem. Also, water treatment costs increase with higher nutrient loads.

Acid Mine Drainage (AMD) has been reported from a number of areas within South Africa, including the Witwatersrand Gold Fields, Mpumalanga and KwaZulu-Natal Coal Fields and the O'Kiep Copper District. The Western, Central and Eastern Basins have been identified as priority areas requiring immediate action because of the lack of adequate measures to

manage and control the problems related to AMD, the urgency of implementing intervention measures before problems become more critical and their proximity to densely populated areas. There is also an estimated 62 Mℓ/day post-closure decant from coal mines in the Highveld Coalfield and around 50 Mℓ/day of AMD discharging into the Olifants River Catchment, reducing the quality of water for irrigation and municipalities, as well as damaging freshwater ecosystems (11). An inter-ministerial committee was set up which made recommendations to address problems associated with AMD). Interventions are urgently needed.

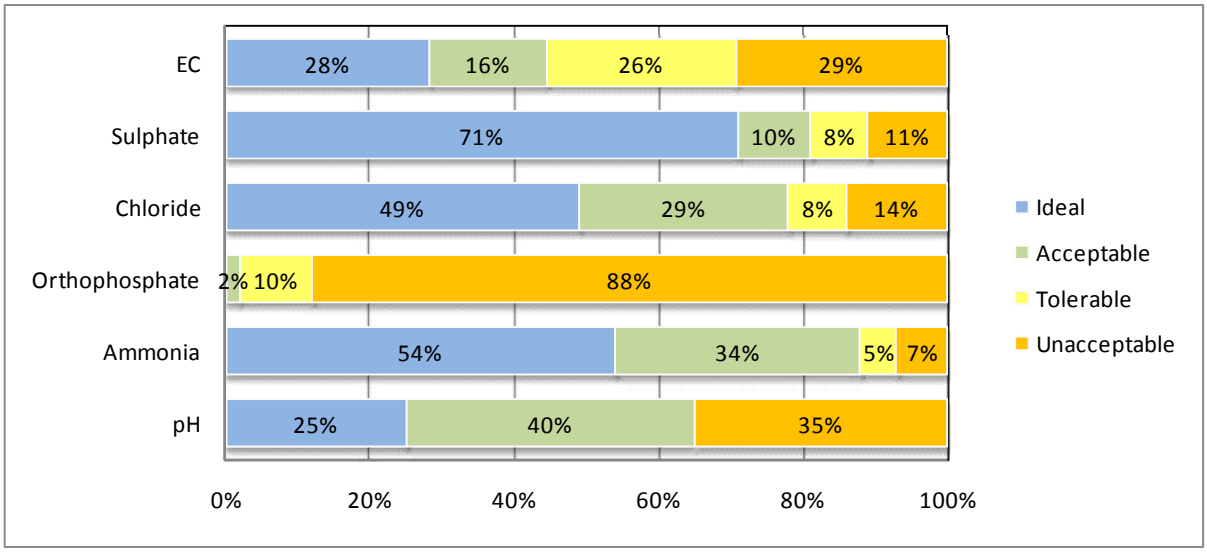


Figure 6:National percentage compliance of current in-stream water quality to Resource Quality Objectives (11)

Salinisation is also a water quality problem in many catchment areas. Elevated levels of sulphate, sodium and chloride pose a risk to industrial water supply, agricultural water supply and aquatic ecosystem health. There are two main anthropogenic sources for salinisation: mines (acid mine drainage); and irrigation return flows from large-scale irrigation schemes (11). Coal mining activities are expanding in the Olifants and Vaal catchments thereby increasing the risk of salinisation. The Waterberg coalfield will be further developed in the future adding additional stress to the water resources situation.

Aesthetic pollution of streams and rivers is not monitored in official reports, but also calls for attention. Much more can be done to remove litter from urban storm water runoff before this enters rivers.

Key pressures on freshwater ecosystems, expected to be exacerbated by climate change include: over-abstraction of water; water quality problems; habitat destruction especially from bulldozing in riparian zones; development in the estuary functional zone; and impacts of alien invasive fish species.

Shared water resources

South Africa shares four major river systems with six neighbouring states (Zimbabwe, Botswana, Mozambique, Swaziland, Lesotho and Namibia). International agreements on water sharing are in place in all of these river basins, in line with the Revised SADC Protocol on Shared Watercourses. These shared river basins raise the importance of water in the regional integration agenda in SADC.

The international obligations have priority over other agreements. International agreements are in place for the Incomati, Maputo, Limpopo and Orange-Senqu Rivers, with contents ranging from information sharing to capacity building. Flow regimes obligations are captured in different ways.

South Africa cooperates with other countries and international agencies on various issues related to water resources, sharing of technologies with developing and developed countries. South Africa is a signatory to several international conventions that are related to water such as the United Nations Convention on Biodiversity and Combating of Desertification, the United Nations Framework Convention on Climate Change and the Ramsar Convention on Wetlands.

South Africa's policy and legislation recognises international obligations in allocation protocol, which is dealt within the support strategies.

Water security: where do we stand?

Are we facing a potential water crisis?

There are in principle two answers. In terms of "crisis" being defined as a disaster, a catastrophe, or an emergency, there is no water crisis. However, in terms of "crisis" meaning a situation having a negative impact on economic, political, societal or environmental goals, there is a potential crisis.

In terms of water resource availability, there is no crisis. There are sufficient water resources available to meet our demands, especially if we include the sea.

The challenge and risk lies in:

- the water resource choice, its location and the associated cost, technology and effort to develop it;
- the ability to ensure timeous access to these resources;
- the ability to ensure functionality and sustainability of the water delivery systems;

- the ability to secure life cycle financing, from planning to implementation, to operations & maintenance;
- the viability of schemes and associated services in terms of sector related affordability;
- the ability to protect the water resource in terms of quality and habitat for sustained use and re-use;
- the spatial context within the physical, economic and hydrological environment; and,
- The potential skill shortage as well as the capacity and ability to manage the various water challenges.

In the short to medium period, a potential water crisis will not be a result of water resources per se, but rather due to a lack of appropriate institutional arrangements, skills and capacity, financing and financial management, effective water management and poor governance. In selected areas the reality of water resource challenges, the present economic climate as well as potential climate variation, will dictate the possibility of water crisis.

What is the likelihood of this occurring? :

- Poor functionality of existing water supply infrastructure and inadequate management thereof due to a lack of investment in and focus on operation and maintenance, is a current reality;

- Fresh water deficits already occur in the majority of water management areas, and water allocation challenges are a reality;

- All existing water reconciliation studies, with associated development proposals, are based on the principle (and assumption) that water conservation and demand management (WCDM) will effectively be implemented. Failing to implement WCDM will result in local and regional water crises. This is already a reality in the Western Cape, the KwaZulu-Natal metropolitan area and the Upper-Vaal system;

- Deteriorating water quality with associated socio-economic impacts is already evident in key river catchments such as the Vaal River, Crocodile River and Upper-Olifants River. This situation, together with the failure to address poor wastewater treatment, mine water pollution and poor land use management effectively, is already a major risk area;

- Although the investment framework for new infrastructure development is well advanced, a delay in its timeous implementation will result in potential water crises. With present funding levels less than 50% of what is required, delays of some projects are imminent;

- Societal and political expectations from intended economic development and job creation programmes, which depend on water availability, may not be realized. In many cases, water may not readily available due high development costs, with associated implications.

3. Water management issues

South Africa must rethink its water resource management approach

The present and future physical climate perspectives, the present economic climate, but also logical and business management principles, force us to become more effective and more efficient in the way we manage our scarce resource. We not only need to stretch our water, but also need to stretch our money and thus our infrastructure. This implies investment in improved planning, incorporation of financial management as a critical part of water management, and the commitment to focus on operations and management, including infrastructure asset management (lifecycle management).

To facilitate and enable new growth and development, South Africa must review its present approach towards water resource management and broaden the definition of water resources.

Ethical and Cultural Value of Water

Apart from the quantitative and qualitative pressures on its physical dimensions, water demand is also growing due to the broadening perspective of water and its ecological, ethical, and cultural roles.

Inadequate financing and poor financial management

Inadequate financing remains a key challenge. Investment in water needs to double if the required outcomes are to be achieved. A recent study by DWA reveals that the capital requirement for the entire water sector over the next 10 years, in real terms, is in the region of R670 billion, and that the funding gap is R338 billion over this 10 year period.

Operation, maintenance and refurbishment are also underfunded. And there is insufficient funding available for programmes such as water demand management and conservation, research, information management, skills development and effective planning.

A key issue is the lack of effective financial management in water management. This includes the ring-fencing of the water 'business' and the need to be able to measure the actual cost of water delivery, ensuring cost recovery with appropriate protection for the poor, appropriate tariff setting, effective and long-term financial planning as well as business and project viability and the application of basic water economics. Cost recovery is essentially based on three sources of revenue – tariffs, taxes and transfers (generally from international donors). These three sources of income must be used to cover capital and operational costs.

It is also critical that the policy should guide the allocation of financial resources so that sufficient resources are dedicated to achieving priority outcomes. Although performance-oriented budgeting is hard to implement, and requires extensive analytic and operational changes in practice – its potential value cannot be underestimated. A comprehensive performance-oriented budget is the best option.

Shortage of human resources

The lack of appropriate skills and capability in the right places has been identified as a critical challenge in the sector, from engineers, scientists and artisans, to project and programme management, as well as leadership, governance and oversight.

In addition to the shortage of critical and scarce skills in the right places, the water sector lacks capability to perform optimally because of the loss of institutional knowledge, experience and competency. This is of particular importance when considering the increased skills and capacity required for improved water management and governance.

It must be recognised, however, that if one looks across the entire water sector, including government, the private sector and civil society, there is a range of skills, knowledge and capability in some areas that can be drawn on for the implementation of the NWRS-2. The challenge lies in mobilising these skills and resources to a common end whilst urgently building more capacity in other critical areas.

4. Contribution of water to the South African economy

The reliable supply of water in sufficient quantities and required quality is a crucial input to economic growth and job creation. The contribution of water to the major economic sectors is highlighted below. The water use per sector is shown in figure 7.

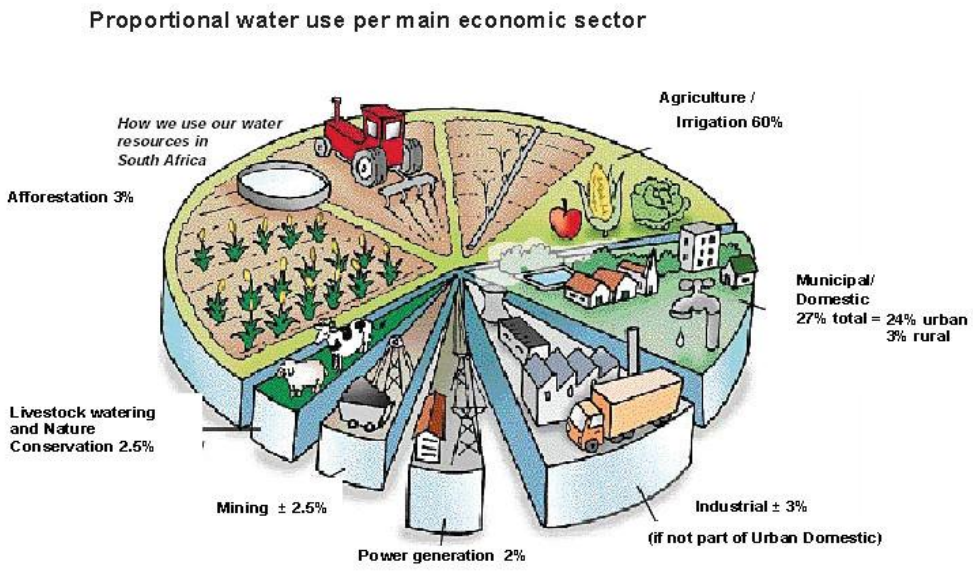


Figure 7: Estimated volume of water per sector

Agriculture

About 8.5 million people are directly or indirectly dependent on agriculture for employment and income (GCIS, 2011). The sector contributes about 3% to the GDP and 7% to formal employment. The agricultural sector is made up of commercial farmers and subsistence farmers: about 1.3 million hectares are irrigated. The New Growth Path has set a target of 300 000 households in smallholder schemes by 2020 and 145 000 jobs to be created in agro-processing by 2020 (DED, 2010). Irrigated agriculture is the largest single use of water in South Africa (60%) and it has a huge potential socio-economic impact in rural communities. Water is the major limiting factor to the growth of this sector and poor water quality has a negative impact on agricultural exports and associated foreign income.

Energy Sector

The energy sector although only using 2% of water, contributes about 15% to the GDP of South Africa and creates jobs for 250000 (GCIS, 2011). It generates about 95% of the

electricity in South Africa and also exports it to countries in Africa. The energy sector, including Eskom, the national power generator, is highly dependent on reliable supplies of water for the generation of electricity (steam generation and cooling processes), and an elaborate and sophisticated network of water transfer and storage schemes have been developed specifically to support this sector and ensure high levels of reliability. The water sector is on the other hand highly dependent on a constant and reliable supply of electricity to "move water"

Mining Sector

According to the Chamber of Mines of SA, the mining sector contributed 8.8% directly and 10% indirectly to the GDP of SA in 2009 (GCIS, 2011). It creates about 1 million direct and indirect jobs. The sector accounts for approximately one third of the market capitalization of JSE and it is also the major attractor for foreign investments. The NGP has set a potential employment target of 140 000 new jobs by 2020 for the mining sector (DED, 2010). Mining and related activities require significant quantities of water whilst also impacting on the environment with associated potential pollution. The development of new mines in water scarce areas requires forward planning to make arrangements for the transfer of water and development of new sources.

Manufacturing Sector

The manufacturing sector contributed 15.5% to the GDP and 13.3% to jobs in 2009 (GCIS, 2011). The NGP has set a target of 350 000 new jobs for this sector by 2020. Water is an input in the manufacturing processes and it also used for cooling.

Tourism Sector

In 2009, the tourism sector directly and indirectly contributed 7% to the GDP and it created 575 000 jobs (GCIS, 2011). This sector is earmarked for high economic growth, which is expected to generate a huge number of new jobs. The NGP has set a target of 225 000 new jobs by 2015 (DED, 2010). Drinking water quality that match international standards as well as a reliable water supply and sanitation services are critical to the success of this sector.

Food and Beverages Sectors

The food and beverage sectors are highly dependent on water for the production of their products, however, the precise contribution of the food and beverage industries to the South Africa economy has still to be reckoned.

4.1 Committing Water Use Sectors to sustainable water management

A major gap in the management model is that water resource management is not effectively institutionalised in water sector business management. This has resulted in water related sectors and industry not giving water the attention and priority it deserves, and a lack of ownership, commitment and self-regulation in the private sector. A recent study revealed that many South African businesses are not prepared for managing potential water risks.

Water-dependent businesses can no longer take water for granted regardless of the industry sector they operate within. One of the earliest and most comprehensive discussions of the risk water represents to businesses was published by the Pacific Institute (Morrison and Gleick, 2008). Business opportunities accompany these risks, for those companies that can deliver their products and services efficiently (low water use or no water use), or can develop technological solutions to provide clean water to the public and private sectors.

First, there is physical risk to a business, which arises from decreasing water availability (water scarcity) and the reliability of supplies. The first driver of physical water risk is increased population and its resultant demand from urban and agricultural uses, coupled with water availability. The second driver is poor operation and maintenance of water systems that business is dependent on.

Increased water scarcity will increase competition between business and local communities, particularly between business and poor and historically marginalized communities. This potential competition and associated conflict must be effectively resolved by improved management and planning.

With declining water quality, the physical risks to businesses can become acute. A decline in water quality can result in the need for pre-treatment, which is an additional cost to businesses. This can be especially true when high-quality water is required in the pharmaceutical, beverage and food processing sectors. Companies can expect increased regulation of water quality, and along with increased regulation come potential constraints on availability and higher costs for quality control.

Water supply-chain disruptions represent a real and to a large degree unqualified threat. Businesses are just coming to terms with the realization that they must quantify water use and risk within their supply chain. They have been grappling with this challenge with regard to their carbon risk and seem to have made real progress in quantifying and reducing carbon in this portion of their footprint. Managing water risk within a company's supply chain will

be no small task, as most companies that outsource manufacturing can only influence, and not control the behaviour of up-stream suppliers.

Business and commitment to water management

Water security risk to business is real. Companies across several industry sectors should start to take the lead in quantifying their exposure to water risk, and should develop plans to mitigate these risks.

There is a strong commitment from a number of significant enterprises and organisations to work closely with DWA to improve water management across the country. Some industries and business have not only initiated actions in this regard, but have set world class examples in terms of developing water footprints, water master plans and committing themselves to effective and smart water management.

Business, Stakeholder Management and Partnerships

Partnerships with the public sector, NGOs, research institutions and other key stakeholders must be part of any corporate water provision programme. The importance of stakeholder management and partnerships with NGOs and communities cannot be overemphasized. A number of factors drives the need for truly collaborative partnerships. Neither government nor businesses alone can solve water issues, such as climate change and water scarcity. As a result, government and companies increasingly have to forge new types of partnerships, and rethinking relationships with traditional stakeholders. Leadership now demands a transparent engagement with stakeholders, including water users from poor communities, that includes establishing priorities and setting measurable goals and actions. Apart from poor communities, stakeholders should include investors, regional, national and global NGO's, intergovernmental organizations, and employees.

As stakeholders, employees are critical in building and implementing a water strategy. Besides developing and implementing a water strategy, employees will also help communicate access and performance to other stakeholders. In the strategy process, the importance of employees cannot be overestimated. In this regard, it is important to deliver simple, relevant, personal messages tailored to the needs of employees and local communities.

Water use authorization has become a critical business risk which has to be managed, and is no longer a routine matter of business license or permits; license to operate can be given and withdrawn by a variety of stakeholders important to a business. The emerging issue of the human right to water will only make the competition, in turn, increase the risk to a company's license to operate unless water stewardship is a key aspect of business strategy, governance, and operations for both direct and indirect water use.

Business, Stakeholder and Sector Involvement Framework

In dealing with water related sector involvement, with associated requirements for sector specific water strategies and water footprints, an engagement and response framework has been developed to guide the process. The specific items and actions are as follows:

- Develop an effective understanding and comprehension of the water situation and associated implications for the specific sector. This includes the climate and its variability in terms of space and time, existing use and risks and water resource choices;
- Defining the strategic role and actions in terms of social economic development (integrated strategic planning and partnerships);
- Developing sector based water strategies and comprehensive life cycle footprints including sector viability and risk management;
- Responding and committing to effective water resources management in terms of water planning, appropriate resource choices, including water use efficiency;
- Responding as a water resource "impactor" in terms of water quality management, resource and ecosystem protection, hydrologic and hydraulic impacts (e.g. runoff changes due to urban development and river diversions);
- Responding as a water resource "impactee". This is dealing with impacts on the specific user due to upstream use, development, pollution as well as disaster management;
- Confirm role and commitment to effective water management including monitoring, information management, effective planning, resource management and protection as well as sustainable management (formalise water management as a core business activity);
- Dedicated and active involvement in water governance and management structures including national water information, integrated catchment management including CMA involvement, water use associations, water boards as well as planning and management forums;
- Reflect and commit to facilitating and enabling activities such as financing, skills development, research and innovation;
- Active involvement in the finalisation as well as implementation of this Strategy.

4.2 Water for human needs, equitable growth and development

"Of all natural resources, water permeates perhaps most deeply into all aspects of our life. It is as essential as the air we breathe for our survival; its presence determines the nature of the natural environment in which we live; the majority of our economic activities depend on it. The achievement of South Africa's development vision will thus only be possible if water resources are managed in a way which is sensitive to and supportive of the many demands we place on them." (White Paper on a National Water Policy for South Africa 1997)

The NWRS-2 is centred around a recognition of water as a basic human need, and a recognition of its critical role to ensure equitable socio-economic development. The principle of equity means that special attention must be given to the needs of those that were historically denied access to water or to the economic benefits of water. Equity implies a concept of fairness, which allows for different practices in the management of water in response to different social, economic and environmental needs.

In order to bring equity to a practical level it is important to distinguish between equity in access to water services, equity in access to water resources and a thirdly, equity in access to benefits from water resource use through economic, social and environmental development and management.

Equity in access to water services

The Water Services Act (Act 108 of 1997), and its accompanying regulations, translated the Constitutional right of "access to sufficient water" into firm definitions in terms of quantity, quality and assurance of supply. Since 1994 impressive progress has been made in providing millions of South Africans with access to a safe water supply as the backlog was reduced from 41% to 5% over the period 1994 to 2012. While major investment in water resources infrastructure has enabled the provision of reliable water supplies to large urban areas, in large parts of the rural areas and to commercial water users, and to the economic sectors described above, there are still many South Africans who suffer from water insecurity and lack of access to reliable water supplies for domestic and productive purposes. The NWRS-2 recognises the need to address equitable allocation as envisaged in the policy and legislation, which has not been fully realised yet.

Equity in access to water resources

Equity in access to water resources deals with the concept of direct access to water for productive purposes such as water for irrigating crops or water for a business or an industry. Critical, therefore, to the NWRS-2, is the requirement to address equity in water allocation, and to ensure the beneficial use of water to create jobs, contribute to poverty eradication, and reduce the major inequality of South African society. It is however neither practical nor possible to divide South Africa's water resources so that each person has access to the same amount of water.

Equity in access to the benefits from water resource use

The third equity principle is equity in access to the benefits from water resource use. This means that water must be allocated in such a way that it brings maximum benefit to all whether directly or indirectly.

Achieving this will require placing emphasis on emerging opportunities such as renewing infrastructure, investing in human capabilities, stimulating innovation and technological

development, redressing historical inequalities, and increasing participation in the governance and management of water. It also requires an appreciation of emerging challenges such as climate change and how they might influence current and future strategies.

Conflating Means and Ends

It is critical that the strategies presented in the NWRS-2 support the ends as set out in the national policy:

> "The objective of managing the quantity, quality and reliability of the nation's water resources is to achieve optimum, long-term, environmentally sustainable social and economic benefit for society from their use".

This is premised on principles of equity, sustainability and efficiency. The NWRS-2 is, therefore, aimed at managing our water resources in a manner that will achieve optimum, long-term, environmentally sustainable and equitable social and economic benefit for society. These aims and values must remain central and conscious in the interpretation and implementation of the NWRS-2.

Since water management is in itself complex, and is operating within a complex social, economic and ecological environment, it is uncertain that specific activities will necessarily lead to particular outcomes. It is therefore critical that the NWRS-2 sets clear outcomes, that progress towards these outcomes is monitored and assessed regularly, and that adaptive management approaches are used to ensure that changes can be made where sufficient progress towards the outcomes is not being achieved.

Equally important is the participation of people in water management. In particular, the participation of the poor is critical in eliminating poverty and ensuring the political legitimacy of policies and strategies. Participation has evolved over the last eighteen years from a passive model to a more action-oriented concept. Top-down consultation, has been replaced by citizen participation. This is a critical approach underpinning and supported in the NWRS-2.

4.3 Alignment with national development strategies

It is important to recognise that, in most cases, water is only one of a number of inputs required for economic growth and development. At the household level, access to a relatively small amount of water for productive purposes can make a substantial difference to the quality of life of the poor, but without access to other resources such as markets and transport infrastructure, it is unlikely that such access will enable people to truly escape from poverty.

It is now being realised by most sectors as well as in most national and sector strategies that water is important and that no development can happen without water planning, development and the corresponding budget allocations.

However, for water to play an optimal role in poverty eradication, growth and development, and building a just and equitable society, water resources planning must be integrated into national, provincial and local planning, and must be addressed in all growth and development strategies. This section highlights some of the key strategies and plans that must be integrated with water planning to achieve national development objectives and outcomes.

Some of the macro strategies are reflected below:

National Development Plan 2030.

Water Management and associated issues are reflected as a subset under the chapter on Economic Infrastructure. Water and its management, however, is more than just about infrastructure: its future management will require extensive improvements in governance, sustainable management as well as improved technology and strategic decision-making and prioritisation.

New Growth Path (NGP)

Water has a role to play in four out of five of the job drivers identified in the NGP and the NWRS-2 supports the NGP in the following areas:

Jobs Driver 1*: *Infrastructure for employment and development – The NWRS-2 includes a sub-strategy that focuses on infrastructure development and management which will create new job opportunities over the next 5 years. The sub-strategy outlines a plan for funding infrastructure development needed to support economic growth in South Africa.

Jobs Driver 2: Improving job creation in economic sectors - The NWRS-2 includes reconciliation strategies for balancing water supply and demand in high growth areas. It also provides a framework for strong sector leadership, streamlined water use authorisation processes and an economic regulator. The NWRS-2 also prioritizes water conservation and water demand management (WC/WDM) in all sectors in order to increase productivity per unit of water. This enables the possibility of the water saved being used in new or expanded enterprises.

Job Driver 3: ***Seizing the potential of new economies*** – The NWRS-2 makes provision for the recycling and re-use of wastewater, and for water to be used in supporting the green economy and the creation of jobs in this area.

National Government Outcomes

The Cabinet Lekgotla in January 2010 adopted 12 government outcomes which are the key indicators for the national government's programme of action for the period 2010-2014.

The following national government outcomes are intricately linked with availability of water resources:

Outcome 2**: **A long and healthy life for all South Africans – Water is fundamental requirement for human health. The NWRS-2 makes provision for allocation of water to meet basic human needs and includes a sub-strategy for protection of water resources.

Outcome 5**: **A skilled and capable workforce to support an inclusive growth path - The NWRS-2 recognize the importance of a technically competent workforce in the sustainable management of water resources and it includes a sub-strategy for water sector capacity building.

***Outcome 6**:* **-** The NWRS-2 makes provision for investment in water infrastructure to support economic development through a strategy for infrastructure development and management and the National Water Sector Investment Framework.

Outcome 7: ***Vibrant, equitable and sustainable rural communities with food security for all*** - The NWRS-2 adopts the principle of 'source to tap and back to source' and maximization of local water resources to improve access to adequate water for domestic and productive use in rural communities in particular. The equity and redress focus of the NWRS-2 is particularly in line with supporting outcome 7.

Outcome 8: ***Sustainable human settlements and improved quality of household life***, and ***Outcome 9: A responsive. Accountable, effective and efficient local government system***– The NWRS-2 provides options for water resource development to meet water supply and - sanitation services for a growing population and for the provision of higher levels of service.

Outcome 10: ***Environmental assets and natural resources that are well protected and continually enhanced*** – Protection of water resources and associated aquatic ecosystems is one of the strategic goals of the NWRS-2 and a sub-strategy for protection of water resources and regulatory framework for water resources are included.

Industrial Policy Action Plan

The Industrial Policy Action Plans (IPAP) is a central tool in the NGP job creation strategy (DTI, 2011). The NWRS-2 is in line with the IPAPs support for job creation through the promotion of rainwater harvesting, water recycling and the production of water and energy efficient appliances.

Rural Development Strategy

Water availability is a crucial input to the Rural Development Strategy. The NWRS-2 makes provision for supporting rural development through the multiple use of dams, investment in appropriate water infrastructure, water allocation reform, and a programme of support to small scale water users.

National Biodiversity Management Strategy

This strategy falls under the auspices of the Department of Environmental Affairs, and is aimed, inter alia, at the integrated management of terrestrial and aquatic ecosystems (DEAT, 2005). Protection of aquatic ecosystems is addressed in a specific strategy in the NWRS-2.

Irrigation Strategy

The Irrigation Strategy, developed by the Department of Agriculture, Forestry and Fisheries, aims to increase the contribution of agriculture to the GDP, reduce poverty and create employment (DAFF, 2010). It also aims to increase water use efficiency and redress imbalances in access to irrigated agriculture for historically disadvantaged groups. The NWRS-2 makes provision for infrastructure development to support the implementation of this strategy, sets targets for water use efficiency by the agriculture sector, and sets targets for water reallocation to historically disadvantaged water users.

National Energy Efficiency Strategy

This strategy has set a target for energy efficiency improvement of 12% by 2015 (DE, 2010). This will contribute to a reduction in CO_2 and also reduce water use which is a key input to energy generation. The NWRS-2 addresses water demand management initiatives for the energy sector in the WC/WDM sub-strategy.

National Tourism Strategy

The National Tourism Sector Strategy (NDT, 2011) has set a growth target of 3.5% in 2015 from a rate of 3.2% in 2009. The NWRS-2 has made provision for infrastructure development in high growth centres, which will ensure that there is adequate water for meeting the needs of tourists to South Africa. The NWRS also promotes the use of water resources for recreation, and the protection of water resources, which will support jobs and income generated from tourism.

Mineral Beneficiation Strategy

The government objectives with respect to mining focus not only on the mining of primary commodities, but also on significant contribution to the economy through beneficiation (manufacturing) and on mining tourism (services). The NWRS-2 makes provision for infrastructure development to support the implementation of this strategy and it also sets targets for water use efficiency by the mining sector.

Water resource implications

South Africa as a democratic developmental state has a responsibility to support job creation as an intervention for reducing inequality and defeating poverty. The NGP has identified economic sectors that have a potential for creating employment on a large scale and water is a critical input for meeting the economic growth and job creation targets. However, in many parts of the country, we are fast approaching the point at which all our economically exploitable freshwater resources are utilised.

The NWRS 1 estimated a high scenario economic growth rate of over 4 % up to 2025 and a low scenario growth rate of 1.5 % per year up to 2025. Growth up to 2009 was on average 3.7% (18). Targets are high for the coming years as the Government's NGP aims to create 5 million new jobs by 2020 (19). These plans, however, may be influenced by changes in global markets.

Future water demands for agriculture will to a large extent depend on crop selection and financially attractive opportunities of increasing water efficiencies. National policies and strategies related to compulsory licensing for water rights, food security, energy (electricity costs), bio-fuels, environmental protection and job creation will also influence future water demand (20).

The Irrigation Strategy (21) has set a target of an increase of more than 50% of irrigated land in South Africa. For future scenarios, DWA assumes that the amount of water allocated for agriculture will stay the same as before; all land reform projects and revitalization of small holder irrigation schemes will use the same amount of water as before. Increase in irrigation will be effected through water use efficiency, and selected new development such as in the Mzimvubu.

The import of food crops from countries in the region to reduce irrigation is under discussion and would decrease the pressure on water demand (10). This also relates to policies on food security and the possibility for development in those areas.

There are thousands of mine workings that are abandoned or derelict in South Africa. At the same time, new mining operations are underway, particularly for coal and platinum. The location of some of these new mines is in water scarce areas (for example, in the Lephalale and Steelpoort Valley areas) and these activities will put more pressure on the water resources. Both abandoned and new mines pose a water pollution threat. The development of coal mines in Mpumalanga threatens the quality of a number of important rivers which originate in this area. An inter-ministerial committee made recommendations for dealing with AMD as a source of pollution, affecting mainly the Vaal and the Crocodile River systems.

Development opportunities for forestry are confined to high rainfall zones, e.g. in the Eastern Cape. For the sector to grow, more forestry areas are needed, but growth can also be enhanced by downstream processing activities, such as sawmills, pulping and paper production (22). Downstream activities, however, may use considerable amounts of water and may cause pollution of water resources. Serious thought should also be given to the conversion of dense stands of invasive alien trees to managed woodlots or plantations

compared with forestation of virgin land. Forestation will not only reduce stream flow but also protect biodiversity, especially in KwaZulu-Natal, the Eastern Cape and to a lesser extent in Mpumalanga and Limpopo Provinces.

Energy production capacity is expected to increase with the Department of Energy planning significant investment in new power generation capacity. Current plans include building dry-cooled coal-fired power stations which will be more water efficient. However, these power stations are located in water-scarce areas which would strain available water resources. The return to service of older power stations which are wet-cooled has further burdened available water resources.

The integrated resource plan for electricity (23) prefers a scenario in which from 2010 to 2020, coal based power generation will increase by 10 000 Mega Watt (MW). From 2020 to 2030 coal based power is envisaged as increasingly being replaced by nuclear energy. This is the revised balanced scenario which represents the best trade-off between least-investment cost, climate change mitigation, diversity of supply, localisation and regional development. Including renewable energy and import of hydropower, the total increase is projected to be 40 000 MW for the period 2010-2030. Renewable energy, like solar energy, may also need cooling water.

Sasol is investigating the possibility of building additional coal-to-liquid fuel plants, referred to as Mafutha 1 and 2. Since these plants require large quantities of water, their location will be determined by the most accessible and adequate supply of water and two options are currently under consideration.

It is unlikely that changes in global politics and global economy will be fast enough to fully mitigate expected impacts of climate change. Water management will therefore have to adapt to the expected climate change impacts. It is currently predicted that the net effect of climate change for South Africa will be a reduction of water availability, although impacts will be unevenly distributed, with the eastern coastal areas of the country becoming wetter. In the interior and the western parts of the country, climate change is likely to lead to more intense and prolonged periods of droughts. In general, climate change will probably lead to weather events that are more intense and variable than in the past, such as sudden high volumes of rainfall leading to flooding.

South Africa's institutional and financial capacity has changed over the past years. The shortage of management and technical skills coupled with weak institutional capacity are a concern. At local government level, failure to plan effectively to determine water resource requirements as well as to provide for effective wastewater treatment has serious implications for water management. The DWA projections on human capacity show sufficient influx of university graduates but no attraction of new engineers in the higher age groups, with posts in the higher levels remaining vacant (13).

Water demand and water supply can only remain in balance through smart water management actions. Water management solutions will differ between catchments and will require dedicated management capacity and the mandate to be effective and efficient. Some water management areas are already stressed and additional water is not readily available.

Water can be made available, but at a cost and associated viability and environmental implications. In other areas water can be made available through major infrastructure development and investment. Water sector institutions must be actively involved in water management and must be held accountable for effective water use and water quality management. Water pollution must be prevented as this directly impacts on the potential to use /re-use the water resource.

5. There is potentially sufficient water available for development

To date, South Africa's water security has mainly been reliant on surface (fresh) water and its development. Based on the completed water reconciliation studies, it is clear that surface water availability and its remaining development potential will be insufficient to support the growing economy and associated needs in full. Surface water development potential only exists in a few water management areas, whilst serious challenges remain in the majority of water management areas.

Where additional water is still available, such as in the uThukela, Mzimvubu and Pongola basins, it is located in relatively remote areas far from existing centres of demand. The limits to the development of surface water sources have almost been reached and the opportunities for economic siting of new dams are few and far between (DWA, 2010). The costs of transfers per cubic metre to locations where water is needed are also rising with longer distances and escalating energy costs. In addition, the development of new water resources infrastructure is a complex and time-consuming process that typically takes more than a decade from inception to commissioning (DWA, 2010). For larger and more complex projects with environmental and political sensitivities, the lead times may be more than two decades. This highlights the need for careful planning with long time horizons. To meet growing demands, therefore, South Africa will need to exploit alternative resources.

The good news that by adopting a more holistic approach towards water management, its availability and its use, water resources can be defined in a much broader context. Despite being a water-scarce country, South Africa faces high levels of water wastage and inefficient use.

In municipalities, non-revenue water sits at more than 37% on average although it is not measured in many municipalities where losses are estimated to be close to 50%. In many irrigation and domestic schemes it is worse, with losses of up to 60%. In terms of loss in revenue, these losses account for more than R11 billion a year in the municipal sector alone

Many municipalities, water user associations and farmers do not meter water use and are unable to assess their water losses. This is exacerbated by a lack of infrastructure asset management, operation and maintenance. The result is that water requirements are exceeding supply in many areas. The catchments that supply water to the Durban-Pietermaritzburg area for example are already in deficit in terms of water provision. Other large water supply systems will soon face a similar situation.

It is essential that water losses must be accounted for and curtailed, especially in terms of the need to provide for the growing water requirements of new socio-economic development.

By including water loss reduction, water use efficiency and water demand management, improved water governance, optimisation of existing water resources including groundwater, rainwater harvesting and water systems management, re-use of water, resource protection and recharge, as well as desalination in the resource pool, South Africa has adequate water resource potential to serve its requirements for many years to come.

Groundwater is a significant and under-utilised resource in many parts of the country although local yields are usually quite low. The most recent estimate of sustainable potential yield of groundwater resources at high assurance is 7 500 million cubic metres per annum with potentially about 3 500 million cubic metres available for further development. This resource is, however, widely distributed and often far from centres of demand.

In ensuring sufficient water, spatial and local challenges remain, where the format (characteristics) of these specific resources, the associated cost of supply, user specific footprints and viability, competing demand and the critical need for reallocation to marginalised groups, will dictate particular development solutions and allocation criteria.

Reconciliation strategies

South Africa's growing economy and social development is giving rise to growing demands for water. Given the limited water resources available, it is likely that it will not be easy or economically feasible to meet all the demands that may arise. New approaches will have to be adopted to balance demand and supply, particularly in the most-stressed inland catchments where much of South Africa's economic growth and social development are occurring. Meeting water demands is also important in rural areas to stimulate economic growth.

The National Spatial Development Perspective (NSDP) of 2006 identified 26 priority growth areas in South Africa (**Error! Reference source not found.**8) and water scarcity was identified as a constraint in the major urban centres, which are experiencing rapid population growth due to the migration of people from rural areas to urban centres (14). DWA has therefore focused its planning efforts on the metropolitan areas where the needs are most urgent (10).

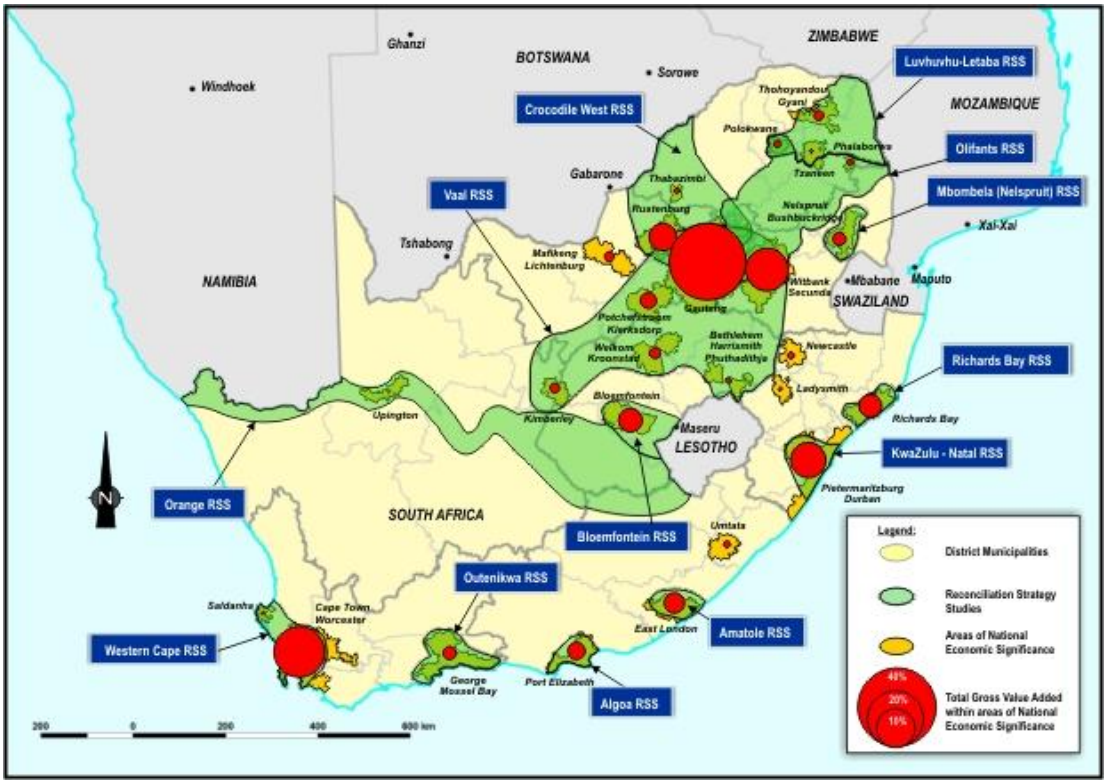
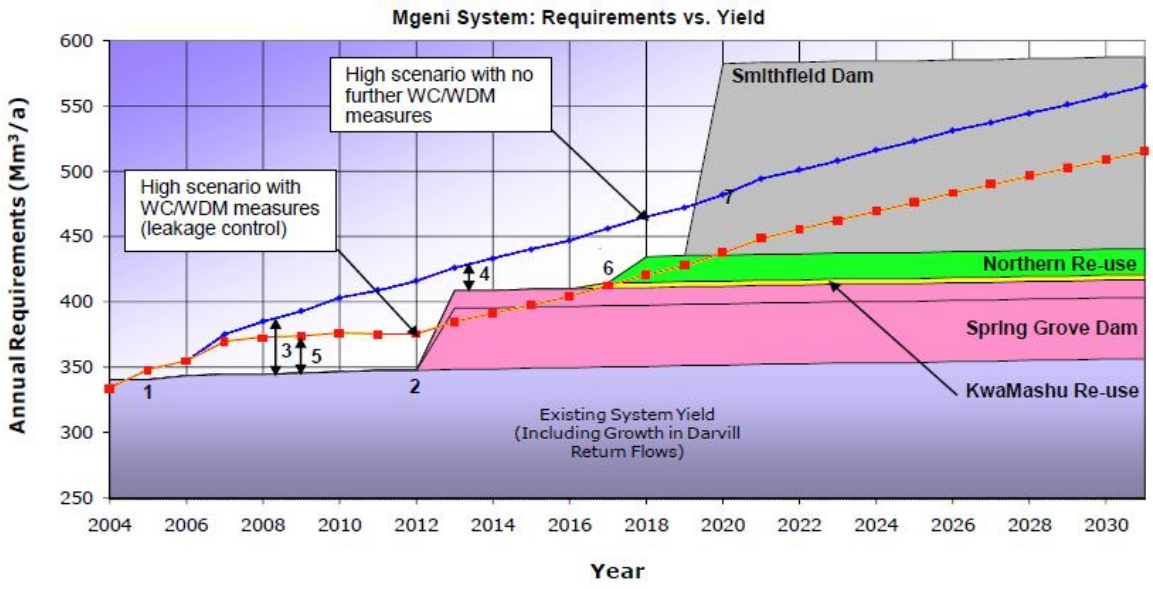


Figure 8: Areas (red or orange) key economic significance in the 2006 NSDP, in relation to existing water supply systems. Current reconciliations studies are shown in green (10).

Apparent from the reconciliation strategies conducted in the major metropolitan areas is that if water requirements grow, more frequent water shortages will be experienced as the growth in demand is faster than the time it takes for implementation of reconciliation measures. In the short term, water shortages will be most probable in the Pietermaritzburg – eThekwini area (the Mgeni system) as well as in the Nelson Mandela Metro area where a relatively mild drought has already necessitated water restrictions (10). It should be noted that in several WMAs the ecological component of the Reserve is not yet fully implemented as other water users are given priority.



1. Requirements exceed existing system yield in 2005. The situation remains until Spring Grove Dam has been completed. Note: The situation has been masked by good rainfall in recent years, resulting in high storage levels in the reservoirs.
2. The implementation programme for Spring Grove Dam (Phase I and II) is for the scheme to deliver water by 2012.
3. Serious shortages are evident before the implementation of Spring Grove Dam.
4. If no WC/WDM measures are implemented, the yield of Spring Grove Dam will not be sufficient to solve the shortages.
5. With the implementation of WC/WDM measures, the shortages before the implementation of Spring Grove dam are reduced, however not completely resolved. Depending on the rainfall up to 2012, restrictions may be required to manage the shortages.

Additional interventions need to be introduced in 2017, where the water requirements exceed the available yield (including Spring Grove Dam). The KwaMashu and Northern re-use options were scheduled to be implemented in 2017 and 2018 respectively. he earliest implementation date for Smithfield Dam is in 2019 and hence the re-use options were selected.

6. Smithfield Dam has been scheduled to be implemented and deliver water by 2020, where the need for further interventions is required.

Figure 9: Mgeni System: Reconciliation of water supply and demand (15).

Figure 9 shows the phases of infrastructural interventions for different areas in South Africa. The development of new water resources infrastructure is a complex and time-consuming process that typically takes more than a decade from inception to commissioning (15). For larger and more complex projects with environmental and political sensitivities, the lead times may be even more than two decades. This highlights the need for careful planning with long time horizons and the use of high demand scenarios.

Most of the identified measures, however, can be implemented much faster if the planning and legal processes are completed beforehand.

Possibilities for the development of additional dams are limited. Other reconciliation options can be implemented (water conservation and demand management, groundwater, water re-use, desalination, and rainwater harvesting), but are not easy to implement in general. WC/WDM is the most cost effective and environmentally friendly measure to consider, but needs the involvement of many parties.

The choice between different reconciliation options is time and site specific. The choice is not only based on financial costs of investment and maintenance and operation, but also on optimal use of resources and other considerations like energy, security, environmental impacts and implementation time.

Error! Reference source not found.3 provides an overview of planned reconciliation options for major water supply systems and their contribution to resolve imbalances between water demand and water supply.

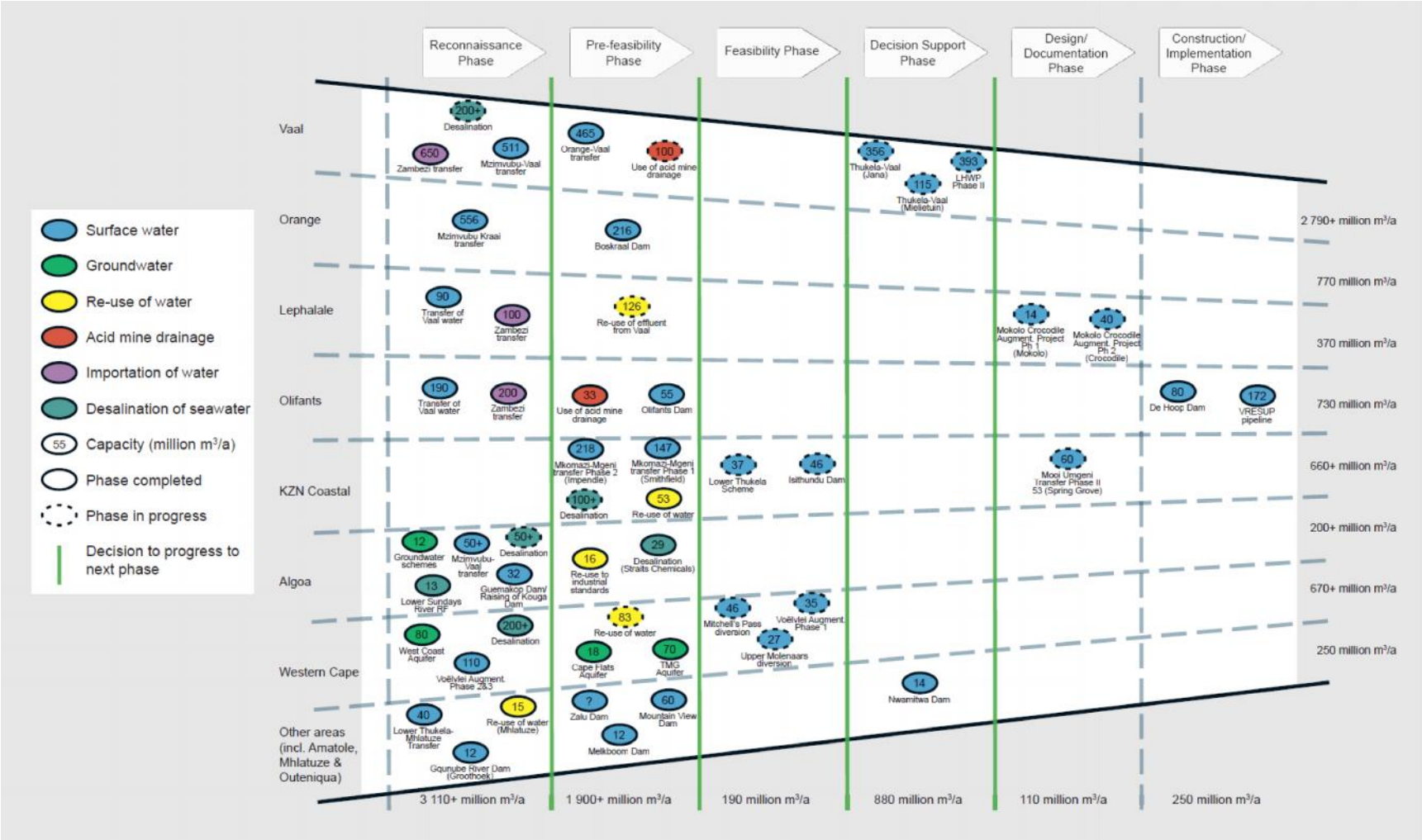


Figure 10: Water Resources Projects Funnel / Filter (15)

Table 3: Implementation plan per water supply system (16)

Location	Action
Vaal River Water Supply System	• Eradicate extensive unlawful water use • Undertake WC/WDM to reduce urban demand by 15% • Undertake Feasibility Study into re-use of water from gold mines • Implement the Vaal River Integrated Water Quality Management Strategy • Implement Phase 2 of Lesotho Highlands Water Project
Crocodile West River Water Supply System	• Water for urban and industrial use in the areas south of the Magaliesberg to be supplied from the Vaal River System via Rand Water. • Water for irrigation and rural users should be supplied from local sources • Transfer surplus effluent from Northern Gauteng to Lephalale area to meet demand
KwaZulu Natal Coastal Metropolitan Water Supply System	• Mgeni System o Implement WC/WDM o Spring Grove Dam on the Mooi River to be constructed to supplement the Mgeni System o Re-use of treated effluent from several wastewater treatment plants o Feasibility studies will be undertaken to assess supply options after 2023 ▪ A dam on the Mkomazi with a transfer into the Mgeni System ▪ The desalination of seawater ▪ Further re-use of treated effluent • Mdloti System o The deficit in the Mdloti System will be met in 2012 by augmenting the yield of Hazelmere Dam from 18 Mm^3/a to 28 Mm^3/a through the addition of crest gates o Further augmentation from the Thukela River with first water delivery anticipated in 2015 o Re-use of KwaMashu effluent is planned after 2016. o In the long term (after 2020) the water resource of the Mvoti River will have to be developed
Western Cape Water Supply System	• Implement WC/WDM • Surface water schemes (consider the most feasible option) o Voëlvlei Dam augmentation (and further o phases) o Further phases of the Palmiet Transfer Scheme. • Feasibility studies o Groundwater development of the Table Mountain Group Aquifer o Desalination of seawater o Re-use of water
Algoa Water Supply System	• The maximisation of the yield of the Kouga/Loerie Scheme • The early construction of the Nooitgedagt Low Level Scheme, for which the EIA and design had already been completed • Implement WC/WDM • Re-use of effluent (various configurations)

Location	Action
	• Desalination of seawater in the Coega IDZ and of irrigation return flows in the lower Sundays River • Development of groundwater resources • A dam on the Kouga River
Amatole Water Supply System	• Operate the Amatole System as an integrated system to maximise yield • Complete bypass works on the Wriggleswade Dam/ Yellowwoods River link • Implement WC/WDM • Re-use of water from the system • Augment system yields through new surface water supply schemes
Greater Bloemfontein Water Supply System	• Implement WC/WDM • Increase the capacity of Novo Pump • Increase the capacity of Tienfontein Pump Station with a further increase in capacity of Novo Pump Station • Bloem Water to investigate the problem and amelioration of the sedimentation in the Welbedacht Dam and the strain it places on the Welbedacht water treatment works and on Tienfontein Pump Station • Local groundwater schemes will be assessed as a source of water for the smaller towns • Water re-use remains an option as a future source of water for the Greater Bloemfontein Area

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Accessibility to these alternative water resources is conditional and comes at cost:

Except for water losses, these alternative water resources are not readily accessible. The critical success factor to supply water to all depends on the ability to mobilize these resources, and to ensure sustainable management thereof. This will require extended effort (in the form of planning, research, and technology (appropriate solutions)), improved governance, leadership and management models, extended funding models and financial management, as well as timeous organising and implementation.

These developments will also come at high cost, which will have major impacts not only on the funding thereof, but also on the viability of the development and specific potential users, e.g. agricultural development.

This emerging approach has extensive implications for water resource management. By broadening the narrow traditional focus on resource development as the solution, a more inclusive business and systems management approach, including effective water use, use

control and regulation, research and technology, as well as creative solutions, need to be adopted.

6. Water economics and allocation priorities

6.1 Water economics

One of the principles that informed the White Paper on a National Water Policy states that the objective for management of water resources is "to achieve optimum, long term, environmentally sustainable social and economic benefit for society from their use."

This recognises. In essence, that water has social, economic and ecological value. The White Paper also recognises that weighing up the social and/or economic benefits of competing water uses is not easy, and becomes more complex when the ecological costs and benefits must be considered as well. This means that the decision on how best to allocate water between competing uses requires a complex and difficult assessment, which includes the ability to assess social, economic and ecological values arising from various water uses.

Overall, however, there is an insufficient appreciation of the value of water, the challenges of the water situation, and the effort required to make water available on a sustained basis. This is reflected in the way water is wasted, water resources are polluted, and aquatic habitats degraded. These same factors reveal weaknesses in the current governance arrangements, and the priority accorded to water in the social agenda.

The three-dimensional value of water has implications for water financing, and how to determine the cost of water. Several elements make up the cost of providing reliable supplies of water, which include:

- Direct infrastructure and management costs, which include the capital, operation and maintenance costs of infrastructure, and the costs of managing water which include planning, monitoring, regulating, etc.
- Economic costs which include opportunity costs which reflect the scarcity value of the resource, the cost of depriving a potential user of water and economic externalities. The economic externalities consist of two elements: positive externalities, such as the groundwater recharge benefits from irrigation; and negative externalities, such as downstream pollution impacts from industrial discharge.
- Full costs. These are the sum of the supply and economic costs, plus environmental and social externalities such as costs to public health and ecosystems arising from, for example, pollution of water resources.

This then leads to the question of who pays the costs of managing and providing water, who pays for aquatic ecosystem protection, and how the price of water is determined.

There are three sources of funding for water development and management: taxes, tariffs, and transfer of funds from aid agencies and international donors and loans. While there can be no argument that the full costs of developing, managing and providing water must be covered, the question is how best to utilise the options of taxes, tariffs and transfers of funds to cover these costs. In consideration of this, issues of equity and affordability must be taken into account, as well as using pricing as a tool for driving water use efficiency and pollution reduction.

A sustainable water price in South Africa is one that will:

- Reflect true costs (including infrastructure, management, operation and maintenance and environmental costs) and incentivise efficient water use and reduce pollution;
- Promote least-cost solutions to providing water;
- Achieve equity in terms of incorporating cost-sharing practices as needed, to enhance affordability for poor water users;
- Enhance the long-term viability of water institutions.

6.2 Allocation priorities

Based on the limited availability of fresh water for further development, and the effort and cost required to realize “new” resources, it is necessary to confirm the protocol by which this scarce resource is allocated. Equally important is how an understanding of the social, economic and ecological value of water, influences the allocation of water.

A proportion of the available water, in respect of both quantity and quality in each water management area, is under the direct control of the Minister in terms of his or her national responsibilities. This includes the Reserve, water to meet international obligations, a possible provision to meet realistic future requirements, transfers between water management areas, and water uses of strategic importance.

Priority 1:

In line with the Constitution and the National Water Act, the highest allocation priority is afforded water for the Reserve. The Reserve specifies the quantity and quality of water required to:

- Satisfy basic human needs by securing a basic water supply for people who are or who will in the reasonably near future be relying upon, taking water from, or being supplied from the relevant water resource; and
- Protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.

The first objective is to ensure that sufficient quantities of raw water are available to provide for the basic water needs of people who do not yet have access to potable water. In terms of current policy, a quantity of 25 liters per person per day has been incorporated in the Reserve Determination. The present practice of providing higher levels of service, especially in urban areas, as well as the need to facilitate enabled economic development (in support of poverty eradication), will have an impact on the present reserve determination. This implies a revision of the reserve and related policy.

The second objective is ensuring sufficient water of an appropriate quality to sustain healthy aquatic ecosystems. Comprehensive work is continuing in this regard, but challenges remain in the implementation of the reserve requirements.

Currently, Preliminary Reserve Determinations are being carried out in support of license applications. Several higher confidence (i.e. more comprehensive and detailed) Reserve determinations have also been done throughout the country in stressed catchments (from a water quantity and quality perspective), often in support of water resources planning.

The status of reserve determination up to 2010 is presented in **Error! Reference source not found.** & 12.

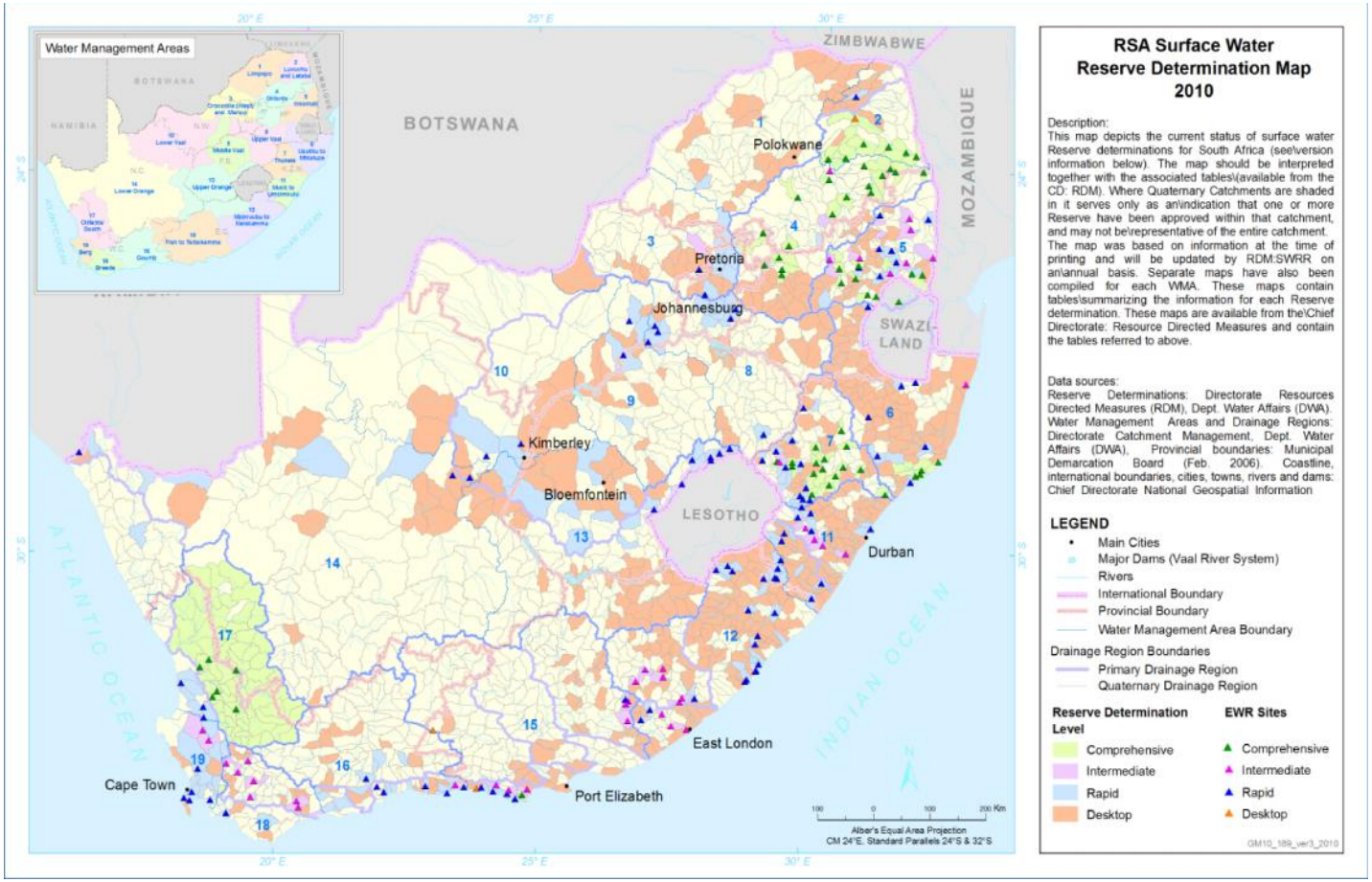

Figure 11: Status of surface water reserve determination map (30)

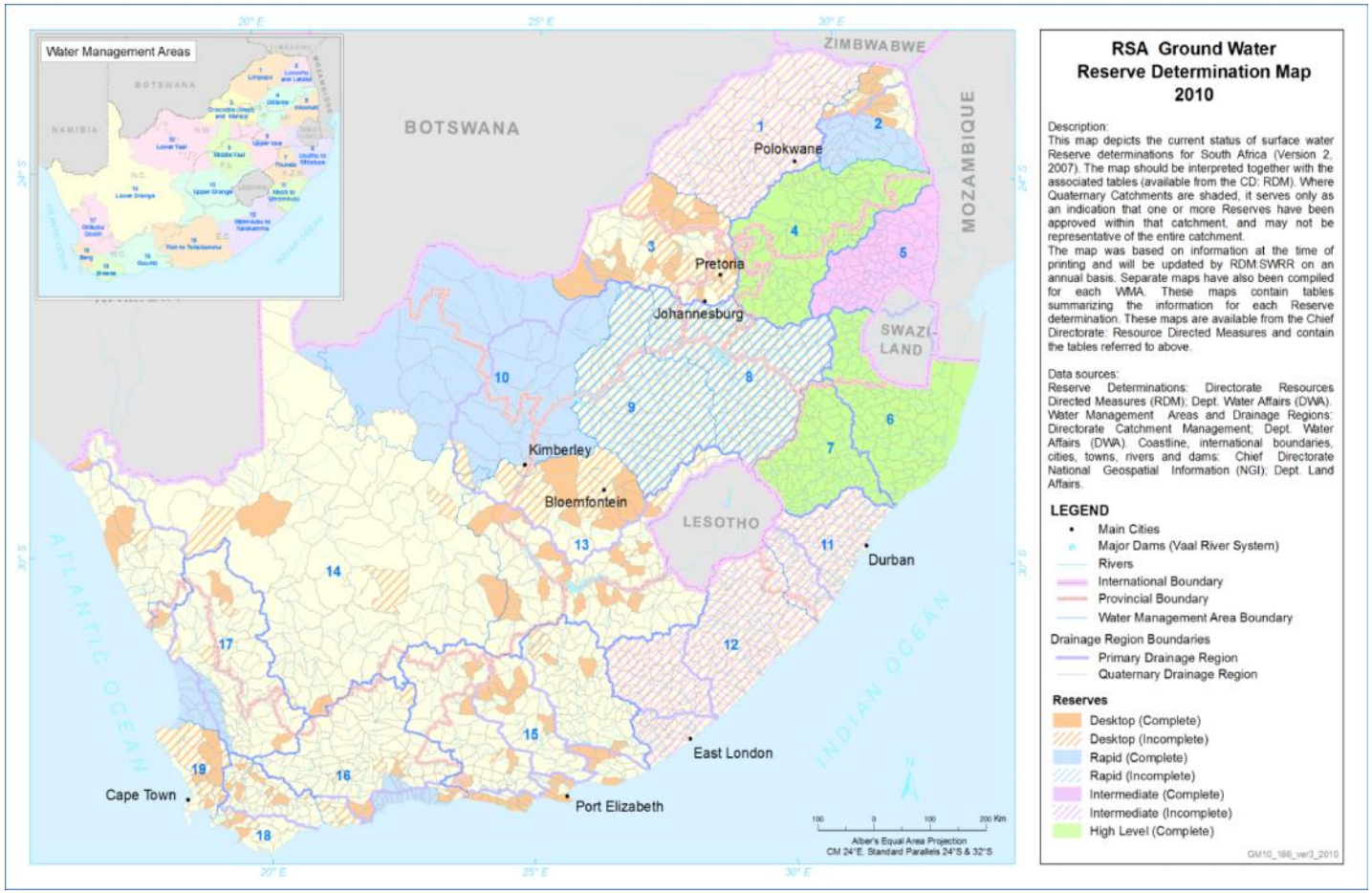

Figure 12: Status of groundwater reserve determination map (30)

Water resources can be grouped into classes representing different levels of protection and utilisation under a national Classification system. The present status and/or risk, determined for each water resource class, are related to the level of protection and water usage determined for that class. The Resource Classification System has been gazetted in September 2010 (31).

Priority 2:

The second highest priority is the meeting of international water requirements in terms of the agreements with riparian states. South Africa is committed to managing shared river basins in line with the revised Protocol on Shared Water Courses in the Southern African Development Community (SADC) and in terms of specific agreements with riparian states. Table 4 reflects present international obligations.

Table 4 Water sharing agreements with neighbouring countries

	International River Basin	**WMAs in South Africa**	**Brief content of international obligations**
	Orange Senqu	8. Upper Vaal, 9. Middle Vaal, 10. Lower Vaal, 13. Upper Orange, 14. Lower Orange (or proposed WMAs 5. Vaal and 6. Orange)	The Botswana/Namibia/Lesotho/ South Africa ORASECOM is implementing the 'Agreement for the Establishment of the Orange-Senqu Commission', signed in 2000. Water resource developments or river control infrastructure that may impact on neighbouring countries will be subject to national authorisation. A separate agreement with Lesotho regulates a transfer from Lesotho of 491 Mm^3/annum to enter South Africa. This is to be increased to 835 Mm^3/annum after commissioning of the Mohale dam. Another separate agreement reads that the abstraction of water by Namibia and all water-related negotiations with Namibia are subject to national authorisation.
	Limpopo	1. Limpopo, 2. Luvuvhu and Letaba, 3. Crocodile West and Marico, 4. Olifants (or proposed	The Botswana/Mozambique/Zimbabwe/ South Africa Limpopo Water Course Commission (LIMCOM) are implementing the 'Agreement for the Establishment of the Limpopo River Course Commission', signed in 2003. Water resource developments that may impact on neighbouring countries will be subject to national authorisation. In the Crocodile West and Marico

International River Basin	WMAs in South Africa	Brief content of international obligations
	WMAs 1. and 2. Olifants)	WMA a transfer of about 7 Mm^3/annum is reserved from the Molatedi Dam to Gaborone in Botswana.
Inkomati	5. Inkomati (or proposed WMA 3. Inkomati-Usuthu)	The Swaziland/Mozambique/South Africa Tripartite Permanent Technical Committee implement the interim INCOMAPUTO Agreement, signed in 2002. Water resource developments that may impact on neighbouring countries will be subject to national authorisation. According to the Pigs-Peak Agreement, South Africa and Swaziland are obliged to release a minimum flow of 109 Mm^3/a to Mozambique at Komati Poort (55 % from the Komati River and 45 % from the Crocodile river). A separate treaty between South Africa and Swaziland reserves 132 Mm^3/annum in the InKomati Water Management Area.
Maputo	6. Usuthu to Mhlathuze (or proposed 4. Pongola-Umzimkulu)	The Maputo river basin is part of the interim INCOMAPUTO agreement, see above. For Maputo there is no separate quantitative agreement.

Priority 3:

The third highest priority is accorded to the allocation of water for poverty eradication, the improvement of livelihoods of the poor and the marginalised, and uses that will contribute to greater racial and gender equity. **This is an amendment of the previous protocol as reflected in the first National Water Strategy, where water for strategic use was awarded priority 3 allocation.**

Priority 4:

The fourth highest priority is accorded to the allocation of water for uses that are strategically important to the national economy, and then other uses.

Analogous to the importance of water as a primary life sustaining resource, electricity is fundamental to the functioning of modern society. Much of the country's economic activity, as well as social stability, depend on a sufficient reliable supply of electrical power. Until thus far, this sector has been classified as a water use of strategic importance.

The reality of the water situation is that after taking into account all the present and priority uses, limited fresh (surface) water remains available for strategic and other use. In the light of the need to support growth and development priorities, as well as to secure water for social development and to meet equity targets, it is proposed that all surplus fresh (surface) water, be placed under direct control of the Minister.

There is an urgent need to define "strategic water use", especially in the light of the priority Outcomes as spelled out by Cabinet, the National Development Plan, the New Growth Path and spatial development programmes. Specific development and security challenges include electricity, food security, and mining as well as the associated job creation.

This situation further requires the development of advanced tools and criteria to guide and enable effective and consistent decision-making on allocating a limited resource to competing priority uses. This includes the development and implementation of (pro-active) allocation conditions such as committing to effective use and resource protection, the development and application of water lifecycle footprints, as well as water re-allocation protocols.

Addressing the challenges

7. Enhanced water governance and developmental water management

The vision underpinning this NWRS-2 is of:

- A democratic, people-centred nation with equitable social and economic development enabled through equitable, sustainable and effective water management;
- Water valued and recognized as a strategic national asset and fulfilling its central role in society and the economy;
- A prosperous society enjoying the benefits of clean water and hygienic sanitation services;
- A healthy, ecologically sustainable and protected water environment;
- A Department of Water Affairs and related water management institutions that serve the public effectively and loyally, meet their responsibilities with integrity, transparency, energy and compassion;
- A committed and dedicated water sector, actively co-operating and contributing towards sustainable water management and associated outcomes.

This vision reflects and builds upon the principles of equity, efficiency and environmental sustainability that underpin the National Water Policy and National Water Act. The policy and legislation are founded on the principles of integrated water resources management (IWRM). However, it is necessary to reinterpret these principles within the context of a developmental state, and recognising the linkages across the entire value chain from resource to tap and back to resource. This gives rise to the concept of developmental water management (DWM) which takes, as a central premise, that water plays a critical role in equitable social and economic development, and that the developmental state has a critical role in ensuring that this takes place.

Water management challenges

South Africa is facing a number of water challenges and concerns, which require urgent and timeous intervention. To address these effectively it is important that there is a good understanding of the underlying reasons and causes. The following overview presents some of the core areas that need to be addressed:

The role and status of water is not appreciated

Water is not a priority and concern. This is reflected in the manner in which water is poorly dealt with in the national and sector planning processes and budget allocations. There appears to be an assumption that water is readily available at minimal cost, resulting in ineffectual planning and unrealistic developmental expectations.

Since the majority of the macro goals are water resource related (from a supply and impact perspective), it is of critical importance that water and its management, must form an integral part of the development planning and framework. This is especially true for South Africa where water has been defined as a scarce and limited resource. Specific water related examples are the goal to ensure sustainable water services to all people; the focus on rural development with clear job creation targets through agricultural and more specific, irrigation development; the expansion of the mining industry with associated water supply and environmental impacts; and the role of water as a catalyst for social and economic development e.g. the Mzimvubu Dam.

There is a culture of indifference and disrespect

This is reflected in the manner in which a scarce water resource is wasted (more than 37% water losses on average), water is polluted, and services (infrastructure) are vandalised. This is also evident in the poor and ineffective response to address and prevent such events.

There is a lack of ownership and accountability

A major gap in the management model is that water resource management is not effectively institutionalised in water sector business and outcome management. This has resulted in water related sectors and industry not giving water the attention and priority it deserves, and has lead to a lack of ownership, commitment and self-regulation.

South Africa however, is fortunate that some industries and business have not only initiated actions in this regard, but have set world class examples in terms of developing water footprints, water master plans and committing themselves to effective and smart water management.

There is inadequate financing and poor financial management

Inadequate financing remains a key challenge. Investment in water needs double if the required outcomes are to be achieved.

There are also serious challenges in terms of funding for operations and maintenance as well as core programmes, such as demand and conservation management, research, information management, skills development and effective planning.

The key issue is the lack of effective financial management in water management. This includes the ring-fencing of water as a business, cost recovery, tariff setting, financial planning as well as business and project viability and application of basic water economics.

Skills and capability challenges

Skills and capability (capacity) have been identified as critical challenges in the sector, from engineers, scientists and artisans, to project and programme management, as well as leadership, governance and oversight.

In addition to the shortage of skills, the water sector lacks capability to perform optimally because of the loss of existing knowledge, experience and competency. This is of particular importance when considering the increased skills and capacity required for the new "smart management" approach.

Government and the water sector urgently need to address skills development, experiential training, succession planning and mentorship to ensure that the wealth of knowledge is nurtured, transferred and increased.

Inadequate governance

The present governance model focuses mainly on policymaking, planning and selected regulation. There are major gaps with regard to integrated development planning, organizing and control, gaps in terms of sector involvement and accountability, sector leadership and drive, as well as effective and comprehensive regulation.

To ensure effective achievement of social and economic goals, urgent attention must be given to these gaps. Alignment of the water sectors in terms of policy, water resource allocation, licensing, sector performance, accountability and regulation, also need be addressed.

Improved water sector leadership is a key success factor for water security. This includes improved coordination, commitment to address challenges and the drive to achieve the desired outcome.

Sector involvement, effective partnerships and commitment, ownership and accountability, are also critical success factors. Sectors must become strategic partners, commit themselves to effective water resource planning, management and use, and accept accountability for water resource protection and associated actions.

The present institutional framework is inadequate, especially in terms of participatory management, integrated governance and development coordination.

An incomplete water management model and approach

The traditional water management model is mainly based on infrastructure development. Although important, infrastructure in itself does not ensure sustainable water delivery. Thus far, inadequate attention has been given to life cycle and sustainable management, resulting in poor operations and maintenance, poor service delivery, and poor infrastructure asset management. A recent SAICE assessment reflected a very low score for national and local water infrastructure ("D-minus" score benchmarked against A as top performance and E as total failure).

In the light of the need to extend the water resource pool with associated availability, and to ensure effective service delivery and outcome, the water resources management model needs to be broadened to include business management, systems management, new technology, scheme functionality and lifecycle management.

The present attitude and culture towards water availability, its value, strategic importance, its use and its appreciation, must change. This change involves politicians, sector leaders, the profession and the public at large.

There is a lack of outcome orientated planning and dedicated implementation management towards timeous achievement of critical development goals. This requires a change in the management approach and commitment to deliver.

The core objective of this strategy is to introduce, facilitate and lead South Africa into a new era of smarter and Developmental Water Management.

Need for "Smart" water management

South Africa has reached a point where traditional water management approaches are insufficient to deal with an ever-growing water demand and an increasingly complex water business.

The core objective of this strategy is to introduce, facilitate and lead South Africa into a new era of "smart water management". The concept of "smart" is introduced to emphasize a fundamental change in traditional water management and to allow for creative and extended management techniques. "Smart" in this context is defined as "clever". "Intelligent", "creative" and "doing the right thing".

The "smart water management" concept inter-alia includes:

- Raising the profile, value and importance of water and re-positioning its strategic role in the social and economic development environment;
- Extending the application of traditional engineering and technology based management approaches to also include sound business and sustainable management approaches;
- Developing innovative solutions, including harnessing of new technology with associated skills and capacity;
- Improved water and integrated governance, including investment in complex water management planning, institutional arrangements and coordination, effective regulation as well as strong water sector leadership;
- Application of lifecycle management principles in the context of never-ending service delivery, as well as developmental impact; and
- Development and application of advanced management tools and systems e.g. multi-parameter decision-making, complex system management, multi-lateral networking, and coordination;
- Applying the basic principles of management (doing the basic things right).

The above-mentioned vision and management approach must be translated into executable actions and practices. This is enabled through the formulation of strategies and associated action plans.

The new approach builds on successes from the post 1994 period, incorporates the lessons learned over this period (in South Africa and internationally) and draws on the development and equity imperatives of the government. It addresses both short-term challenges and longer-term sustainability and equity objectives. Specific focus areas are:

- A rigorous focus on implementation of policy and legislation, applying basic principles of good governance ("do the basic things right"). This includes good planning, effective organising, leadership, control and programme management;
- Extending water governance to include integrated planning, governance and sector partnerships, looking outside the water box to work with other critical sectors such as agriculture, mining, land reform, industrial development and environment;
- Ensuring the involvement of stakeholders and sector partners in planning and management of water resources, including the marginalised and the poor;
- Continuing to extend the water management model to include options such as water use efficiency, local resource optimisation (ground water), re-use, desalination, systems optimisation, improved regulation and control;
- Taking a comprehensive view of water management across the entire value chain from resource to tap and back to resource;
- Applying smart solutions by focussing on functionality, sustainability, technology, accountability, sector involvement and ownership, and harnessing the considerable research and development capability in South Africa behind this programme;
- Mobilising the extensive capacity and knowledge in South Africa, including at the community level and in the NGO and private sectors, and drawing from a range of knowledge sources including indigenous knowledge systems;
- Building a capacitated sector and workforce;
- Ensuring the speedy establishment and transformation of the necessary water sector institutions to achieve implementation of the national water resource strategy and the aims and objectives of national water and development policy;
- Measuring impact by a focus on the achievement of outcomes, not just outputs.

It is essential that commitment to the new DWM approach is obtained from all stakeholders and that compliance to this approach is actively monitored and managed. It requires strong leadership to motivate and direct stakeholders along the transformation process and to manage their performance in a constructive cooperative and outcomes-based manner.

It also requires diligent risk management to ensure that the transformation is effected in full compliance with legislation and consideration of environmental circumstances.

The main challenge is to ensure that water managers across the board understand what is required, and commit to implementation and ensuring achievement of goals.

While there has to be realism in terms of ability and available resources of what can be achieved, the challenges demand brave and bold action and commitment to raise water management to a higher level.

7.1 Water governance

Water Governance can be referred to as the range of political, social, economic, organisational and administrative processes through which interests are articulated, input is absorbed, decisions are made and implemented, and decision makers are held accountable in the development and management of water resources and delivery of water (and sanitation) services at different levels of society (***Modified from Nowlan and Bakker, 2007***).

According to UNDP, Water Governance:

- Is about developing and managing water resources and delivery of services;
- Includes a range of issues intimately linked to water - from health and food security to economic development, land use and the preservation of the natural world on which water resources depend;
- Is concerned with drawing up and adopting the right laws, policies and institutions – also how these are established, enforced and implemented.

Governance in the water sector has political, administrative and economic dimensions and includes both the activities of government, as well as the interaction of civil society with these processes. Good water governance requires predictability, participation, transparency, equity, accountability, coherence, responsiveness, integrated and ethical decision making. This must be built around open policy-making, a professional bureaucracy and a strong, engaged, civil society.

While the regulatory framework and institutional arrangements have changed since the advent of democracy, the water sector is still facing challenges. Such diagnosis raises our hope that the crisis can be averted by improving water use and management. But the task is extremely difficult, as it involves significant changes in the way water resources are developed, allocated, and managed. At the heart of the NWRS-2 is how to design, and sustain these changes on a durable basis within the economic, ecological, and capacity constraints.

Although much has been achieved since 1994, the performance of the sector has fallen short of expectations in three important respects:

The **outcomes** of the sector relative to sector goals have been disappointing. Although substantial progress in increasing access to water and sanitation has been made, this progress has slowed in recent years and the number of people without adequate services is still too large, particularly amongst the poor. Secondly, progress in allocating water for productive purposes to promote transformation has been very slow and water use patterns are still highly skewed and unequal. Thirdly, the stresses on water are increasing and water is not being managed in a sustainable manner. In other words, service delivery has fallen short of expectations.

Uncertainty and a lack of clarity with respect to institutional roles and responsibilities have contributed to poor performance. Proposed institutional reforms such as the creation of catchment management agencies and an entity to manage national water infrastructure have not taken place.

In addressing this poor performance, it is necessary to address legal, institutional and implementation issues. The National Water Act and the Water Services Act are currently under review in order to address a number of challenges currently faced in the water sector.

Promoting a deliberative and participatory agenda will also require adjustments in the structure and functions of water institutions. Issues related to expertise, accountability, and democratic authority must be addressed in an integrated way at the highest level in the Department of Water Affairs. There is therefore the need to strengthen the capacity of the Department at local, regional, and national levels to integrate the consolidation of democratic practices across the sector. But the intensity and scope of consolidation needed to advance democratic practices exceeds the mandate of any one department. All departments and non-governmental entities that have a direct relevance to water should be involved. Aligning all such departments and organizations to focus on water requires the use of political capital.

The NWRS-2 addresses the proposed institutional arrangements to improve water resources management, within a governance framework that ensure that all water management institutions serve the national developmental agenda.

7.2 Core values

Sustainability and equity are identified 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 some 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. (summary of Chapter 1 of the NWA).

8. Making it happen: The core water strategies

"We have to think about the big things while you are doing small things, so that all the small things go in the right direction." (Toffler)

The National Water Resources Strategy encompasses the following critical thrusts:

- Building an efficient water administration by fostering innovation and knowledge management, investing in people's capabilities, cultivating a more water educated and literate society, as well as increasing economic growth and social development;
- Promoting an equitable water sector by eliminating unequal access to water and reducing imbalances within and among groups as well as regions, perpetuated largely by pervasive administrative inefficiencies;
- Sustaining high water infrastructure investment and development by strengthening the sources of growth, the financial, corporate and water institutions as well as investing in pro-poor local-level infrastructure;
- Enhancing Indigenous Knowledge Systems to meet the challenges of globalization, focusing on the role of women and the youth. The Water Research Commission should be required to conduct research on indigenous knowledge systems, focusing on the role of women and youth.
- Developing a knowledge-based water sector as a strategic move to raise the value added of all water initiatives and optimizing the brain power of the nation. In this regard, also, the Water Research Commission has a special role to play;
- Strengthening human resource development to produce an efficient, effective and knowledgeable workforce; and
- Pursuing water security and environmentally sustainable development to reinforce long-term growth.
- Pursuing sound infrastructure management, and ensuring prudent investment policies as well as enhancing efforts to develop a knowledge-based water economy;
- Strengthening and streamlining redress strategies and mechanisms to ensure balanced participation among and within cultural and income groups as well as enhancing performance of water institutions through improvement in user's knowledge, skills and expertise as well as upgrading innovation, science and technology;
- Increasing efficiency and economic growth through accelerating the shift of the work-force towards more efficient performance processes and high-value added

activities. However, this should not be done at the expense of jobs; and the growth must have a job creation as its basis and rationale;

- Expanding the usage of Information and Communication Technology (ICT) and across and within the water sector to accelerate the growth process;
- Strengthening the human resource base to ensure the availability of person power with higher levels of knowledge, technical and analytical skills;
- Adopting an integrated approach in addressing water quality and environmental issues to attain sustainable development;
- Enhancing further the quality of life through improving accessibility to quality water as well as developing the aesthetic and spiritual dimensions of water; and
- Intensifying efforts to nurture and inculcate positive values and attributes among users through the education system, social and religious organizations and the media.

To address the water challenges and accommodate management interventions in a structured manner, the various identified interventions have been clustered into logical and meaningful overarching strategies. These "core" strategies give effect to the objectives of developmental water management, as reflected in the National Water Act, namely "to provide a framework for the protection, use, development, conservation, management and control of water resources for the whole country". They also form the framework and provide context for specific technical, enabling and support strategies.

The core strategies cover four specific business areas, consisting of socio-economic, functional management, tactical, and governance strategies, each setting a different dimension to developmental water management.

Core strategy 1: Implementation of Equity Policy

South Africa's water policy and legislation has been hailed as advanced in respect of addressing equity issues. Central to this is the issue of progressive realisation of the equity goals. However over the past 14 years significant challenges have been identified.

The pro-poor focus of the NWRS-2 is based on several considerations:

- The need to invest in appropriate infrastructure to serve the needs of the poor;
- The need for appropriate water resource strategies to be developed and implemented to assist poor communities to mobilize themselves so as to strengthen their voice in policy and implementation processes;
- The development and implementation of a pro-poor regulatory framework;
- The need for ongoing monitoring to establish what is working and what is not, as well as learning from effective practices in selected countries;

- Extensive engagement between policy makers, administrators, experts, civil society, grassroots movements, and the private sector.

The NWRS-2 sets as a goal to review the extent to which the equity policy as reflected in policy principles has been implemented and will develop an equity protocol which may lead to proposals for legislative amendments.

This protocol will distinguish (as discussed above) between the three concepts namely access to water services, direct access to water resources for productive uses as well as the concept of equity of access to the benefits from water resource use (by another user).

Equity in access to water resources deals with the concept of direct access to water for productive purposes such as water for irrigating crops or water for a business or an industry. Critical, therefore, to the NWRS-2, is the requirement to address equity in water allocation, and to ensure the beneficial use of water to create jobs, contribute to poverty eradication, and reduce the major inequality of the South African society.

The third equity principle is equity in access to the benefits from water resource use. This means that water must be allocated in such a way that it brings maximum benefit to all, whether directly or indirectly.

Core Strategy 2: Putting water at the centre of integrated development planning and decision-making

As has been raised earlier, while water plays a pivotal role in everyday life and in socio-economic development, the management of water resources does not receive the attention and status it deserves. Despite its strategic role, water is:

- Not properly acknowledged and reflected in macro and sector strategies. Water needs to be placed at the centre of all integrated planning and decision-making;
- Not adequately provided for in national budget allocations. To ensure water security and minimize negative impacts on growth and development, the current budgets need to be at least doubled;
- Not valued and appreciated as a scarce resource. Current financial values do not reflect the real value of water. This requires a new value system across all sectors and stakeholders, including implementing water tariffs that reflect the real cost of supply;
- Not embedded in business and sector management. Water management must be formally embedded in sector businesses with associated accountability.

It is imperative to raise the profile of water at all levels of government and decision-making. Water must be placed at the centre of integrated planning and decision-making with a

specific aim to respond to and support the achievement of national development and sector goals.

The Strategy comprises the following actions:

- Raise the awareness of water, its strategic role and challenges at all levels of business and society;
- Establish a national drive and passion for water;
- Embed water in all spheres of the education curriculum;
- Include water as a formal agenda item in all planning and decision-making processes;
- Entrench water management functions in sector businesses;
- Promote awareness of the role of water as a critical and strategic natural resource amongst politicians, decision-makers, planners and the public;
- Extend the valuing of water to include its scarcity, its social and economic contributions and its environmental role.

The success of this strategy relies on DWA's ability and commitment to lead and drive this water agenda. The Department must demonstrate its capability and leadership through effective drive, sector coordination and mobilisation.

This strategy is the core of the NWRS-2 and requires immediate implementation with dedicated resourcing. Support actions include political ownership, sector mobilisation, ownership and partnerships, formal promotion and educational programmes. Water must also be entrenched in all integrated planning and decision-making, notably the outcomes agreements and processes. The National Planning Commission must play a central role in facilitating this process.

Core strategy 3: Ensuring water for equitable growth and development

Government has set clear goals and programmes to create prosperity for and improve the well-being of those living in South Africa. This is reflected in the National Development Plan (Vision 2030), New Growth Path, sector specific strategies, Ministerial Performance Agreements, and specific Cabinet decisions.

Water plays a central role in most of these national planning initiatives, such as agricultural development, energy security, tourism and recreation, mining, industry and municipal water supply. However, water is not adequately appreciated and reflected in most of these development plans.

Although water resource options are available, there are spatial, economic and viability constraints, which will have major effects on planning, decision-making and outcomes in certain areas. These considerations must be included in all the planning processes, from national to local levels, to influence and direct appropriate development solutions.

Economic growth implies that more water will be required. However, water is not always in surplus and growth will only be possible through optimized use of existing water resources, expensive imports and/or re-allocation.

This situation and perspectives, however, are not adequately appreciated and reflected in most of these development plans. Economic growth has to be planned in context of sector-specific water footprints, which include the water use footprints, the various water and environmental impact footprints, as well as the relevant socio-economic impacts and contributions.

There is an urgent need to reaffirm the role and purpose of water and water management. As indicated in the National Water Act, the ultimate purpose of water management is to enable and facilitate prosperity through providing water to the various social and economic sectors for growth and development.

The reality is that water, in itself, does not generate prosperity. Growth and development is achieved through integrated development solutions, which require integrated planning and partnerships with economic sectors. At present, these partnerships and integrated processes are not effective and need to be enhanced.

This partnership has specific conditions:

- Planning processes must be proactively informed on the water situation and opportunities to ensure appropriate solutions;

- Similarly, the water sector needs to be informed of development objectives to proactively reconcile water balances and inform water resource management plans at catchment and systems level; and,
- These partnerships and multi-dimensional development require effective facilitation and leadership. The National Planning Commission can play a key role in this regard.

The country's economic growth targets cannot be achieved at the expense of the ecological sustainability of water resources or the obligation to meet people's basic needs. Economic growth implies that more water will be required. However, water is not always in surplus and growth will only be possible through optimized use of existing water resources.

In areas where there is a surplus of water, or where there are viable water resource development opportunities, water can be used as a stimulus for development. Such an opportunity exists, for instance, in the Eastern Cape with the proposed development of the Mzimvubu Dam and associated economic and social development opportunities.

Social and economic sectors must not only take part in water planning, but must also accept responsibilities and accountability for specific water management functions and outcomes, such as resource protection and water use efficiency.

Various actions have been identified to facilitate and improve water resource alignment with growth and development:

- Raising the status and profile of water;
- Enabling integrated planning processes (National Planning Commission);
- Formally respond and align water to macro and sector strategies;
- Establishment of strategic partnerships with relevant sectors;
- Development and maintenance of water development and allocation criteria and processes;
- Development and maintenance of an integrated water investment framework;
- Development and application of sector based "water footprints and water strategies:
- Facilitate sector involvement in water management with associated accountability;
- Facilitate and improve interdepartmental governance and regulation (e.g. mining development with associated licensing and authorisation);
- Effectively respond to national priority actions and programmes such as the 12 Outcome Agreements and SIPS.

The following macro and sector strategies have been identified that affect or are impacted by water resources and its management (Table):

Table 5: Response and alignment to macro- and sector strategies

Sector/ Department	Sector strategies and plans	NWRS responding strategies
Agriculture, Forestry & Fisheries	Irrigation Strategy Food security Rural development	• Infrastructure Development and Management • Water Conservation and Demand Management (WCDM) • Water Allocation Reform • Water Sector Institutional Arrangements • Water resource protection
Cooperative Governance	National Disaster Management Framework Water services	• Disaster management • Water security • Infrastructure development • Investment framework • Water resource protection • Water Conservation and Demand Management (WCDM) • Sustainable management
Economic Development	The New Growth Path	• Infrastructure development and management • Job creation • Water security for development • Water Sector Capacity Building • Research and technology
Energy	Integrated Resource Plan for Electricity	• WC/WDM • Infrastructure Development and Management • Water allocation • Resource protection • Water footprint • Integrated planning
	National Energy Efficiency Strategy	• WC/WDM • Research and technology • Resource protection

Sector/ Department	Sector strategies and plans	NWRS responding strategies
Environment	National Biodiversity Management Strategy	• Water Resources Protection • Water reserve and its application
	National Climate Change Response Green Paper	• Climate Change • Water Resources Protection • Infrastructure Development and Management • Improved water management
	National Strategy for Sustainable Development and Action Plan for Sustainable Development 2011-2014	• Water Resources Protection • Climate Change • Water Sector Institutional Arrangements • Sustainable water resource management • Reserve management
Office of the Presidency	National Spatial Development Perspective	• Infrastructure Development and Management
	National Development Plan: Vision 2030	• Infrastructure Development and Management • Water Sector Institutional Arrangements
Trade & Industry	Industrial Policy Action Plan 2	• WC/WDM • Infrastructure Development and Management • Water security and allocation • Water footprint
Rural Development & Land Reform	Rural Development Strategy	• Water Allocation Reform • Infrastructure Development and Management • Water security

An outcomes approach was adopted by National Government to improve government performance. The Twelve Outcomes focus on high priorities for government programmes and water features strongly in several.

Table 6 Response to National Government Outcomes

Outcomes	NWRS Responding strategies
Outcome 2: A long and healthy life for all South Africans	• Water Resources Protection • Water security • Sustainable services
Outcome 5: A skilled and capable workforce to support an inclusive growth path	• Water Sector Capacity Building • Research & Innovation
Outcome 6: An efficient, competitive and responsive economic infrastructure network	• Infrastructure Development and Management • Water security
Outcome 7: Vibrant, equitable and sustainable rural communities with food security for all	• Water Allocation Reform • WC/WDM • Water availability and security • Infrastructure Development and Management • Water Sector Capacity Building • Water Sector Institutional Arrangements
Outcome 8: Sustainable human settlements and improved quality of household life	• Infrastructure Development and Management • Water security
Outcome 9: Effective local government	• Sustainable Water services • Ware security • infrastructure • Resource protection
Outcome 10: Environmental assets and natural resources that are well protected and continually enhanced	• Water Resources Protection • Climate Change • WCWDM • Infrastructure Development and Management
Outcome 12: An efficient, effective and development oriented public service and an empowered, fair and inclusive citizenship	• Water Sector Capacity Building • Improved water governance

This Strategy comprises the following actions:

• Centralise the role of water through improved integrated planning and decision-making;

• Cross-sectoral planning needs to be facilitated and coordinated through the establishment of necessary partnerships, processes and protocols. The National Planning Commission and lead departments must give effect to this;

- Reconciliation strategies must be maintained and act as a platform for inter-sectoral water negotiations and integrated solutions;

- Reconciliation and planning processes depend on accurate and up-to-date information. The required knowledge base must be strengthened and extended;

- The development and application of sector water footprints is essential for integrated planning and strategic decision-making. This includes spatial views on sector-specific socio economic profiles, water needs, water use, benefits (value chain) and impacts (i.e. social, economic, as well as environmental and water resource quality impacts);

- To facilitate meaningful response to proposed socio-economic development, the water sector must pro-actively prepare appropriate development options for the growing water needs. This must include "smart" solutions such as water use optimisation, "stretching" the water resource and associated water infrastructure, as well as investment in new technology and research;

- In terms of poverty eradication and associated socio-economic development, it is essential to rethink the basic services approach to also include enabling economic development opportunities and allocations;

- Based on the scarcity of water and the need to maximize socio-economic development within a constrained economy, the development solutions must be optimized through multi-purpose use and beneficiation. All developments must be undertaken in the context of water availability and scarcity. A protocol in this regard must be formalized and applied; and,

- To enable effective response to the growth and development needs, we have to pro-actively invest in the development of "smart" solutions for water use efficiency, research of appropriate technologies, management solutions and appropriate institutional arrangements. These activities must be formalized, resourced and managed through dedicated programmes.

Core strategy 4: Contributing to a just and equitable South Africa

Government has committed itself to meeting basic human needs, improving the lives of all South Africans, particularly the poor and marginalised and building a more equitable and just society. This is entrenched in the Constitution of South Africa, the Bill of Rights and in national programmes such as the Universal Access to Basic Services, Health, Poverty Alleviation, Job Creation, and other relevant programmes.

As reflected in the New Growth Path and National Development Plan, economic development is a key enabler for social development and job creation. On this premise, the role of water in social development is not only based on direct water provisioning, but also through the support of economic and social development and job creation.

Water is a public good, and is both a social and economic good. The National Water Act requires that it is used beneficially and in the public interest. Meeting basic human needs, creating jobs and eradicating poverty all fall squarely within this paradigm. This strategy builds on the water for growth and development strategy outlined above, pulling out some more specific elements for the water sector to focus on.

This means that water must be allocated in such a way that it brings maximum benefit to all whether directly or indirectly.

Job creation through water infrastructure development, operations and water management

Job creation is a key intervention in water on poverty, and the water sector is a key role-player in this regard. The potential for job creation can be grouped in the following categories:

Job creation through water infrastructure development: This includes major water infrastructure, regional bulk infrastructure and municipal infrastructure. However, apart from jobs related to operation and maintenance of infrastructure, most of the jobs created in the construction of water infrastructure are temporary in nature (from a few weeks to a maximum of 5 years).

Water infrastructure jobs, however, have the potential to employ local workers, and to provide skills development and work experience at a number of levels, from the highly technical to manual labour. It is important that, where possible, labour intensive methods of construction are used. In this regard, managers and design engineers must be trained to understand the potential for and requirements of labour-intensive construction methods.

Job creation through water functional management: This involves more sustained job opportunities in areas such as operations and maintenance, alien vegetation removal (e.g.

Working for Water, Working for Wetlands, etc.). Specific opportunities exist in the intervention actions required to address water conservation and water demand management, wastewater turn-around programmes, infrastructure asset management, integrated catchment management and resource protection.

Job creation through water provisioning to economic sectors: The greatest job creation opportunities, however, lie within the different economic sectors such as agriculture, mining, industry and tourism. Water is a key enabler in the expansion of these sectors, whether it be in relation to large enterprises, small-scale, or even micro-enterprises. Without reliable water supplies, many of these jobs would not be viable or created.

This again emphasizes the importance of integrated planning and the central role of water in economic development.

Protecting human rights and well-being

The Bill of Rights in the Constitution guarantees the right to a healthy and safe environment. The quality of our resources is a key element of this, as degraded and polluted water resources have negative impacts on human health, on benefits derived from ecosystem goods and services, and on the cultural, spiritual and aesthetic value of water resources.

Protecting our water resources includes managing water quality and the protection of water habitats to support functioning ecological systems. Water resources, including rivers, dams, lakes, estuaries and wetlands, as well as groundwater aquifers, are an important support to rural livelihoods in particular, through, for example, fishing, harvesting of plant material, cultural and spiritual activities, and tourism.

It is of utmost importance that water is not only managed for quantity of supply, but also for the required quality of water and the health of the water environment, to ensure this human right into the future.

Another important area in the protection of human rights and well-being is disaster management, especially the management of floods which have a direct impact on human safety and economic security. The present management systems and processes are inadequate and need to be enhanced across government, the private sectors and civil society.

We must empower citizens to participate in water governance. Our institutional framework provides the basis for this, but without structured activities and forums, the ability of civil society to engage in water management issues is weak. This will also require capacity building initiatives that will be driven through the various institutions such as CMAs and WUAs.

Core strategy 5: Protecting water ecosystems

The water ecosystem is a priority performance area and as a user is given preferential water rights. This is legislated in the National Water Act as the "environmental reserve".

South Africa's ecosystems range from sub-tropical in the north-eastern part of the country, to semi-arid and arid in the interior, to the cool and temperate rivers of the fynbos. This diversity is a result of a geologically and climatically complex country, giving rise to a diverse range of ecosystems. Keeping a representative sample of these river and wetland ecosystems in a good condition (A or B ecological category), helps to support the ecological functioning of catchments and the sustainable development of water resources.

The recent National Biodiversity Assessment 2010 (SANBI) identified 223 river ecosystem types that are representative of the diversity of rivers in South Africa, based on soil, geology, vegetation, climate, flow and the slope of the river channel. In addition, 792 wetland ecosystem types were identified in a similar manner to describe wetland diversity across the country.

Consistent with global trends, this assessment found that freshwater ecosystems in South Africa are highly threatened, much more so than terrestrial ecosystems. Almost 60% of river ecosystem types are threatened, with 25% of these critically endangered. Wetland ecosystem types are of even more concern with a 65% identified as threatened, including a staggering 48% critically endangered. This is of enormous concern given the crucial role of wetlands in delivering ecosystem services such as water purification, flood regulation and drought mitigation.

High levels of threat are also documented for freshwater fauna: 31% of freshwater fish indigenous to South Africa are threatened (Bills and Skelton, 2001), and a recent southern African study on the conservation status of major freshwater-dependent taxonomic groups (fishes, molluscs, dragonflies, crabs and vascular plants) reported far higher levels of threat in South Africa than in the rest of the region (Darwall et al., 2009).

South Africa's system of protected areas shows significant gaps in conserving freshwater ecosystems, and less than 15% of the river ecosystems assessed can be considered moderately- to well-represented within protected areas. Moreover, inclusion in protected areas does not guarantee conservation: almost half of the large river systems that are incorporated into protected areas have been degraded by upstream human activities before entering the protected area. Despite these deficiencies in protection levels, rivers inside protected areas are in better condition compared to those outside, emphasizing the positive role protected areas can have through appropriate land management strategies.

Key pressures on freshwater ecosystems are expected to be exacerbated by climate change and include:

- Over-abstraction of water especially in the dry months of the year (this is exacerbated by invasive alien plants);
- Water quality problems (associated with non-point-source pollution from fertilizers, as well as point-source pollution from mining and failed waste water treatment works);
- Habitat destruction, especially from bulldozing in riparian zones, sand-winning from river beds, mining development, urbanisation and agricultural cultivation;
- Of particular concern is the impact of development on water generating capability (e.g. river sources) and its associated impacts on water availability, groundwater recharge and down-stream water quality;
- Development in estuarine functional zone; and,
- Impacts of invasive alien fish species.

Urgent attention is needed to ensure that we conserve some representative natural examples of the different ecosystems that make up the natural heritage of this country. A strategic approach to freshwater ecosystem conservation and management is needed to focus efforts where they will have the greatest impact. To this end, Freshwater Ecosystem Priority Areas ("FEPAs") have been identified across South Africa, providing strategic spatial priorities for conserving South Africa's freshwater ecosystems and associated biodiversity. These products represent the biodiversity sector's input into water resource protection, specifically targeting Resource-Directed Measures tools (Water Resource Classification, Reserve Determination and setting and monitoring of Resource Quality Objectives).

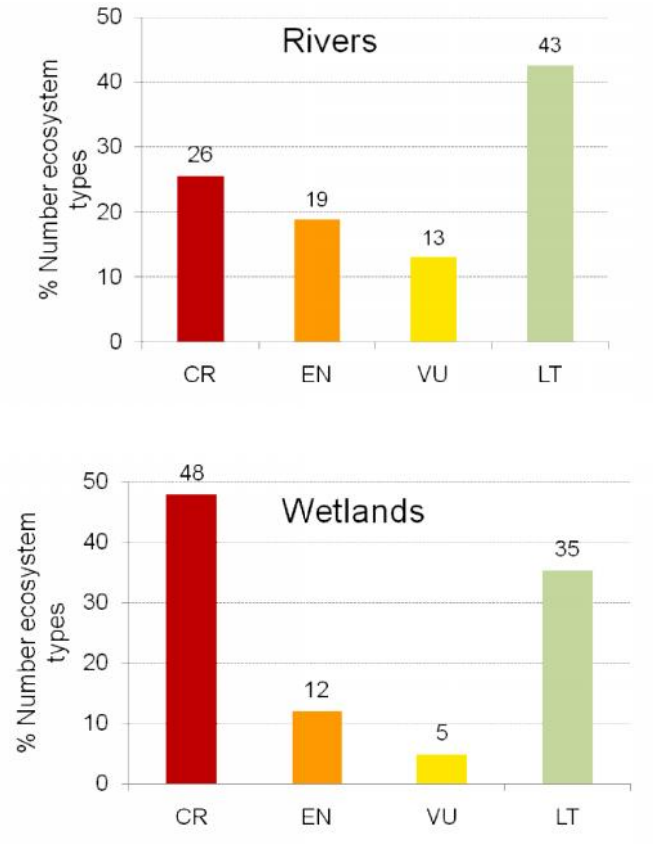

Figure 13: Ecosystem Threat Status for rivers and wetlands (as per National Biodiversity Assessment 2010).

This Strategy requires the following actions:

- Determination of the environmental reserve must be accelerated. The implications thereof is a major challenge as they require advanced reconciliation with existing water situation, uses and water systems management. This requires dedicated planning and action;

- Implement Water Resource Classification, the Reserve and Resource Quality Objectives at a catchment scale;

- Prioritise the protection of freshwater ecosystems for the benefit of human health, economy, society and the environment. Protection of our water resources requires the adoption of an integrated catchment management approach that will address water quality and quantity challenges for surface and groundwater;

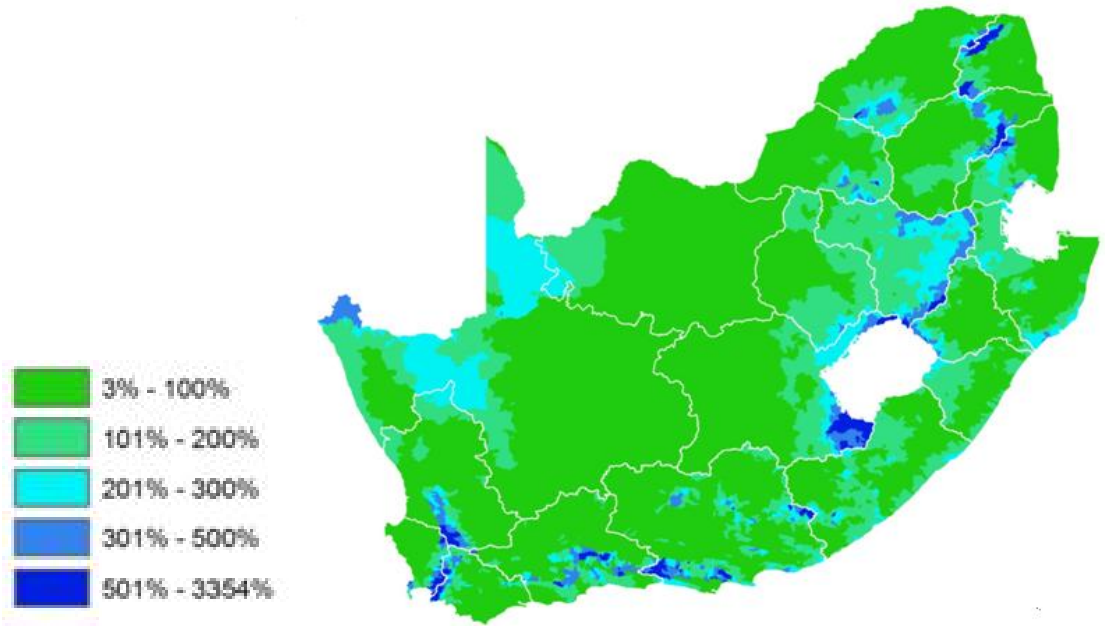

Figure 14: High water yield areas (Mountain Catchments)

- Pollution of water resources must be reversed to protect human health and degradation of aquatic ecosystems;
- Strategic freshwater ecosystem priority areas should be identified and promulgated as protected areas. Dedicated management must be put in place to keep them in good ecological condition in order to support sustainable use of water resources;

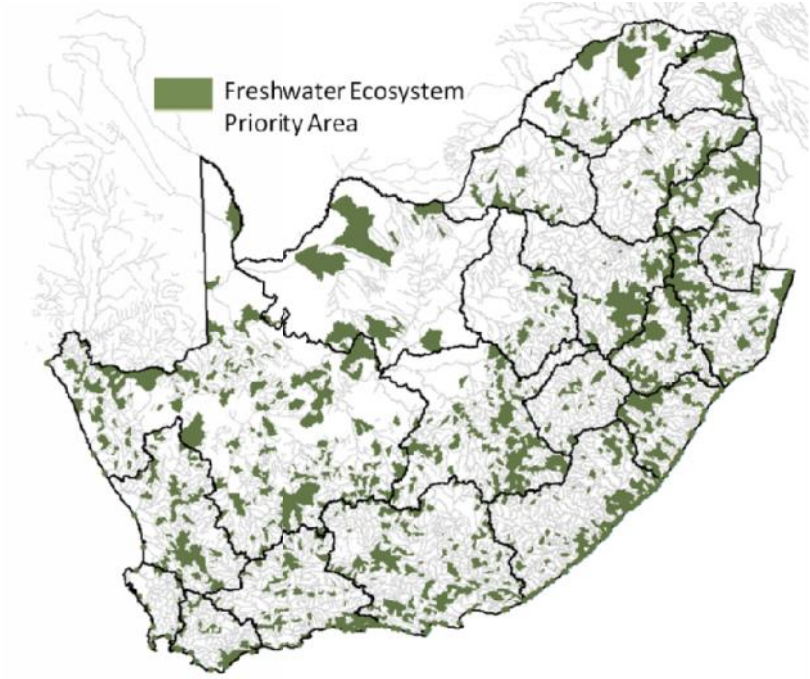

Figure 15: Freshwater Ecosystem Priority Areas (FEPAs) have been identified for each Water Management Area in South Africa, and include river, wetland and estuary FEPAs. This figure is an example of the river FEPAs in South Africa. Rivers identified as FEPAs should remain in a good condition (A or B ecological category). Wetlands and estuaries identified as FEPAs should be afforded the best attainable ecological status

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- FEPAs have been identified for each Water Management Area in South Africa, and include river, wetland and estuary FEPAs. This figure is an example of the river FEPAs in South Africa. Rivers identified as FEPAs should remain in a good condition (A or B ecological category). Wetlands and estuaries identified as FEPAs should be afforded the best attainable ecological status.

- Key pressures on freshwater ecosystems must urgently be addressed. This includes the control of over-abstraction of water through improved regulation, the establishment of a dedicated water quality management programme, controlling of habitat destruction (especially in riparian zones), restricting development in estuarine functional zones, and minimizing the impacts of alien invasive fish species;

- Prioritise rehabilitation of important water ecosystems. This includes dedicated programmes to deal with acid mine drainage (AMD), removal of invasive plants and reintroduction of endangered fish species;

- Freshwater ecosystems priority areas (FEPA) need to remain in a good condition and must thus be supported by good planning, decision-making and management.

- Create renewed vigour in applying **Conservation of Agricultural Resources Act** (CARA) and/or new regulations to protect riparian and wetland buffer zones and critical groundwater recharge areas

- Provide formal mechanisms for strengthening collaboration around managing and conserving freshwater ecosystems between DWA, DEA, DAFF and other key government departments

- Strengthen River Health Programme and establish a Wetland Health Programme and an Aquifer Health Programme

- Urgent attention is needed to ensure that we conserve adequate, representative and strategic areas of the different ecosystems that make up the natural heritage of this country. A strategic approach to freshwater ecosystem conservation and management is needed to focus efforts where they will have the greatest impact. This requires dedicated management and partnerships.

Core strategy 6: Implementing water use efficiency, conservation and water demand management

Despite being a priority strategy in the NWRS-1, and critical in ensuring sufficient water for South Africa's needs, water conservation and water demand management has not been effectively implemented to date. This is a non-negotiable performance area and, based on recent reconciliation studies, must be implemented immediately in all water user sectors and municipalities specifically.

Water conservation and water demand management (WCWDM) can be implemented in a shorter time span than new infrastructure development and can significantly postpone the need for capital intensive new water resources infrastructure and new water and waste water treatment works. It is also more cost effective to fix and upgrade existing infrastructure than to develop new water infrastructure.

Arising from the NWRS-1, a water protocol was established under which the development of new water resources infrastructure will only be considered if sufficient WCWDM measures have already been implemented. The NWRS-2 builds on this with a further suite of actions. Iimplementation of water use efficiency and water demand management is the critical success factor to ensure water security for South Africa. This is a non-negotiable performance area and, based on the reconciliation studies, must take immediate effect.

It is unacceptable that a water scarce country like South Africa has non-revenue water of more than 37% on average. In many irrigation and domestic schemes, it is even worse, with losses of up to 60%. In terms of a loss in revenue, these losses account to more than R11b/a in the domestic sector alone. Despite legislation and being a priority strategy in the NWRS-1, this performance area is not adequately addressed.

Many municipalities and water user associations do not meter the water distribution and use and therefore are unable to account for the water losses. This is exacerbated by a lack of infrastructure asset management, operation and maintenance.

The catchments that supply water to the Durban-Pietermaritzburg area for example are already in deficit in terms of water provision. Other large water supply systems will soon face a similar situation.

In view of the water scarcity, it is essential that such water losses must be curtailed, especially in terms of the need to provide for the growing water demands of new socio-economic development.

This Strategy comprises the following actions:

- A dedicated WC/WDM programme to reduce water losses and increase water use efficiency must be implemented in all sectors. This is a non-negotiable principle and requirement. As a priority, bulk water meters must be installed;

- WC/WDM must be implemented in all water stressed areas to prevent negative impacts on economic growth and job creation;

- Implementation of an incentive programme to promote water saving, including smart technology and rebates for water savings;

- Water savings in agriculture and the domestic sector are required to make large volumes of water available for new growth and development. This must form part of the integrated planning protocol;

- Fast tracking the implementation of water conservation and water demand management (WC/WDM) has been given a high status in the National Government's Plan of Action. Outcome 10 has set a target for the reduction of water losses in distribution systems from the current average of 30% to 15% in 2014. This must actively be pursued;

- Control invasive plants and manage water use by forestry;

- Conduct public awareness campaigns on the value of water to the economy, society and the environment;
- Invest in development and implementation of water efficient technologies; and,
- Implement financial management and control to reflect the scarcity of water and as an incentive to improve revenue and opportunity to expand economic activity.

To ensure successful implementation of WC/WDM, the following must be implemented:

- effective regulation;
- the establishment of dedicated sector programmes and the setting water consumption targets for all sectors; and,
- Formal commitments from different water use sectors.

A comprehensive strategy is reflected in Part B.

Core strategy 7: Optimising and stretching our water resources

South Africa has limited opportunities for further development of fresh surface water resources. Maximising the use of local resources through groundwater development, water re-use, rainwater harvesting and desalination of brackish or seawater, improved systems management and the control of illegal water use will "stretch" our already limited and scarce water resources.

Based on national groundwater studies, this resource is presently underutilized and provides development opportunities in specific areas. This is very relevant for small rural communities and areas where surface water is not readily available. This development is subject to proper planning, siting, monitoring, abstraction management, and infrastructure maintenance and resource protection.

At present, up to 14% of water use is re-used, mostly through water use return flows into rivers, which are then abstracted downstream for indirect re-use. This resource is directly linked to water use and will increase with new development. This is a logical choice of resource but is subject to water quality management and control with associated introduction of advanced treatment technology and operating capacity, requiring skilled operators and proper monitoring systems.

Water can further be optimized by improved control over illegal use and river systems management.

Stretching our water resources has become even more important in the light of South Africa's variable climate and expected climate change impacts on water resources. Appropriate use, allocation and re-allocation of available water resources are part of this Strategy.

A possibility to decrease the stress on South African water resources is to import water intensive goods, such as agricultural crops, from other countries where there is sufficient water. DWA has done a study on the potential of crop production in neighbouring countries, and in physical terms (soil, climate) the potential is high (DWA, 2010). This approach fits well with the drive towards regional economic integration in SADC.

Water facilities represent an important portion of the net national and regional infrastructure necessary for food security, agricultural innovation, and agriculture-based economic development. The department must develop a comprehensive infrastructure investment strategy that recognizes how each sector and region is linked to the next, and instruments must pool regional resources and numerous international borders.

Water infrastructure is critical for inputs to farms; widespread and efficient irrigation is essential to increasing fields and crop growth; energy, inconceivable without water, is a vital input, particularly for irrigation and value-added food processing; and telecoms, powered by both energy and water, are critical for the exchange of farming, market, and weather information.

National and regional water investment strategies will be needed to pool resources, share risks, and promote the private sector often critical to substantial investments in such ventures. It seems obvious that water will play a critical role in agricultural development, but it has often received inadequate investment.

Specific interventions also include:

- **Improved operation of water resources systems**

Regular revision of the operation of the large water resources systems remains as valid as it was in NWRS 1. There is still scope for improving the operation and management of smaller or localised surface water and groundwater projects to improve efficiency and decrease losses. DWA is currently implementing the revision of operating rules for smaller systems for all regions

- **Improved water resource management and control**

A critical element is to improve abstraction management including water use compliance and enforcement. This includes improved water use knowledge and effective water loss management.

- **Groundwater development and management**

Groundwater is a strategic resource in many parts of South Africa, especially in rural areas as well as for the supply of small towns and villages in the drier parts of the country. There is considerable potential for additional development of groundwater resources to augment existing resources. The need for improved groundwater management to ensure sustainable and efficient use of the resource was recognised in NWRS 1 and led to the formulation of a National Groundwater Strategy (NGS) (35) with strategic actions to be undertaken.

- **Water re-use**

In 2000, re-use of water (mainly water flowing back to rivers) already accounted for 14% of all available water.. The return flows of urban areas to rivers are about 50% of the water being used. Re-use could be significantly increased with re-use of return flows in coastal cities, where it would otherwise drain into the sea. In the coastal cities, water re-use and desalination compete as two options for water conservation. Re-use is becoming more and more acceptable and feasible because of increasing shortages, improved purification technology and decreasing treatment costs. For example, membrane technologies, also used for desalination of seawater, have become more affordable and have improved. The re-use of treated wastewater will have to be managed carefully to ensure public health safety. Currently, about 280 Mm^3/annum of re-use is in a pre-feasibility stage and 15 Mm^3 is in a reconnaissance phase (10). DWA has developed a water re-use strategy (36) with the intent to encourage informed decisions relating to water re-use.

- **Rainwater harvesting**

There is currently more emphasis on rainwater harvesting as a reconciliation option when compared to the NWRS 1. DWA supports a national rainwater harvesting programme, which presently has a narrow but important focus on the construction of above and below-ground rainwater storage tanks by rural households for food gardens and other productive water uses. Several municipalities already have experience with roof rainwater tanks for domestic use, which have been found to be particularly effective when used in conjunction with other water supply options. Although there are no 'hard' figures yet on how many Mm^3/annum rainwater harvesting can contribute, it is an option that can be implemented within a short time-frame although it is relatively costly in terms of the small yields it provides if separate infrastructure needs to be built. EThekwini Municipality has piloted rainwater harvesting to supplement the water supply to 500 poor households in Inanda, Ntuzuma and KwaMashu in the greater Durban Metro and managed to save 10% on bulk water demand (21).

- **Desalination of seawater**

Desalination of seawater could potentially provide an unlimited resource of fresh water. It has become more attractive since the NWRS 1 because of improved technologies, decreasing costs and increasing water scarcity. However, the rising cost of energy has also become a concern. Like other infrastructure projects with potential environmental impacts, the planning for a desalination plant will have to undergo an Environmental Impact Assessment in compliance with the National Environmental Management Act. DWA will ensure that desalination is considered as an option for meeting future water requirements, in particular in coastal cities where there is sufficient electricity for desalination. The target is not only to implement desalination in several locations in South Africa, but also to become an international knowledge centre in this particular field. DWA has developed a supporting desalination strategy, which also includes desalination as a technology for treating other water than seawater for water re-use (37).

This Strategy comprises the following actions:

- Enhance the use of groundwater through the implementation of the reconciliation and "all-towns" studies, water services planning and associated programmes, and agriculture related development programmes;
- Invest in the reuse of water (including mine water drainage), through effective planning, technology and management;
- Improve the development, implementation of operation rules for water supply systems with associated engagements of stakeholders;
- Invest in institutional capacity, specifically in the skills for water conservation and demand management and water reuse;
- Invest in desalination of seawater in coastal cities that are faced with water shortages to augment fresh water supply, and invest in desalination of mine water in inland areas;
- Invest in research and new technology;
- Invest in operations and maintenance, including infrastructure asset management; and,
- Facilitate improved abstraction control and improved regulation.

The various strategies supporting this core strategy are reflected in Part B.

Core strategy 8: Achieving effective water governance and Developmental Water Management (DWM)

The ultimate success factor for effective water management is good governance. The present governance model is mainly based on policy making, planning and selective regulation. To improve performance and respond to new developments, the governance model needs to be enhanced and extended.

Good water governance depends on strong and accountable sector leadership, a robust regulatory framework, and effective water management institutions with clear roles and responsibilities and capacity to perform these.

The Department of Water Affairs' capacity in terms of leadership must be enhanced to enable co-ordinated implementation of the NWRS-2 across the water sector.

The implementation of DWM requires a review of existing policies, legislation AND approach. This applies to both the water and associated sector policies. Planning remains the critical element for successful governance. The Department's planning capacity must be strengthened, especially in the light of the dwindling skills base and a lack of succession planning. Integrated planning is not as effective as required and dedicated actions must be taken to facilitate this.

Regulation remains a cornerstone of successful governance and must be strengthened. Various initiatives have been taken, with varied success. Addressing the water challenges demands an effective regulatory system and framework. Both technical and economic regulations are critical to successful governance and must be strengthened. Addressing the water challenges demands an effective and targeted regulatory approach with adequate resourcing.

Collaboration of diverse stakeholder groups in water resources management is crucial to effective water governance. This requires an efficient institutional framework, which not only addresses formal water institutions, but also extends into total sector mobilisation and involvement. It also needs to address creative solutions to enhance service delivery in specific functional areas.

The extended water governance model demands enhanced integrated governance between the DWA, relevant sector departments and institutions. This specifically includes the Department of Environment Affairs (DEA), the Department of Minerals (in term of mining licences), the Department of Cooperative Governance (in terms of municipal interventions such as wastewater pollution and integrated development planning), the National Treasury, financing agencies, and other sector departments involved with water-related growth and development initiatives.

Catchment Management Agencies (CMAs) are a critical element of water governance and management. The original 19 proposed CMAs are to be reduced to 9 CMAs as outlined in section 9 of the NWRS-2.

In the face of limited human and financial resources, a targeted approach to the regulation of water use must be adopted. A "one size fits all" regulatory approach is not appropriate in the South African context; rather, regulation should focus on high-impact uses where the most gains can be achieved with limited resources, with a parallel process of support and development for small water users.

In addition, the allocation of financial resources is an important part of ensuring effective water governance. In this regard, the following fundamental prerequisites for effective budgeting and financial management call for urgent attention:

The *primacy of policy and mandate* – water institution budgets must promote the policy objectives of government and the priorities determined in the NWRS

Transparency – water sector institutions must make information about their budgets available to the public.

Publicly expressed preferences – water institutions must collect information on the preferences of the people in order to inform their strategies and budgets. In the absence of reasonable information on the people's preferences, it is very difficult for resources to be allocated efficiently.

Internal audit capacity – water institutions must have the capacity to ensure financial accountability through effective internal auditing.

Financial management capacity – water sector institutions must have capacity to develop and manage their finances effectively.

These are the basics which must be in place if budget reforms are to be implemented. Without these basics, the chances are slim that a successful marriage of policy, mandate, performance information, and the budget can be carried out.

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This Strategy comprises the following actions:

- Facilitate improved inter-sectoral governance between relevant departments;
- Facilitate improved integrated and associated water resources planning at all levels;
- Strengthen DWA's planning capacity;
- Extend the water governance model to include stronger and accountable leadership, coordination, regulation and participatory management;

- Strengthen the DWA leadership with associated capacity;
- Separate regulation from policy development and operational activities within DWA to support the independency of the regulator;
- Develop and implement an improved water institutional framework and model;
- Accelerate the establishment of CMAs and provide them with adequate resources to perform their roles as stated in the National Water Act;
- Allocate adequate resources to build competencies required to manage water quality and quantity and to regulate water use according to the provisions of the National Water Act;
- Support inclusive stakeholder participation in water governance through the building of appropriate inter-sectoral governance, sector involvement and accountability as well as stakeholder consultation; and,
- Enhance existing policy and legislation to accommodate new water management elements.

Core strategy 9: Embedding sustainable business principles and practices

Unsustainable water management translates into risks to human health, service delivery, the environment, employment and social and political stability. This NWRS-2 introduces four business principles that will form the foundation of sustainable water resources and infrastructure management.

The first principle is striving for efficiency from source to tap and back. This principle implies that the value chain from river or groundwater to wastewater should be considered in its totality when making water resource management decisions.

The second principle is implementation of life cycle planning and sustainable management of assets and services. The problem of lack of proper operation and maintenance has been generally acknowledged throughout the water sector, in particular for wastewater treatment plants, reticulation systems and water resources infrastructure. It is a growing concern that there is too little provision for the replacement or refurbishment of aging infrastructure. This must be addressed through rigorous asset management and allocation of adequate funds.

The third principle is that of sustainable financial management. Clear decisions are needed on who should pay for what, and where transparent subsidisation is to be used and why. Sound financial management also includes financial planning, viability assessment, funding and financing models, revenue management (including ring-fencing of water revenue, charge and tariff setting, and billing and revenue collection) and budgeting.

The fourth principle is applying sound management principles and practices within a developmental framework. This includes effective communication and consultation, ongoing investment in skills, capacity and education (short and longer term), as well as investment in knowledge, information and monitoring systems.

This Strategy comprises the following actions:

- Apply and implement sustainable water resource management principles in line with the proposed National Strategy for Sustainable Development.
- Ensure that the planning, financing, and management of new infrastructure apply the principle of "source to tap and back" and the availability of a life cycle management plan;
- Ensure application of systems operations and maintenance, including infrastructure asset management;
- Establish the proposed National Water Infrastructure Entity for the development and management of national water resource infrastructure;
- Make funds and resources available to reduce the backlog in maintenance of water infrastructure;
- Entrench financial management as a core element in water management and planning;
- Improve billing and revenue collection through additional organisational means and effective customer services;
- Prioritise the investment in the refurbishment and upgrading of wastewater treatment plants in order to prevent pollution of water resources;
- Invest in skills development and build the capacity in existing and new management areas. This includes investments in education and youth development programmes; and,
- Develop and implement a dedicated communication strategy in this regard

Core strategy 10: Implementing a water sector investment framework

To facilitate effective and pro-active investment in both water infrastructure and water management, DWA has already initiated the development of a comprehensive investment framework and strategy. The objective of the investment framework and strategy is to inform budgeting and integrated planning for water infrastructure and management. A key element is the application of the life-cycle approach, which includes all costs from planning to construction and sustainable management, as well as financing and management costs.

Present indications are that infrastructure investment requirements need to double for the next ten years. There is also major under-investment in operation and maintenance, and there is an urgent need to invest in priority water investment programmes such as water use efficiency, water resource protection and improved governance.

To meet the outcomes set for the water sector and to put water to work to achieve the national objectives, improved ways of financing and managing must be sought and implemented. The development a water financial and funding model is of utmost importance.

The framework must also address the whole value chain (source to tap to outcome – waste to source to impact).

This Strategy comprises the following actions:

- Develop and maintain an integrated water sector investment framework;
- Develop an appropriate water financial management and funding model;
- Develop appropriate water development and allocation criteria;
- Align the prioritisation and delivery of projects across the water value chain; and,
- Align the development of project proposals and rectify possible gaps or omissions in planning and implementation schedules.

Core strategy 11: Engaging the private and water use sectors

Water security risk to business is real. There is need for the water sector in South Africa to take cognisance of the increasing water security risk, and to take the appropriate actions to reduce their exposure to risk. There are several aspects to this, depending on whether the risk impacts on the company or the supply chain, and whether the management of the risk is within the authority of the company or lies outside the company authority. As per figure 16, different actions should be initiated to deal with water security risks according to the location and nature of the risk.

Figure 16: Matrix of water security risk facing the private sector

What is important in South Africa at this time is an increased awareness in the public sector of the water security risk, and of the actions that they should be taking to minimise this risk. Taking the lead from the UN based CEO Mandate, and the experience of several large corporations in managing water risk, the private sector in South African needs to mobilise to manage water risk effectively. In this process, there is the opportunity for partnerships with government and civil society in order to manage shared water risk.

This is a critical role that South African members of the *United Nations CEO Mandate* and the members of the *South African Strategic Water Partners Network* should take forward.

A critical place to begin to manage water security risk is with the employees of a company. Besides developing and implementing a water security risk management strategy, employees will also help communicate this action to other stakeholders. The importance of employees in managing water security risk cannot be underestimated. In this regard, it is important to deliver simple, relevant, personal messages tailored to the needs of employees and local communities.

9. Key strategic actions

Arising from the core strategies, the following have been identified as key strategic actions that must be undertaken across the water sector and related sectors in the next five years. The actions will involve and be driven by a range of players across the spectrum, not just DWA, although DWA, as sector leader, will play a critical role in driving and co-ordinating many of the actions, and monitoring implementation.

1. DWA will co-ordinate, with key government departments, municipalities, SALGA, the private sector and civil society, the development and implementation of an equity strategy for the water sector, setting out and quantifying how to practically achieve significant equity goals in access to water and the benefits (direct or indirect) derived from water;

2. The water use and impact sectors, with the support of the WRC and DWA sector, will develop water footprints for their specific sectors;

3. Water sector institutions, the private sector and civil society must improve awareness around water and its strategic role at all levels of business and society, and promote awareness of the role of water as a critical and strategic natural resource amongst politicians, decision-makers, planners and the public;

4. DWA will work with the Department of Basic Education and the WRC to enhance water education in the school curriculum;

5. Water use and impact sectors will raise the level of awareness around water security risk and responsibility, and drive improved water management in each of the sectors;

6. DWA and CMAs will appoint appropriate staff, in both leadership and technical positions, to ensure that is can play this leadership role;

7. DWA and CMAs will proactively engage with relevant national and provincial departments and the National Planning Commission to ensure that water is included in all relevant sector strategies at national and provincial levels;

8. DWA will continue to develop and update reconciliation strategies as an information platform for inter-sectoral water planning and integrated solutions and for the development of catchment management strategies;

9. DWA will drive a sector-wide monitoring and data collection improvement programme which will include a number of elements: DWA will work jointly with SAWS and the ARC to ensure improved investment in rainfall monitoring to turn around the decline in the rainfall monitoring network across the country; DWA, in partnership with water sector institutions, will develop and implement a national monitoring plan to turn around the decline in the number of monitoring stations over the past 20 years and to ensure an appropriate information base for effective water resources planning. The WRC is a critical partner in the monitoring and information management programme;

10. Water use and impact sectors will develop and maintain sector specific water footprints to form an input to integrated planning and strategic decision-making. This includes spatial views on sector-specific socio economic profiles, water needs, water use, benefits (value chain) and impacts (i.e. social, economic, as well as environmental and water resource quality impacts);

11. DWA, in consultation with water sector institutions, other government departments, and water users, will prepare a 20-year programme to meet the growing water needs that will include traditional solutions such as new infrastructure development, as well as "smart" solutions such as water use optimisation, water re-use, "stretching" the water resource and associated water infrastructure, as well as investment in new technology and research;

12. DWA and CMAs will work with water services authorities to promote and implement the multiple-use systems approach which addresses both the domestic and productive water needs of communities;

13. DWA will clear the backlog in water use licensing by 2016 and will put in place streamlined processes to ensure that licence applications are dealt with in a reasonable time. DWA will also make greater use of General Authorisations to reduce the burden of license applications on the Department. In order to support the processing of licence applications, DWA will fast track the Reserve Determinations so that this does not become a bottle neck in the water use authorisation process;

14. Over the next 3 years, DWA will delegate water use licensing to at least 4 CMAs as they are progressively established and develop relevant capacity;

15. The WRC will support, promote and co-ordinate investment in the development of "smart" solutions for water use efficiency, research of appropriate technologies, management solutions and appropriate institutional arrangements.

    - Strengthen and support the basic water supply programme:

16. DWA and CMAs will ensure that effective water resources planning and financing are in place to provide reliable and affordable raw water for basic water supply projects. DWA will also revise the basic water services policy to ensure planning for a multiple use services approach that takes into account the need for water for productive purposes as well as for domestic use;

17. DWA will work with National Treasury and water sector institutions to develop appropriate financing models to address the viability of projects and the affordability of services to the poor;

18. DWA, with water boards and regional water services institutions will focus particularly on ensuring the development and financing of regional bulk infrastructure to ensure that there is sufficient water to meet the basic human needs;

19. DWA and CMAs will engage with provincial departments of agriculture and relevant NGOs to support and guide water-dependent social development programmes such as the household food security (vegetable gardening) and rural development initiatives. The availability of water and the viability of sustainable supply will be addressed in this process.

- Water Allocation Reform:

20. The implementation of the Water Allocation Reform programme will be given high priority by DWA and will be addressed through a number of programmes, including compulsory licensing (which will be completed in 3 catchments by 2014), the use of General Authorisations, and the promulgation of regulations on BEE and gender requirements for issuing of water use licences. The reduction of assurance of supply for existing water users as well as reduction of water losses will be critical components of making more water available to historically disadvantaged, small-scale users;

21. The water allocation reform programme will be closely aligned with the land reform programme and the rural development programme. DWA will work closely with the relevant national departments to ensure the alignment and integrated implementation of these three programmes.

- Job Creation:

22. Where possible, labour intensive construction methods will be applied in all water infrastructure construction, operation and maintenance projects. SAICE and the WRC will assist DWA in investigating the potential for the use of labour intensive methods, and DWA will develop guidelines for the sector in this regard. The addressing of existing water challenges, such as the backlog in infrastructure maintenance, water use efficiency and infrastructure asset management, must be utilized as job creation opportunities. Partnerships with the economic sectors must be strengthened to optimize job creation;

23. Social reform and equity must be part of the protocol of all integrated development initiatives and actions, such as electricity security, and must be reflected as part of the water-related performance; and,

24. Areas with water surplus and potential to facilitate socio-economic development will be identified by DWA, building on work already done in this regard, and potential projects will be prioritized, budgeted for and implemented.

- Water for social livelihoods:

25. DWA and CMAs will enhance their engagement with other relevant government departments, community based organisations, and NGOs to ensure that sufficient water can be provided to enhance livelihoods, particularly in under-developed rural areas. DWA will also continue to roll out its programme of providing rainwater harvesting tanks;

26. Determination of ecological Reserves must be accelerated by DWA, along with a structured programme to implement Water Resource Classification, and determination of Resource Quality Objectives at a catchment scale. A programme for monitoring the status of implementation of the Reserve and for monitoring the impacts on ecosystems will be developed jointly by DWA, DEA and the WRC. Implementation of this monitoring programme will begin by 2015;

27. Catchment management strategies will be developed by CMAs once they are established and must address the protection of water ecosystems and water resources in the water management area;

28. DWA will intensify its compliance monitoring and enforcement activities to reduce illegal activities that impact on the health of aquatic ecosystems. The compliance monitoring and enforcement will be focused on high impact activities in order to achieve the optimal use of limited state resources;

29. DWA and CMAs will work with DEA, SANBI, SANParks and provincial conservation authorities as well as relevant civil society structure to take forward the work already done through the National Freshwater Ecosystems Priority Areas (NFEPA) programme into an implementation plan to be jointly implemented and monitored;

30. DWA, in partnership with the Department of Mineral Resources, the Chamber of Mines, the CSIR and the WRC will implement short and medium-term programs to deal with acid mine drainage (AMD) whilst finalising the long- term strategy to deal in a sustainable and cost-effective way with this national problem;

31. DWA and CMAs will work with the national and provincial departments of agriculture to ensure the implementation of the Conservation of Agricultural Resources Act (CARA) to protect riparian and wetland buffer zones, critical groundwater recharge areas, and estuaries;

32. DWA and CMAs will strengthen the River Health Programme and establish a Wetland Health Programme by 2015;

33. DWA and CMAs will establish a ten-year water quality management programme focusing on priority interventions such as wastewater treatment works and acid mine drainage. This includes the restoration of polluted rivers and lakes;

34. DWA will support the building of capacity of institutions that are responsible for water quality management;

35. DWA will maintain and improve the water quality information system to support effective water quality management and regulation;

36. DWA, DEA and CMAs will work together to improve regulation and enforce compliance;

37. DWA will intensify the existing WCWDM programme across all sectors, and will identify targets for critical water use sectors in stressed areas where targets have not already been set;

38. Water Services Authorities will drive intensive WCWDM programmes in order to achieve the Outcome 10 target for the reduction of water losses in municipal distribution systems from the current average of 30% to 15% in 2014;

39. Where targets have been set, DWA will monitor progress against targets, will support WC/WDM interventions, and will ensure that a review of relevant water use licences is done to reflect the required impact of the WC/WDM interventions;

40. DWA will promulgate regulations requiring the measuring and reporting of raw water use;

41. DWA will work with National Treasury and SALGA to develop an incentive programme to promote water saving, including smart technology and rebates for water savings;

42. DWA, with the Department of Agriculture, will drive a programme of water conservation and water demand management in the agriculture sector, with water savings to be reallocated to both male and female historically disadvantaged farmers;

43. All water management and services institutions will conduct public awareness campaigns on the need for water conservation and water demand management;

44. The WRC will develop a programme for investment in research and development of water efficient technologies and management systems;

45. The review of the Raw Water Pricing Strategy by 2013 will address the issue of water scarcity and how best to use water pricing as a tool for driving improved water use efficiency without impacting negatively on small-scale or poor water users;

46. DWA will continue to ensure that the potential for using groundwater and alternative water resources is thoroughly explored in all reconciliation and water resources planning studies and that capacity is built in DWA to assess and implement these alternative solutions;

47. In the water sector investment strategy DWA will incorporate the costs of re-use of water (including mine water drainage), water conservation and water demand management, and use of alternative water resources where cost-effective and appropriate, including desalination of sea and inland water;

48. DWA will work with municipalities and water boards to improve the development and implementation of operating rules for water supply systems;

49. All water sector institutions will invest in building their institutional capacity, including around water conservation and water demand management and water re-use;

50. DWA will work with sector partners to improve investment in infrastructure operations and maintenance, and to improve infrastructure asset management within DWA and in the whole sector, especially in local municipalities;

51. DWA and CMAs will put in place improved regulation of water abstraction, including through increasing capacity for compliance monitoring and enforcement. In this regard DWA will work in close partnership with the DEA 'Green Scorpions". -

52. DWA will establish an intergovernmental forum to facilitate improved inter-sectoral water-related governance and planning between relevant departments;

53. DWA will appoint and train 5 water resources planning interns per annum as part of a ten-year programme to ensure the building and strengthening of DWA's planning capacity;

54. DWA will fill vacant SMS posts with appropriate staff by December 2012 and will fill any newly vacant posts with appropriate staff within 2 months to Strengthen the DWA leadership with associated capacity;

55. DWA will establish an effective economic regulator for the water sector by 2014. One of the functions of the economic regulator will be to ensure that budgetary allocations support government policy and priorities;

56. DWA and CMAs will develop and implement a targeted regulatory strategy focused on ensuring compliance from high-impact water users as a priority, with a parallel strategy of support for small-scale water users;

57. DWA and CMAs will ensure transparent and inclusive stakeholder participation in water governance through catchment forums and other appropriate consultative forums and processes;

58. DWA will revise the National Water Act, the Water Services Act and the Water Research Act by the first half of 2013;

59. DWA will implement sustainable water resource management principles in its own work, and will develop guidelines for the implementation and monitoring of such principles in other water institutions.

60. All water sector institutions will ensure that the planning, financing, and management of new infrastructure apply the principle of “source to tap and back” and the availability of a life-cycle management plan;

61. All water sector institutions will ensure the application of systems operations and maintenance, including infrastructure asset management;

62. The Minister will establish a National Water Resources Infrastructure Government Component by 2013 for the development and management of on-budget national water resource infrastructure. The TCTA will continue in its current role of financing and project managing the construction of off-budget water resources infrastructure;

63. DWA will work with National Treasury to source funds to reduce the backlog in maintenance of water infrastructure;

64. DWA will improve its billing and revenue collection through updating the information on WARMS, developing improved revenue management and reporting systems, and putting in place a national programme for collecting outstanding water charges from water users; CMAs will take over the billing of the water resources management charge to water users in their water management area and the associated revenue collection;

65. DWA will develop a programme which prioritises investment in the refurbishment and upgrading of wastewater treatment plants in order to prevent pollution of water resources;

66. The WRC, with DWA and tertiary education institutions, will co-ordinate a skills development programme to build capacity in water and infrastructure management. This will include investment in education and youth development programmes;

67. DWA will work with sector partners to finalise the infrastructure water investment framework and will review it at least every five years;

68. DWA will develop innovative water financing models by 2013, in consultation with sector institutions and National Treasury;

69. DWA will work with water sector institutions to align the prioritisation and delivery of projects across the water value chain and to ensure the development of viable project proposals and to rectify possible gaps or omissions in planning and implementation schedules;

70. DWA will establish 9 CMAs by 2015 as follows:
    - 2013: Inkomati/Usuthu; Breede/Gouritz; Phongola/Umzimkulu
    - 2014: Vaal; Olifants; Limpopo; Berg/Olifants
    - 2015: Orange; Mzimvubu/Tsitsikamma

71. DWA will establish a dedicated high-level team to drive the establishment of the 9 CMAs by 2015;

72. There will be the development of a detailed programme for each CMA of the progressive delegation of functions from DWA;

73. DWA will ensure clear communication to sector institutions and stakeholders of the establishment programme and the powers and functions of CMAs;

74. The revision of the guidelines on the development of Catchment Management Strategies to reflect the strategies in this NWRS-2 , and the need for value-chain management will be done by DWA;

75. The development of the oversight and regulatory processes of DWA including actions to be taken in the case of non-compliance or poor performance by CMAs will be done by DWA by 2013;

76. by 2019, DWA will put in place a system for the effective collation of data from a range of water institutions including CMAs into an easily accessible national water resources information system, will develop a data sharing protocol and will set national data standards;

77. DWA, in partnership with StatSA and relevant water use sectors, will initiate the development of national and WMA-level water accounts during 2013 in preparation for NWRS-3;

78. DWA will work with SAWS to develop a programme to ensure sufficient rainfall monitoring stations around the country to provide the necessary information for effective water resources planning and management;

79. DWA will ensure the necessary resources are available to improve the current water monitoring infrastructure over the next five years to achieve an effective monitoring network across the country.

10. Revising the water management area boundaries

The decentralization of water resources management – a key factor to accelerate the implementation of DWM and to achieve equity in access to water – is an unmistakable feature of the NWRS-2. South Africa has recognized the functional distinction between the centralized mechanisms needed for coordination and enforcement and the decentralized arrangements needed for participatory management - a key feature of the ongoing process of decentralization is the importance assigned to broad-based participation in all water institutions.

The NWRS-1 established 19 water management areas, and proposed the establishment of the 19 Catchment Management Agencies (CMAs) to correspond to these areas. Since 1999, 8 of the 19 CMAs have been gazetted, of which two are operational, namely the Inkomati CMA in Mpumalanga and the Breede-Overberg CMA in the Western Cape.

In rethinking the management model, and based on viability assessments with respect to water resources management, available funding, capacity, skills and expertise in regulation and oversight, as well as to improve integrated water systems management, it is proposed that the 19 WMAs be consolidated into 9 as follows: Limpopo; Olifants; Inkomati-Usuthu; Pongola-Mzimkulu; Vaal; Orange; Mzimvubu-Tsitsikamma; Breede-Gouritz and Berg-Olifants.

The boundaries of these water management areas take into account catchment and aquifer boundaries, financial viability, stakeholder participation, and equity considerations and are, as a result, not aligned with provincial or local government boundaries.

The advantages of the proposal of nine water management areas are:

- It provides for improved management of integrated systems which were previously split across the WMAs;
- It enables the distribution of scarce technical skills over a smaller number of institutions;
- It provides for an improved balance in revenue streams supporting more sustainable institutions;
- It facilitates the faster establishment of CMAs, and
- Larger CMAs enables improved cooperation and coordination on regional, provincial, and international levels.

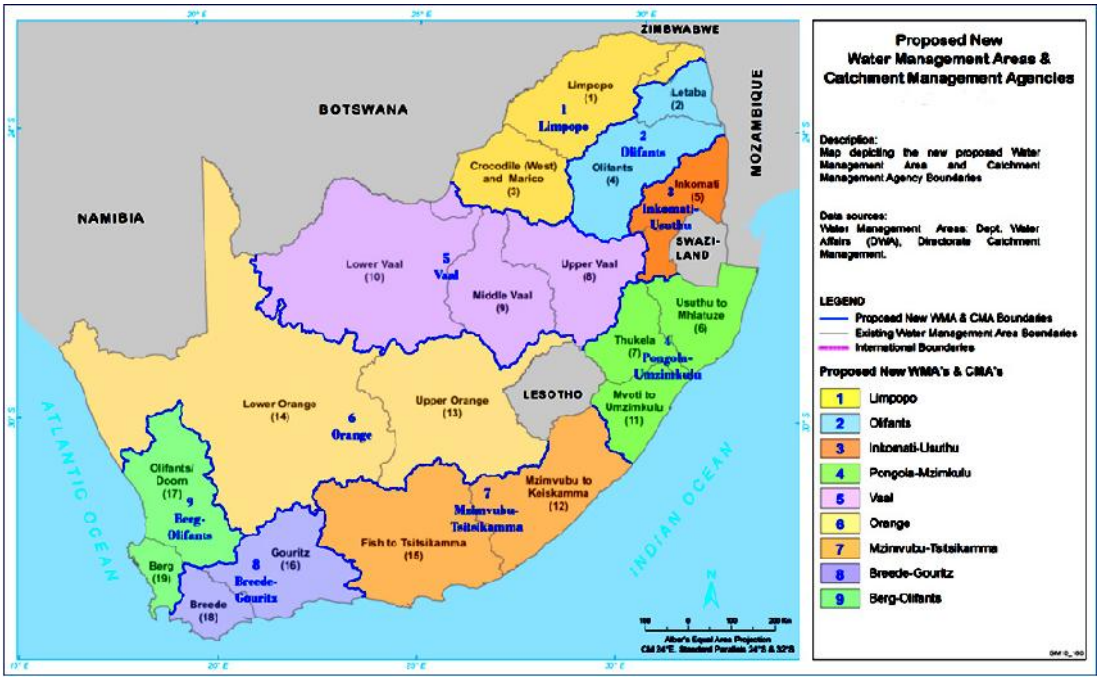

Figure 17: Map of the Proposed 9 Water Management Areas

In order to be able to fast track the establishment of the nine CMAs, the boundaries of the proposed nine water management areas have been published in the Government Gazette number 35517 of 27/07/12.

Strategic perspectives on the water resources situation in each of the WMAs are presented in Section C of the NWRS-2.

A critical implication of these new boundaries is the issue of facilitating sector involvement and community participation (participatory management). Increasing the size of the water management areas has an impact on the ability to engage effectively with stakeholders on the ground. Key objectives of the CMAs are the promotion of equity through more effective water resource management, greater responsiveness to the needs of poor and marginalized communities, and closer links with stakeholder groups in the water management area. The proposed CMA model will facilitate the involvement and empowerment of stakeholders and communities through structures such as catchment committees, catchment forums and water user associations.

11. Water resource information

In terms of the requirements of the NWA, the NWRS must contain estimates of present and future water requirements; state the total quantity of water available within each water management area; and state water management area surpluses or deficits.

Unfortunately, due to a lack of resources and the proposed changes in the water management area boundaries, the national and water management area level information provided in the NWRS-1 has not been updated.

Nonetheless, considerable work has been done on reconciliation studies for priority areas, selected hydrological studies, validation and verification of water use, and strategic assessments like the All Towns Reconciliation Strategy Studies. Over and above these studies, several groundwater studies, water resource modelling (WR 2005 updates), as well as water resources quality and sector-specific research projects, were undertaken. Although these studies do not facilitate updated national or WMA water accounts, they provide sufficient insight to develop and present strategic perspectives of the national and WMA water situations.

The water information reflected in this NWRS-2 is, as a result, based on the comprehensive water balance studies (hydrology and water use) from the NWRS-1, with the addition of the information generated from the studies referred to above. The combined information was used to develop updated strategic water perspectives for the country.

The following issues must be addressed:

Inadequate Investment in Water Related Information.

Appropriate and relevant information is the basis of all good management and governance. This is especially applicable for water management and even more so in terms of the need to address the extended management model and challenges, to align with socio-economic development with associated integrated planning as well as to proactively respond to the impact of climate change. This requires improved knowledge and information on the hydrological cycle, development, technical issues and specific functional and management programmes, business management issues including communication, financial management, social issues, service quality as well as effective governance.

Since 2004, there was a reduced investment in water planning information (no updated water account available since 2000). There was also a dramatic decline in useful hydrological data (according Pitman et. al., present hydrological monitoring equals the levels of monitoring achieved in the 1950s). This is also applicable to rainfall monitoring by the South African Weather Services.

Reality is that the need to pro-actively respond to climate change, to effectively manage disasters, to facilitate effective water resource protection and water quality management, facilitate improved integrated development and water systems management as well as more effective water governance, including regulation and enforcement, demands extended

investment in information and associated systems. At present, this is not receiving the level of attention as required.

Confidence in the Strategic Perspectives.

In terms of the requirements of the NWA, the NWRS must present updated water balances and perspectives. Unfortunately, due to a lack of investment and resourcing, these water balances were not updated, and the present water situation could therefore not be presented.

Within the limitations of available resources and funding, the approach was to focus on reconciliation studies for priority areas, selected hydrological studies, water registration and water use surveys, as well as strategic assessments like the All Towns Studies. Although these studies do not facilitate an updated national water account, they provide sufficient insight to develop and present strategic perspectives of the national water situation of South Africa.

The water information reflected in this strategy is based on comprehensive water balance studies (hydrology and water use) which formed part of the development of NWRS-1. These studies were already initiated four years prior to the finalisation of NWRS-1 and included detailed studies, water use surveys, internal strategic perspectives per water management area, as well as comprehensive public consultation.

Since 2007, DWA initiated water reconciliation studies focussing on strategic and priority development areas in South Africa (as per national spatial development plan). The remaining areas were covered by the All Town Studies. These studies were overseen by steering committees representing water users, interest groups and decision makers' These representatives also had the responsibility to validate relevant sector information. Over and above these studies, several groundwater studies, water resource modelling (WR 2005 updates), as well as water resources quality and sector specific research projects, were undertaken. All these were used to develop improved strategic water perspectives for the country

A Critical Success Factor.

An important principle is that it is not only about information, not only about an advanced information technology, but more so about knowledge, understanding, insight and application. This includes improved integrated decision-making, planning, appropriate intervention and regulation. This demands effective monitoring with appropriate reference systems and accessibility. In this context, monitoring includes factual, strategic, performance, project, intervention and outcome monitoring.

Quality and validity of information is critical to successful negations, management and development decisions. Added to this is the need for shared understanding, ownership and confidence in the relevant information. Based on the principle that water management is an

integrated sector business, special focus must be placed on the development and maintenance of a shared knowledge base with an associated, integrated information system.

To ensure effective NWRS 3 development, as well as effective water governance and catchment management, it is of critical importance that a dedicated effort and information management programme is timeously instituted. Investment in information, its management and associated systems must be prioritised and committed.

The following actions are required:

- Dedicated commitment to invest in effective and extended water information and information management systems; This includes improvement and enhancement of water related data and information and advanced technology;
- The development of an integrated water sector information management system, including enhanced accessibility and dissemination of data and information;
- The development of a dynamic water sector account (in partnership with StatsSA and the water use sectors). This must be initiated immediately and pro-actively in preparation of the NWRS-3;
- The development of water footprints per sector and specific development actions;
- The development of a dynamic water governance and management dashboard;
- Development of specific components to facilitate and support smart water management, including financial management, the water investment framework and decision support systems;
- Update and improve water monitoring and assessment systems. This includes hydrology, disaster management, systems optimisation, groundwater development, re-use and regulatory water use and control.

12. Implementing the NWRS-2

Many of the challenges faced in the water sector arise are related to poor implementation of good policies and strategies. An important question, therefore, is how to ensure implementation of the NWRS-2.

Firstly, officials in all water management institutions must give effect to the NWRS-2. To achieve this, DWA will need to exercise strong leadership, and work with the relevant water

management institutions to ensure that the relevant elements of the NWRS-2 are incorporated into their strategic and business plans. Water officials must lead the way.

Water institutions must be strengthened by building their capacity and making them accountable to ordinary people. But that will not work without strong executive leadership and material support from the private sector.

Finally, this will only work where a government has a clear, realistic implementation plan in place – and where the budget system is open, transparent, and outcomes-driven. The implementation plan must be developed co-operatively with key stakeholders and government departments, and must allocate clear actions and targets not only for DWA, but for all water management institutions, relevant government departments, and water-use sectors.

13. The New Paradigm: Key Elements

There are several key elements to the NWRS-2 that are critical in the implementation of a new paradigm for water management. Firstly, the new paradigm is value driven, and driven by the concept of Developmental Water Management, as defined in Chapter 5.

Promoting the equity-oriented agenda will entail adjustments in the structure, functions, priorities and budget of DWA and CMAs. More fundamentally, issues related to enforcement, transition to and consolidation of democracy, changes in behaviour and attitude, will need to be addressed in an integrated way across the sector under the leadership of DWA.

In the same way, promoting a deliberative and participatory agenda will require adjustments in the structure and functions of water institutions. Issues related to expertise, accountability, and democratic authority must be addressed in an integrated way at the highest level in the Department of Water Affairs. There is therefore the need to strengthen the capacity of sector institutions to integrate the consolidation of democratic practices into their work. All departments and non-governmental entities that have a direct relevance to water should be involved. Aligning all such departments and organizations to focus on water requires the use of political capital.

Central to the successful implementation of the NWRS-2 are three factors: the importance of gathering adequate and reliable information; adherence to policies and procedures; and the deployment of the finest people available. The implementation of the NWRS-2 will depend on the quality and sensibility of human resources across the sector, much more so than on material resources.

Senior management in water sector institutions must play a strategic leadership role, inspiring a sense of meaning amongst staff, ensuring that all employees understand and support the spirit and substance of the Constitution and the water policy, and ensuring that all employees understand and implement the NWRS-2.

The Department of Water Affairs must drive the implementation of the NWRS-2, with a focus on all dimensions of water – physical, institutional, economic, social, financial and ecological. The private sector and other social partners should support this as it is in the public interest to ensure that water management support a more equitable, prosperous and sustainable society. The private sector, civil society, and the international community, will contribute to the implementation of the NWRS-2 and the achievement of policy objectives in different ways – strong leadership by DWA is needed to align these different ways and to ensure synergy amongst the various processes to create the right conditions for water management to support growth, development and equity.

The Department of Water Affairs requires the support of business and financial institutions whose shareholders should ensure that they now develop a people-oriented vision and take the steps to become the pre-eminent equity-supporting institutions in South Africa. It is these organizations which, together with the Department, must develop the "agenda for equity" which is the people's hope. None-the-less, responsibility for these equity reforms lies with DWA, which must ensure that water institutions, in the context of the new institutional environment, are more efficient and publicly accountable.

With the cooperation of affected government departments, trade unions, the media, and the business community, water equity can be achieved in the next few years. Civil society and grassroots action can make a profound difference.

Water security risk can be managed effectively only with stakeholders' deliberation and participation. The reliability of water delivery to public and private sectors can only be ensured through public–private partnerships and long-term planning, processes that must include historically marginalized and poor communities. However, with water security risk comes opportunity. Just as the need to control carbon emissions has been a driver for environmental innovation so are the water challenges – but in the last eighteen years, innovation on the water industry has been underfunded and adopted slowly.

Strengthening the national innovation system and improving water management will need to take into account indigenous knowledge systems. Farming communities have existed for centuries, and long before there were modern water innovations, these communities had to develop ways to manage their limited resources. They developed indigenous leadership and management structures to encourage participation and the most effective and equitable use of limited resources. Since the seventeenth century, colonial intervention and the push for modern methods have often caused these structures to fail as a result of neglect or active destruction. However, these indigenous organizational mechanisms can be an effective way

to reach communities and cause their members to use innovations or sustainable water use techniques.

Partnerships between universities, research institutes, industries, and local communities are crucial to encourage increased research and promote innovation. Water innovation has the potential to transform the South African water management scene, but only if strong structures are put in place to help create and disseminate critical best practices and effective technologies. To promote innovation, the water sector could further support interactions, collective action, and broader public-private partnerships.

Government and educational institutions should treat water resource management as a skill to be learned, valued, and improved upon from early childhood through adult careers. Valuing water and trying to improve our management of it takes advantage of South Africa's existing systems and capabilities. In this way, the country could provide significant benefits for its citizens and its economy.

The challenges facing the South African water sector will require fundamental changes in the way universities train their students. Most South African universities do not specifically train students to work in the water field in the same way law schools train students to work in courts. This needs to change so that water-related education can contribute to other sectors such as agriculture, mining, energy, transportation, and tourism.

The importance of technological innovation in the water sector raises serious political questions. Technology in the water sector, as in all other sectors, is one of the major sources of public power. So far as decisions affecting the daily lives of water users are concerned, political democracy is largely overshadowed by the enormous power wielded by captains of technical systems: corporate leaders, and professional associations and groups such as engineers and hydrologists. They have far more to do with the management of infrastructure, the design of dams and irrigation systems, the selection of innovations, our experience as water users, than all the government water institutions put together. Water democracy must be extended from the political domain into the world of technology and work. This is the underlying demand behind the idea of a people-centred water system.

14. Support strategies

A number of technical and enabling strategies guide the implementation of the overarching core strategies and associated key actions. These technical and enabling strategies, which also respond to the various concerns reflected, are presented in the following Section.

15. Spatial Perspectives

In support of the new proposed WMAs, spatial perspectives on each of these areas are presented in Part C.

PART B: IMPLEMENTATION and SUPPORT STRATEGIES

The NWRS 2 is supported by a number of technical and enabling strategies that will guide the implementation of overarching core strategies and associated key strategic actions. These technical and enabling strategies respond to the various concerns identified from the water perspective for South Africa.

Table 7Table below gives a brief overview of the relation between the core strategies and the supporting implementation strategies. What must be noted is the extensive cross-cutting links between the core strategies as specific support strategies. It guides the process and thinking in terms of the scope and indications of each of these strategies.

Table 7 : Matrix linking core strategies with implementation strategies

IMPLEMENTATION STRATEGIES	**CORE STRATEGIES**										
	Implementation of Equity policy	Putting water at the centre of integrated development planning and decision-making	Ensuring water for equitable growth and development	Contributing to a just and equitable South Africa	Protecting water ecosystems	Implementing water use efficiency, conservation and demand management	Optimizing and stretching of our water resources	Achieving effective and smarter water governance	Embedding sustainable business principles and practices in water resources and systems management	Implementing a water sector investment framework s	Engaging the private and water use sectors
DETAILED CORE STRATEGIES											
Protection ecosystems	•	•	•	•	**X**	•	•	•	•	•	•
Water conservation and demand management	•	•	•	•	•	**X**	•	•	•	•	•
TECHNICAL STRATEGIES											

Infrastructure development and management	•	•	•	•	•	•	•	•	•	•	
Climate change	•	•	•	•	•	•	•	•	•	•	
Disaster management		•	•	•	•		•	•	•	•	
Groundwater development and management	•	•	•	•	•	•	•	•	•	•	
Water Resources System Operations	•	•	•	•	•	•	•	•	•	•	
Desalination	•	•	•	•	•	•	•	•	•	•	•
Water Re-Use	•	•	•	•	•	•	•	•	•	•	•
ENABLING STRATEGIES											
Water finance and funding	•	•	•	•	•	•	•	•	•	•	•
Water sector capacity building	•	•	•	•	•	•	•	•	•	•	•
Monitoring and information	•	•	•	•	•	•	•	•	•	•	
Research and innovation	•	•	•	•	•	•	•	•	•	•	•
MANAGEMENT AND GOVERNANCE											
Water allocation reform	•	•	•	•	•	•	•	•	•	•	
Regulation of water resources	•	•	•	•	•	•	•	•	•	•	
Water sector institutional arrangements	•	•	•	•	•	•	•	•	•	•	•
International water management and cooperation	•	•	•	•	•	•	•	•	•	•	

1. DETAILED CORE STRATEGIES

1.1 Detailed core strategy 1: Protection of water resources.

Introduction

A significant proportion of South Africa's usable water resources, including aquatic ecosystems, have been degraded and most exploitable water resources are being used. Protection of water resources encompasses management of quality and quantity of both surface water and groundwater and protection of the habitats. Apart from the intrinsic value of environment, protection of water resources is necessary for securing ecosystem services for economic development and growth and protection of human and animal health. The water resources protection challenge is linked to the variability of water quantity in South Africa as well as human impacts and poor management of the resource.

The protection of Water Resources is prescribed in Chapter 3 of the National Water Act, which states that water resources should be classified, water resource objectives should be identified and the Reserve should be determined and implemented. These provisions of the Water Act have led to complementary strategies on Resource Directed Measures (RDM) (38) (11) and Source Directed Controls (SDC).

Situation analysis

The condition of catchments has an important bearing on water supply, water flow regulation and water quality. Degradation of catchments has resulted in changes in river flows and groundwater storage in addition to the better known problems of soil loss and sediment accumulation in river systems and dams. As described in Part A, there are serious concerns with regard to water quality for many catchments in South Africa.

Components of the full set of resource-directed measures – the classification system and determination of the preliminary Reserve – have been established fairly successfully. The process to determine a class for every significant water resource and for the Resource Quality Objectives in accordance with its class, is currently under development.

The Classification system was gazetted in 2010 and comprises classes of water resources protection. The classification and Reserve determination can only now formally be implemented. Prior to this the Reserve has been taken into account in water balance calculations before a water use license was issued and has been used to determine the implications of providing for the Reserve when reconciling supply and demand in major catchments.

Guidelines have been developed to operationalise the Reserve determination. The Estuaries component of the Reserve was not addressed in the NWRS 1 and a Water Research Commission (WRC) project is currently underway to refine the current methodology. Estuaries are often in a better category than rivers immediately upstream. As a result, there are discrepancies between river and estuarine requirements.

In parallel, Fresh Water Ecosystem Priority Area maps (FEPA) have been developed for each Water Management Area. These give insight into which areas need to be protected to have a representative diversity and ecological functioning. FEPAs inform the process of catchment visioning, water resources classification, reserve determination, setting and monitoring of resource quality objectives and water use license applications (39).

Key issues

The key issues and gaps for water resource protection relate mostly to the implementation of tools and regulations for managing water quality and quantity:

- Limited attention to the protection of water resources in Catchment Management Strategies, Water Services Development Plans (WSDPs) and Environmental management strategies;
- Concerns that the classification system will be highly resource intensive and difficult to implement;

- Unsuitable levels of confidence of Reserve determinations, due to the pressure of back-logs in processing licences;
- Delayed determination and implementation of Resource Quality Objectives (RQOs) as procedures for determining RQOs are still under development;
- Severe shortage of suitably qualified and experienced personnel and high staff-turnovers significantly affecting the management of water quality and quantity;
- Delayed implementation of regulatory instruments - including (a) a backlog in issuing licenses, which results in water use taking place without proper regulation and (b) illegal water use;
- Delayed implementation of the Waste Discharge Charge system due to limited capacity within the Department of Water Affairs, especially within regional offices, to enforce compliance with the license conditions;
- Sub-standard quality of effluent discharges from municipal waste water treatment works, resulting in human health impacts, eutrophication, loss of property values and agricultural productivity;
- Inadequate groundwater management, through lacking implementation of protection;
- Acid Mine Drainage poses a complex problem and serious threat to water quality. Good quality information is needed to make informed decisions regarding the origins of the pollution, potential impacts, interventions, and treatment technologies (12);
- Land degradation (e.g. reduction of basal/vegetation cover through unsustainable grazing practices and ecologically inappropriate fire regimes) which impacts largely on sediments and water quality and to a lesser extent water security and invading alien plants which impacts on water security and to lesser extent sediments.

The Vision of the Protection of Water Resources Strategy

> Vulnerable and valuable aquatic ecosystems are protected against pollution, over-abstraction and other negative impacts on habitats so that they provide water and ecological services for the beneficial use of the environment, society and economy

The objectives of this strategy are:

- Prioritisation of pollution prevention and treatment and restoration of polluted water bodies;
- Establish eco-systems management as a core water business area. This include pro-active management and rehabilitation of water resources (mountain catchments/watersheds, rivers, wetlands, aquifers and estuaries);

- Enhanced capacity of institutions that are responsible for water quality management and compliance enforcement

This strategy is dependent on effective implementation of several NWRS core strategies, including the establishment of Catchment Management Agencies, and the setting and implementation of Water Resource Classification, Resource Quality Objectives, and the Ecological Reserve, as well as continual improvement by local government to ultimately meet the required effluent standards.

Operational objectives of the Ecosystem Sub-Strategy

	Vision: **South Africa invests in healthy ecosystems as the ecological infrastructure to secure and sustain the country's water resources**		
	Objective	**20 year goal**	**5 year target**
	OPERATIONAL OBJECTIVES		
1.	Implement Water Resource Classification, the Reserve and Resource Quality Objectives at a catchment scale	Water resources are managed sustainably to their management class and RQOs are enforced by CMAs and DWA. The Reserve is met. Local government by-laws and provincial planning is harmonised water planning to enable the achievement of management classes.	At least 4 stressed catchments in 4 WMAs have classification and reserve determinations completed and implemented; EMI, DWA and DAFF personnel are empowered to enforce the NWRCS and reserve determinations. In areas where Classification is completed, this is a critical input to spatial development planning and implications are understood by planners and decision makers in local government.

2. Invest in healthy catchment functioning in priority catchments for water supply	Established and effective catchment stewardship programmes are up and running in all priority catchments for water supply, and all mountain catchment areas are legally protected. The costs of ecological management of priority water supply catchments are factored into the water price, and revenues are reinvested in ecological management in priority catchments.	A framework for catchment stewardship has been developed along with at least 4 operational examples in priority water supply catchments. Mountain catchment areas in stressed catchments have been declared as protected environments in terms of the Protected Areas Act. New regulations for MCAs have been developed in terms of the Protected Areas Act. The costs of ecological management of priority water supply catchments have been accurately determined.
3. Incorporate Freshwater Ecosystem Priority Areas (FEPAs) into planning and decision-making processes that impact on aquatic ecosystems	All FEPAs are in an A or B ecological state; water resource planning and decision-making routinely incorporates FEPAs (at national, regional and CMA level, and in provinces).	FEPAs are integrated into water resource planning and decision making at national and regional levels, as well as within CMAs.

4. Create renewed vigour in applying CARA and/or new regulations to protect riparian and wetland buffer zones and critical groundwater recharge areas.	Riparian and wetland buffer zones have been delineated and prioritised; enforcement actions in priority buffer zones are common place, and incentive mechanisms exist to reward sound behaviour and penalise non-compliance.	Framework for delineating riparian and wetland buffers in place, actions within WMAs prioritised; there is evidence of action in at least 30% of the priority areas; incentive proposals have been developed. CMAs collaborate with DAFF to ensure cultivation and intensive grazing is pulled back from riparian areas and landowners restore priority riparian areas.
INSTITUTIONAL OBJECTIVES		
5. Provide formal mechanisms for strengthening collaboration around managing and conserving freshwater ecosystems between DWA, DEA, DAFF and other key government departments	DEA, DWA, DAFF and other key government departments have fully aligned mandates regarding decisions on water resources; roles and responsibilities are well understood and coordinated.	The recently established Inter-Departmental Liaison Committee on Inland Water Ecosystems is a vibrant well-functioning body that influences decisions made within DEA and DWA, and is well attended by DWA, DEA, DAFF, DMR and other key government departments, Natural Resource Management representatives and regional champions. DAFF prioritises land care extension and enforcement of regulations in priority areas for water resource protection.

6. Employ aquatic ecologists in DWA regional offices, provincial conservation authorities and Catchment Management Agencies	At least 6-8 aquatic ecologists are employed in each provincial conservation authority, and each DWA regional office and/or CMA. These aquatic ecologists understand their roles and responsibilities, align their respective mandates and resources, and cooperate to manage and monitor freshwater ecosystems.	At least 4 aquatic ecologists are employed in each provincial conservation authority, and each DWA regional office and/or CMA. These aquatic ecologists interact to understand their respective roles and responsibilities, and have begun to align their mandates and resources towards cooperatively managing and monitoring freshwater ecosystems.

7. Strengthen River Health Programme and establish a Wetland Health Programme and an Aquifer Health Programme	Repeated site monitoring within the River Health Programme informs DWA water resource management and decision-making processes, e.g. setting and monitoring of Resource Quality Objectives, and monitoring and compliance. A well-resourced Wetland Health Programme is up and running in provinces and well-coordinated nationally. The Aquifer Health Programme informs groundwater management and land-use planning in groundwater sensitive areas. Programme design and location of monitoring sites takes FEPA locations into account.	There is renewed vigour for the River Health Programme which is properly resourced for national coordination and provincial implementation. At least one repeat sampling has been done for existing River Health Programme sites. Design of new monitoring sites takes FEPA locations into account. Pilots for a nationally-coordinated Wetland Health Programme exist in at least 3 provinces and plans exist to resource other provinces. Pilots for a national Aquifer Health Programme are underway. Groundwater monitoring sites have been chosen and prioritised, and at least a third of them are being monitored. Monitoring results from all programmes are fed into the RDM office of CMAs and are part of the monthly decision making on management of catchment resources.

Table 8: Operational Objectives

OBJECTIVE 1: Implement Water Resource Classification, the Reserve and Resource Quality Objectives at a catchment scale

The classification of water resources, resource quality objectives and reserve determinations are perhaps the most crucial yet under-utilised provisions of the National Water Act. There is a demonstrable drop in river health and increasing stress on water resources, leaving little buffer for any coming changes or increasing demand. Tough measures are required, including improved political will to support compulsory licensing in key catchments, and commitment to catchment-level plans and solutions. The environmental sector needs to support DWA in promoting and implementing these objectives of the NWA.

- ***20 year goal:*** *Water resources are managed sustainably to their management class and RQOs are enforced by CMAs and DWA. The Reserve is met. Local government by-laws and provincial planning is harmonised water planning to enable the achievement of management classes.*
- ***5 year target:*** *At least 4 stressed catchments in 4 WMAs have classification and reserve determinations completed and implemented; EMI, DWA and DAFF personnel are empowered to enforce the NWRCS and reserve determinations. In areas where Classification is completed, this is a critical input to spatial development planning and implications are understood by planners and decision makers in local government.*

OBJECTIVE 2: Invest in healthy catchment functioning in priority catchments for water supply

Healthy, intact catchment ecosystems are required to secure water quality and quantity for growth and development. However, conservation departmental budgets to maintain compatible land use are limited, land protection and stewardship arrangements in catchments are unclear, and no direct incentives exist for landowners or users to maintain ecosystems in the desired state (i.e. free of invasive alien vegetation, proper fire controls in place, wetlands and river buffers left intact, non-eutrophied to reduce water weeds). The sale of the primary product of these ecosystems (raw water) does not result in a direct flow of benefits to communities and landowners responsible for maintaining the watersheds. The lack of suitable development controls and regulatory responsibility and enforcement personnel prevents catchments from being managed ecologically.

The key recommendation of the biodiversity sector to the NWRS is to create an enabling environment for water stewardship programmes to flourish

- ***20 year goal****: Established and effective catchment stewardship programmes are up and running in all priority catchments for water supply, and all mountain catchment*

areas are legally protected. The costs of ecological management of priority water supply catchments are factored into the water price, and revenues are reinvested in ecological management in priority catchments.

- ***5 year target**: A framework for catchment stewardship has been developed along with at least 4 operational examples in priority water supply catchments. Mountain catchment areas in stressed catchments have been declared as protected environments in terms of the Protected Areas Act. New regulations for MCAs have been developed in terms of the Protected Areas Act. The costs of ecological management of priority water supply catchments have been accurately determined.*

Indicators or milestones

- Protected environment declaration and regulation regime specific to MCAs is developed and promulgated
- Specific water resource charge levied at WMA level in terms of the Water Pricing Strategy to fund implementation of catchment stewardship programmes, especially in MCA Protected Environments and other protected areas
- Working examples exist of WMA or quaternary catchment-wide water stewardship programmes in at least 4 WMAs
- Benefits, incentives and disincentive schedule developed for each WMA water stewardship programme to give effect to water resource classification, RQO and other natural resource management regulations.

OBJECTIVE 3: Incorporate Freshwater Ecosystem Priority Areas (FEPAs) into planning and decision-making processes that impact on aquatic ecosystems

Freshwater Ecosystem Priority Areas (FEPAs) are strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources. FEPA maps and supporting information provide a **single, nationally consistent information source for incorporating freshwater ecosystem goals into planning and decision-making processes**.

For integrated water resource management, the maps provide guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act. FEPA maps are therefore directly applicable to the National Water Act, feeding into Catchment Management Strategies, classification of water resources, reserve determination, and the setting and monitoring of resource quality objectives (see **BOX 1**).

Freshwater Ecosystem Priority Areas (FEPAs) need to remain in a good condition (A or B ecological category) in order to achieve biodiversity goals and protect water resources for

human use. This does not mean that they need to be fenced off from human use, but rather that they should be supported by good planning, decision-making and management to ensure that human use does not impact on the ecological condition of the resource.

- ***20 year goal:*** *All FEPAs are in an A or B ecological category; water resource planning and decision-making routinely incorporates FEPAs (at national, regional and CMA level, and in provinces)*
- ***5 year target:*** *FEPAs are integrated into water resource planning and decision making at national and regional levels, as well as within CMAs.*

Indicators or milestones

- FEPAs are meaningfully incorporated in all Catchment Management Strategies that have been developed
- Terms of reference for consultants undertaking classification of water resources include a requirement to allocate time and budget for including FEPAs in the development and analysis of water-use scenarios. An A or B ecological condition of all FEPAs is achieved in at least one of the scenarios.

See Box 1 below for further specific indicators and requirements in support of the 5 year target.

BOX 1: The use of FEPAs in water resource planning and decision-making in terms of the National Water Act

FEPAs inform the development of catchment management strategies, water resource classification, reserve determination, setting and monitoring of resource quality objectives, and water-use license applications. These planning and decision-making processes need to allow for the inclusion of an aquatic ecologist on the team and ideally also a biodiversity planner.

- ***For development of catchment management strategies***:
  - FEPA maps should be taken into account in catchment visioning.
  - River FEPAs are currently in an A or B ecological category and need to remain so.
  - Wetland FEPAs in an A or B ecological category should remain so; those in a lower ecological category should be rehabilitated to their best attainable ecological category.
  - The desired ecological category of priority estuaries is stipulated in the National Biodiversity Assessment 2010 and varies according to importance, sensitivity and feasibility of implementation.
  - Fish Support Areas are not necessarily in an A or B ecological category but require a fish management plan that outlines management interventions to support the populations of threatened indigenous fish that they contain.
- ***For water resource classification:***
  - River, wetland and estuary FEPAs should be regarded as significant water resources.
  - The location of FEPAs should be used to prioritise the allocation of resource unit nodes, which should be sited immediately downstream of the FEPA.
  - Water-use scenarios should include at least one scenario that achieves the desired condition for FEPAs (i.e. A or B ecological category).
  - In examining the social, economic and ecological trade-offs of different water-use scenarios (and the impact each will have on future ecological condition of significant water resources), the consequences of not protecting a FEPA should be factored into the ecological assessment. This would include assessing whether the biodiversity target that the FEPA is fulfilling can be achieved elsewhere in the water management area concerned, and if not, elsewhere in the country. Many river FEPAs constitute the last remaining option for representing natural examples of the country's river, wetland or estuary ecosystems and associated biodiversity. Degrading the desired condition in these FEPAs means that we will not be able to meet national goals for managing and conserving freshwater ecosystems.
- ***For reserve determination:***
  - FEPAs should be visited to confirm their location, extent and ecological condition and importance.
  - The location of FEPAs should be prioritized for reserve determination in areas where demand and conflict for water resources are high.
  - FEPAs should be afforded a higher-confidence reserve determination rather than desktop/rapid determination, especially FEPAs that are in areas where demand and conflict for water resources are high.
  - The location of FEPAs should be taken into account when allocating resource unit nodes for assessment and monitoring, prioritising the allocation of resource nodes immediately downstream

of FEPAs.

- ***For the setting and monitoring of resource quality objectives:***
  - FEPAs should be used to prioritise the allocation of resource nodes, which should be sited immediately downstream of the FEPA.
  - The ecological requirements for resource quality objectives (as outlined in the Department of Water Affairs guidelines for resource quality objectives) should be prioritised for FEPAs.
  - Ensure that monitoring and analysis of results feeds into adaptive management, compliance and enforcement.
- ***For water-use license applications:***
  - FEPAs should be regarded as ecologically important, due to their role in conserving and managing freshwater ecosystems and supporting sustainable use of water resources.
  - FEPAs should also be regarded as generally sensitive to changes in water quality and quantity.
  - The impact of the application on the ecological condition of the FEPA and how this would affect the habitats and species within the FEPA should be thoroughly assessed. FEPA ecosystem management guidelines can be used as a starting point for assessing the impact of the proposed application on the FEPA (available through SANBI's Biodiversity Advisor website, http://bgis.sanbi.org; or Freshwater Consulting Group, Cape Town). Further assessment, e.g. through seasonal field surveys, may be required.
  - If the application is approved, stringent ecological requirements should be attached to the Record of Decision (ROD) to prevent degradation of ecological condition and to strive towards rehabilitation of FEPAs where necessary, including guidelines for managing water quality, riparian and wetland buffer zones, erosion and sedimentation, and connectivity. FEPA ecosystem management guidelines can be used here as a starting point).

Table 9: Indicators

OBJECTIVE 4: Create a renewed vigour in enforcing the Conservation of Agricultural Resources Act and/or new regulations to protect riparian and wetland buffer zones

Perhaps the single greatest opportunity to improve water resource protection is through improved agricultural extension and regulatory compliance. National and provincial agriculture officials have arguably the broadest network of staff interacting with land users on a regulatory basis, and the most direct powers to prevent damage to the ecological infrastructure of water. Enforcement of CARA (and thus the protection of river banks, wetlands and erosion control efforts on farms) has been slipping in the past decade, with direct impact on economic viability of agricultural production as well as on water resources. An opportunity exists to promote an integrated approach to natural resource extension in the agriculture, water and conservation sectors through joint compliance monitoring, enforcement and creative, robust incentives for protecting watershed services.

- ***20 year goal:*** *Riparian and wetland buffer zones delineated and prioritised; enforcement actions in priority buffer zones are common place, and incentive mechanisms exist to reward sound behaviour and penalise non-compliance.*
- ***5 year target:*** *Framework for delineating riparian and wetland buffers in place, actions within WMAs prioritised; there is evidence of action in at least 30% of the priority areas; incentive proposals have been developed.*

OBJECTIVE 5: Provide formal mechanisms for strengthening collaboration around managing and conserving freshwater ecosystems between DWA, DEA, DAFF and other key government departments

Water and environmental management are inextricably linked, yet the two responsible departments could share substantially more information, and collaborate on compliance monitoring and enforcement activities. Formal linkages to key coordination structures in the environmental sector would benefit from having DWA input, especially in the Biodiversity and Integrated Environmental Management working groups. Although under a different Minister, it is also imperative for other resource management departments, primarily DAFF, to collaborate effectively on water resource protection and land use and natural resource management activities in catchments. DAFF regulations and enforcement are of paramount importance for protecting and restoring water resources, especially riparian buffer zones, wetlands and for ensuring that field and rangeland management don't impact hydrological services unnecessarily.

- ***20 year goal:*** *DEA, DWA, DAFF and other key government departments have fully aligned mandates regarding decisions on water resources; roles and responsibilities are well understood and coordinated.*
- ***5 year target:*** *The recently established Inter-Departmental Liaison Committee on Inland Water Ecosystems is a vibrant well-functioning body that influences the decisions made within DEA and DWA, and is well attended by DWA, DEA, DAFF, DMR and other key government departments, Natural Resource Management representatives and regional champions. DAFF prioritises land care extension and enforcement of regulations in priority areas for water resource protection.*

Milestones and indicators

- DWA has representatives on the Environmental Affairs MinTech and its Working Groups 1 and 2
- Legal amendments enable joint Water Use Licences and Environmental Authorisations
- DWA drafts Mountain Catchment Area protected environment regulations under the Protected Areas Act (Act 57 of 2003 as amended) with support from DEA

- DAFF prosecutes agricultural regulations protecting riparian zones and wetlands from ploughing and other damaging agricultural activities and/or delegates this function to competent provincial agriculture departments.

OBJECTIVE 6: Employ aquatic ecologists in regional DWA offices, provincial conservation authorities and Catchment Management Agencies

Effective management, conservation and monitoring of freshwater ecosystems requires an understanding of how freshwater ecosystems function, and their likely response to management actions and/or proposed developments. Existing aquatic ecology capacity in DWA regional offices and provincial conservation agencies is poor. Ideally, six to eight aquatic scientists and technicians are needed within the DWA regional office or Catchment Management Agencies, and in another six to eight aquatic scientists and technicians in the provincial conservation authorities. These aquatic scientists and technicians should have expertise in limnology, hydrology, fish biology, aquatic invertebrate biology, aquatic plant biology and other aspects of aquatic ecology. Clear roles and responsibilities should be set for the aquatic ecologists within DWA and DEA, and cooperation around common regional objectives should be achieved. Some suggested roles and responsibilities for provincial conservation authorities are shown in **BOX 2**.

- ***20 year goal:*** *At least 6-8 aquatic ecologists are employed in each provincial conservation authority, and each DWA regional office or CMA. These aquatic ecologists understand their roles and responsibilities, align their respective mandates and resources, and cooperate to manage and monitor freshwater ecosystems*
- ***5 year target:*** *At least 4 aquatic ecologists are employed in each provincial conservation authority, and each DWA regional office or CMA. These aquatic ecologists interact to understand their respective roles and responsibilities, and have begun to align their mandates and resources towards cooperatively managing and monitoring freshwater ecosystem.*

BOX 2: Suggested roles and responsibilities of provincial conservation authorities in relation to managing and conserving freshwater ecosystems include:

- **Commenting on development applications**, including EIAs, mining and prospecting applications, and recreational fishing and aquaculture permit applications, to ensure that freshwater ecosystem priorities are taken into consideration. This includes **providing specialist freshwater ecological input**, and advising on mitigation measures and appropriate river and wetland buffers.
- Participating actively in DWA-led processes such as **classification of water resources** and **reserve determination**, to ensure that freshwater ecosystem priorities are taken into consideration.

- Participating actively in processes led by **Catchment Management Agencies**, including the development of **Catchment Management Strategies**. Provincial conservation authorities should play a leading role in providing a regional freshwater ecological perspective as well as technical advice and input on the incorporation of FEPA maps into the work of Catchment Management Agencies.
- **Monitoring** the condition of freshwater ecosystems, with a particular focus on regular monitoring of FEPAs. This requires close collaboration with the River Health Programme.
- Identifying FEPAs that should be included in the **provincial protected area network**, including through biodiversity stewardship programmes.
- Ensuring that freshwater ecosystem priorities inform the development and implementation of **management plans for protected areas**.
- Interacting with Working for Water, Working for Wetlands, and Land Care to direct these programmes towards rehabilitating freshwater ecosystem priority sites.
- Initiating and/or participating in the development of **biodiversity management plans** in terms of the Biodiversity Act, for priority freshwater ecosystems and species.
- **Verifying** all FEPAs that occur in the province, and confirming their status (for example, ground-truthing their ecosystem type and condition).
- **Filling in gaps in knowledge** of freshwater ecosystems and species, for example mapping wetlands that have not yet been included in the national wetland map and surveying the distribution of threatened fish species.

Table 10: Roles and Responsibilities

OBJECTIVE 7: Strengthen the River Health Programme and expand to include a Wetland Health Programme and Aquifer Health Programme

The River Health Programme is a nationally coordinated monitoring programme of DWA initiated to measure, assess and report on the general state of rivers at a catchment level with particular emphasis on habitat and biota. State-of-Rivers reporting provides information on the ecological state of South Africa's rivers to enable resource managers to make informed decisions and take appropriate action. This information must furthermore show whether previous decisions were successful or failed to improve river health. For this to happen, monitoring and reporting must be repetitive to reveal trends and to establish whether appropriate management actions have taken place and have been successful. Trends and findings should also be linked to core DWA policy objectives, outcomes, performance and learning to implement adaptive management practices. Leadership as well as continuity and commitment of national support over the long term is needed to revitalise the initial momentum of this programme (follow-on reporting has not happened in any of the initial catchments). This commitment is urgent to prevent the loss of provincial

structures and institutional memory. In a similar manner, a Wetland Health Programme needs to be established that is nationally coordinated, but implemented at a provincial level. Wetlands are under even greater pressure than rivers, and their deterioration is a major concern given the role they play in maintaining resilient landscapes and water resources. Much of the future growth of water resource use will rely on groundwater, and the implementation of the Aquifer Health Programme, developed by DWAF in 2007, will bring together groundwater monitoring with sustainable use and remediation initiatives (e.g. Acid Mine Drainage in the gold mining areas) in coordinated management.

- ***20 year goal:*** *Repeated site monitoring within the River Health Programme, conducted by experienced inter-departmental/agency implementation teams at the scale of WMAs, informs DWA water resource management and decision making processes, e.g. setting and monitoring of Resource Quality Objectives, and monitoring and compliance. A well-resourced Wetland Health Programme is up and running in provinces and well-coordinated nationally.* The Aquifer Health Programme informs groundwater management and land-use planning in groundwater sensitive areas. *Programme design and location of monitoring sites takes FEPA locations into account.*
- ***5 year target:*** *There is renewed vigour for the River Health Programme which is properly resourced for national coordination and provincial implementation. At least one repeat sampling has been done for existing River Health Programme sites. Design of new monitoring sites takes FEPA locations into account. Pilots for a nationally-coordinated Wetland Health Programme exist in at least 3 provinces and plans exist to resource other provinces. Pilots for a national Aquifer Health Programme are underway. Groundwater monitoring sites have been chosen and prioritised, and at least a third of them are being monitored. Monitoring results from all programmes are fed into the RDM office of CMAs and are part of the monthly decision- making on management of catchment resources.*

Strategic actions

- Identification and promulgation of priority ecosystem zones as protected areas.
- Enhanced monitoring and information dissemination on the state of water resources in South Africa.
- Implement an integrated authorisation process to regulate water and environment under the National Water Act and NEMA.
- Establish integrated compliance enforcement between DWA and DEA.
- Simplify the procedures for- and accelerate of reserve determination and classification of rivers.
- Prioritise pollution prevention and management.
- Set realistic environmental flow requirements.

- Enforce compliance for Fresh Ecosystem Priority Areas.
- Rehabilitate priority water source areas including critically threatened wetlands.
- Develop and implement intervention action plans for priority catchments (to limit pollution and specific source control measures and watershed management measures).
- Formulate Service Level Agreement between DWA and DEA (Natural Resource Management Programmes) for the implementation of large scale natural resource restoration & maintenance, and invasive alien plant control programmes with a specific focus on watershed services.
- Address capacity building and training for internal DWA staff and external practitioners.
- Improve and increase the capacity of staff who operate water treatment facilities in South Africa.

1.2 Detailed core strategy 2: Water Conservation and Demand Management

Please note that this strategy is supported by a more detailed operational strategy.

Introduction

Water Conservation and Demand Management (WC/WDM) is the foremost reconciliation strategy to balance water supply and demand. WC/WDM targets must be met in a number of priority water supply systems to reduce demand and thus 'stretch' the available water resources up to the date when the new augmentation projects will be implemented. If this is not achieved, earlier and more severe water restriction will have to be implemented when droughts are experienced. A dedicated national programme is required to deal with water wastage and losses, which will have additional job creation and small business development benefits.

Situation analysis

The National Water Act recognises the pivotal role of WC/WDM in water resource management with the objective to enable all user sectors to gain equitable access to the desired quantity, quality and reliability of water. Many of the National Water Act's provisions and requirements are related to WC/WDM, such as resource protection, water use authorisation and licenses, water pricing, management of land-based activities and control of invasive alien vegetation. In 2004, DWA developed the National WC/WDM Strategy aimed at various water use sectors (water services, agriculture and industry, mining and power generation) to supply and use water efficiently and effectively, and to minimise water losses. Mid 2011, DWA initiated the development of a consolidated water sector infrastructure investment plan (CWSIP) which includes support in terms of financial and human resources for government and stakeholder initiatives for WC/WDM. Although drafting of water conservation regulations is at an advanced stage, progress of implementation of the Strategy has been limited.

Water supply systems in South Africa, especially those that supply water to major economic centres, are under increased pressure to fulfil present and future water demand. The Vaal River Water Supply System will be in deficit from 2014 to 2019, i.e. until the planned delivery date of the Lesotho Highland Water Supply Project Phase 2; the KwaZulu coastal metropolitan system (eThekwini – Pietermaritzburg area) is already in deficit; and the

Western Cape Water Supply System will be able to meet water requirements up to 2019, provided there is successful implementation of WC/WDM measures. All three major supply systems are already in deficit in terms of providing reliable supply in 98 out of 100 years.

WC/WDM measures can be implemented in a shorter time span and are more cost effective than water infrastructure development (e.g. dams) and WC/WDM does not increase pressures on the water resources system. Note that opportunities for additional dams to address water shortages are limited as South Africa's major river systems are close to full development. Groundwater, water reuse, desalination and rainwater harvesting are alternative measures, but are in general more difficult to implement. WC/WDM has become even more important in the light of climate change when more frequent droughts and floods will impact adversely on the availability of water.

WC/WDM also imply investments in infrastructure (agriculture, water supply losses, metering), softer measures like awareness raising with users, and interventions that use pricing to discourage high consumption. Once revenue collection increases, given additional investment in infrastructure and good institutional support, and less water is unaccounted for, water conservation and water demand management can contribute to the financial viability of the water services providers and bulk water suppliers.

Key issues

The following key issues must be addressed in the water services, agricultural, industry, mining and power generation sectors in order to achieve water conservation and demand management:

Water services sector

Total losses from municipal systems are estimated at 33% of system input, among others due to poor maintenance of the reticulation system, lack of support at the political level and lack of consumer support. The major constraints to the implementation of WC/WDM measures in the water services sector are the following:

- Insufficient provision in municipal budgets;
- Water tariffs showing wide disparities;

- Lack of water and effluent balances and poor meter coverage;
- Inadequate cooperative governance, i.e. inadequate integration of planning between IDPs, Catchment Management Strategies and NWRS.

Agricultural sector

The major constraints to the implementation of WC/WDM measures in the agricultural sector are:

- Limited finances for small scale farmers and emerging black farmers for dams, irrigation systems, farm infrastructure, training and education;
- Dysfunctional irrigation schemes;
- Slow progress in establishment of functional CMAs and WUAs hindering implementation of water use efficiency programmes.

Industry, mining and power generation sector

The major constraints to the implementation of WC/WDM measures in the industrial, mining and power generating sectors are:

- Industry: there is no blue print for an approach in terms of WC/WDM due to the diversity in water use efficiency performance;
- Mining: WC/WDM activities do not take into account the reduction in waste discharge; and
- Power generation: fragmentation of the energy sector due to the emergence of Independent Power Producers will increase the need for WC/WDM standards and regulations.

Vision and objectives

WC/WDM is a critical step in promoting water use efficiency and is consistent with the National Water Act (1998) which emphasises efficient management of South Africa's water resources:

South Africa's economic sectors are internationally regarded as highly water use efficient

The following strategic objectives are set:

- Water losses are curtailed and demand is reduced for large water supply systems;
- Achievement of water use efficiency through setting water consumption targets for all water sectors;
- Control of invasive plants and management of water use by forestry.

Strategic actions

Water Services Sector:

- Set and implement realistic targets for reduction of water use in the water services sector;
- Enforce compliance of all plumbing installation with SABS 0252 by a specified target date;
- Conduct audits of water use by government owned buildings and replace conventional water devices with water saving devices;
- Develop and implement an incentive scheme to encourage households to replace water inefficient devices;
- Implement comprehensive leak detection and repair programmes for households at a nominal charge or free of charge for the low-income households;
- Prioritise the support to municipalities facing or approaching serious water shortages to implement such WC/WDM measures as identified in the reconciliation strategies;
- Implement an accounting framework for WC/WDM supported by appropriate measurements.

- Initiate a metering programme for all water use sectors to measure actual water use.
- Finalise and implement the regulations for WC/WDM for all water use sectors.
- Establish WC/WDM accords for each sector.

Agriculture:

- Encourage farmers to improve their water use efficiency and promote land use practices that will optimize watershed services (optimize flows, minimize sediments and maximise quality);
- Implement appropriate measures to reduce water wastage in the agricultural sector;
- Ensure accurate monitoring of water uses and the implementation of water use audits for all water management and service provider institutions;
- Support benchmarking against same sector industries using 'water footprints', to raise awareness on the water use and pollution in the production chains.

Industry:

- Finalise an industry classification system for the various industrial sub-sectors;
- Assess technologies used in the water intensive industrial sub-sectors and develop appropriate technology roadmaps;
- Revise water pricing for the industrial sector;
- Build capacity to implement WC/WDM measures in the sector;
- Develop best practice water conservation guidelines for water intensive industrial sub-sectors;
- Develop industrial water conservation regulations;
- Support benchmarking against same sector industries using 'water footprints', to raise awareness on the water use and pollution in the production chains.

Mining:

- Expand the current focus on water quantity to include water quality;
- Process annual water and salt balances in order to establish benchmarks and monitor progress with the WC/WDM strategy;
- Investigate the feasibility of introducing a sliding scale water use charge (pricing) which is linked to the industry benchmark;
- Initiate research aimed at significantly reducing the water requirements of generic mining processes;
- Support benchmarking against other mining companies or other mines using 'water footprints', to raise awareness on the water use and pollution in the production chains.

Power generation:

- Conduct a comprehensive technology review of the power generation sector to ensure that the water use impacts of individual technologies are fully understood;
- Conduct benchmarking of all coal-fired power stations;
- Support research on technologies for condensing cooling tower water vapour as it has potential of reducing evaporative losses;
- Define efforts necessary to address water related challenges on sustainable energy generation and production;
- Support benchmarking against other ways of power generation using 'water footprints', to raise awareness on the water use and pollution in the production chains.

Targeting the public:

- Establish a culture of effective water management within the water user domain.
- Develop effective media and communication campaigns.
- Develop water demand management efficiency incentives, e.g. similar to the energy saving interventions.
-

Control invasive plants and manage water use by forestry:

- Sourcing of sufficient funding for restoration of degraded areas and control of invasive alien plants;
- Securing community participation in enhancing watershed services amongst all land users, in terms of deeply ingrained cultural and agricultural practices;
- Extend and reform the Natural Resource Management Programmes (Working for Water, Working on Fire, Working for Wetlands and Working for Land) in partnership with DEA to unlock investment into the restoration of watershed services by private land users and commercial water users;
- Locate new plantation forests in areas only where competing demand is low;
- Review licences and permissions where there is over allocation of water in catchments in parallel with the compulsory streamline, simplify and accelerate forestry licensing and water allocation reform processes.

2. TECHNICAL STRATEGIES

2.2 Technical Strategy 1: Infrastructure Development and Management

Please note that this strategy is supported by a more detailed water investment framework.

Introduction

Infrastructure development remains a critical component of water security. The required infrastructure development applies to macro infrastructure (dams and transfer system) as well as alternative water resource development such as re-use and desalination. Furthermore, it also focuses on waste management, systems management and governance as well as functionality (refurbishment and maintenance).

The aim is to apply the value chain approach of source to tap and waste to source management approach, implying the integrated development and alignment of projects along the chain.

The core intervention areas are discussed under the following headings:

Infrastructure investment

DWA has restated its commitment to water security of South Africa by ensuring the completion of seven major new water projects around the country by 2014. For the benefit of Gauteng, Phase II of the Lesotho Highlands project has been approved and is planned for completion in 2020. In total, DWA currently oversees 151 infrastructure investment projects, including projects carried out by TCTA and Water Boards (43). Furthermore water projects focussing on social development and security, has also been initiated this includes the proposed Mwamitwa Dam in the Letaba River and Mzimvubu Dam in the Eastern Cape.

Securing water for future

Reconciliation strategies that seek to reconcile future water requirements with available resources over the next 25 years have recently been developed for specific spatial development priority areas. These include the Vaal River System, the Crocodile (West) River System, the KwaZulu-Natal coastal metropolitan areas, the Western Cape water supply system, the Algoa water supply system, the Amatole bulk water supply system, and the greater Bloemfontein water supply area. Studies are also underway to cover the Richards Bay area, the Olifants river system, the Orange-Senqu system and the Letaba-Luvuvhu system. Specific studies to cover the remaining towns and communities (All Town Studies) are also well advanced.

Specific solutions for each of these areas are identified and negotiated within sectors. These proposed solutions are summarised and presented in Section C as per the proposed water management areas.

Reservoir Systems Operations

DWA has developed guidelines for operating rules (2006) (4) and has established formal operating rules for a number of water supply systems in South Africa e.g.: the Integrated Vaal System, the Orange River System, the Algoa System, the Amatole System the Western Cape System and the Groot Letaba System. Additionally, a strategy for reservoir systems operations was developed and DWA has started working on developing operating rules for smaller dams. Implementation of operating rules remains challenging for many systems, in particular in drought situations.

Dam safety rehabilitation and rehabilitation of canals

The Dam Safety Rehabilitation Programme was implemented which resulted in the rehabilitation of eighteen dams to ensure sustainability of water supply, limiting water losses and increasing the spillway capacity to ensure the protection of the dams as part of disaster management. Since 2007 to date, the Department has also rehabilitated 24 river canals that supply the Voëlvlei Dam.

Multipurpose and Multi-stakeholder use of infrastructure

DWA developed a Social Assessment and Development Framework (5) and a set of associated implementation guidelines to better integrate social needs into the project cycle of planning new infrastructure. The development and use of water infrastructure for

multiple purposes is a given, and all future planning and development must be done within this framework, especially in terms of socio-economic development.

Economic opportunities from development and management of infrastructure

Additional economic opportunities include the development of aquaculture and hydropower use at existing dams. DWA developed an operational policy for use of water (in dams) for aquaculture purposes, but limited aquaculture opportunities have been used to date (43). Small-scale hydro-electricity plants are being considered on the existing dams in cooperation with the Department of Environment, National Treasury, ESKOM and the Central Energy Fund and other private partners.

Infrastructure for social development

A critical part of infrastructure development is the obligation and commitment towards job creation. Water related job creation takes place via various action streams and processes. The first is job creation through labour intensive practices, the second is one is the indirect job creation created through the establishment of infrastructure and associated water security, e.g. mining and agricultural development.

Functionality and infrastructure asset management

Poor functionality of infrastructure with associated inadequate operation and maintenance is one of the major threats to water security in the country. Investment in- and application of this business are, including infrastructure asset management is non-negotiable and a top priority.

Development and maintenance of a water investment framework and strategy

The present water and economic climate calls for an appropriate investment plan with associated funding and financial management. At present water investment is less than 50% of what is required. The investment in operation and maintenance is even worse and requires drastic intervention. Sustainable management of water infrastructure requires an appropriate financial model including institutional viability and solutions.

Key issues

The following key issues are critical to the achievement of improved development and management of water infrastructure:

- Under investment in state owned infrastructure refurbishment has resulted in a backlog of an estimated R 60 billion.
- Investment in wastewater treatment works and systems is a major concern.
- Development requirements of new infrastructure identified in the reconciliation strategies requires urgent attention.
- Priority focus must be placed on infrastructure functionality and sustainability.

Vision and objectives

The Vision for the Infrastructure Development and Management Strategy is as follows:

> Water resources are developed and used optimally through investments in diverse actions.

The strategy has the following specific objectives:

- Improved asset management through the adoption of smarter management approaches;
- Decisions for investments for reconciliation are made in a balanced way; based on the local situation, costs of investment and of operation maintenance and environmental and social considerations and timelines necessary for implementation;
- Investment in additional infrastructure for other sources of water; water such as re-use, desalination of seawater and rainwater harvesting;
- Multi-purpose and multi-stakeholder use of dams and stakeholder involvement in the management of infrastructure are supported.

Strategic actions

Improved infrastructure management:

Ascertain that every water resources system supplying water to the public has and implements documented operating rules based on conventional science of water resources management;

Decrease the current backlog in rehabilitation of national infrastructure of R10 billion before 2016 to R4 billion, through rehabilitation of 25 dams;

Increase financial resources allocation for maintenance, rehabilitation and refurbishment of infrastructure for government owned infrastructure, through a business plan to be approved by National Treasury;

Improve maintenance of municipal wastewater treatment infrastructure and groundwater supply systems;

Improve preparation of transfer of assets to new owners and/or managers.

Develop and maintain a water investment framework and strategy.

Implement infrastructure asset management including life cycle management.

Decisions on investments of infrastructure in a balanced and timely way:

Compare options for surface water development always with other options (WC/DM, water re-use, groundwater, seawater, rainwater) and compare options in a holistic way for the whole life span;

Investigate for new infrastructure and existing infrastructure different ownership models, including private sector possibilities;

Prepare Phase 2 of the Lesotho Highlands Project, for completion in 2020;

Investigate in the coming five years a transfer of surplus effluent from Northern Gauteng to the Lephalale area, supply from the Vaal River to Duva (Witbank), Welkom Virginia and Potchefstroom, a dam on the Mkomazi to supply eThekwini, a dam on the Kouga river to supply Port Elizabeth, increasing the Thukela River project to supply the Richards Bay area, increasing pump capacities to supply the Bloemfontein area;

Finalise construction in 2014 seven augmentation projects among which De Hoop dam for the Olifants river water resources development project, phase 1 of the Mokolo and Crocodile River (West) water augmentation project, the Raising of Hazelmere dam in the Mdloti River Development, the Vaal River Eastern Sub-System Augmentation, the Spring Grove dam as part of the Mooi-Mgeni Transfer Scheme and the Nooitgedagt Low Level Scheme;

Prioritise the development and implementation of the Mzimvubu Dam with associated socio-economic development.

Additional infrastructure for other sources of water; groundwater, water re-use, seawater and rainwater:

Implement the groundwater strategy (35), the water reuse strategy (44) and the desalination strategy (37). These strategies include the following main actions:

- Implement, within 25 years, water re-use infrastructure in all water scarce areas. In the coming five years in particular around the urban centres, further investments need to be done in using new technologies for re-use of waste water and mine water (44);
- Conduct feasibility studies on water re-use options. In the coming five years studies are planned for eThekwini (treated effluent from eThekwini and Kwamashu), Port Elizabeth, Rustenburg, Greater Bloemfontein, East London, George-Mosselbay, Nelspruit-Bosbokrand;
- Develop desalination infrastructure further to decrease financial costs, environmental costs and/or energy reliability to become an even more viable option for coastal metropolitan centres as an alternative to water re-use;
- Innovate further in desalination infrastructure for treatment of acid mine drainage. South Africa intends to become an international leader in the field of treatment of acid mine water and related mining process waters. (37);
- Implement infrastructure for groundwater use on a larger scale, not only in remote areas but also where groundwater use contributes to reliability of supply (35). For some areas additional investments are necessary for treating the water before use;
- Conduct feasibility studies on large scale groundwater supply schemes in the Table Mountain Group Aquifer and the Cape Flats Aquifer, both in the Cape Town Worcester Area in the coming five years;
- Explore further opportunities for rainwater harvesting by all water management authorities (10). DWA remains supporting a national rainwater harvesting programme, which presently has a focus on the construction of above- and below-ground rainwater storage tanks by rural households. This programme should be extended to rainwater harvesting in household and office buildings in affluent neighbourhoods;

Multi-purposes and multi-stakeholders:

Ensure that existing reservoirs, of which the local communities cannot benefit, have the infrastructure and the operational means of supplying basic water needs to these communities;

Take timely cognisance of local needs and communicate clearly with local communities on priorities and options for addressing local needs when planning new infrastructure;

Encourage stakeholders to know and take responsibilities in the use of water services and to prevent costly maintenance;

Promote the use of reservoirs for tourism in order to create economic opportunities for the region;

Implement actively the operational policy for use of water (in dams) for aquaculture purposes together with the Ministry of Agriculture;

Combine the implementation of the Social Assessment and Development framework (45) and the finances available through the regional bulk water infrastructure programme to benefit the communities that are affected by new infrastructure.

2.3 Technical Strategy 2: Climate change

Please note that this strategy is supported by a more detailed operational strategy.

Introduction

South Africa is a water scarce country with a highly variable climate - a situation that will be exacerbated by the effects of climate change (46). The required response to climate change consists of a suite of approaches, measures and actions, ranging from research to planning and implementation, to mitigation, as well as to reducing impacts through effective adaptation to the expected changes. The climate change strategy provides an integrated framework for the response to minimise the overall detrimental impact of climate change and to maximise any beneficial impact.

Situation analysis

The climate change strategy, as reflected in the NWRS 1, acknowledged that climate change should be addressed, but advocated a balanced approach between preparedness and over-reaction. The situation was to be carefully monitored in un-impacted benchmark catchments and assessed for climate-change response measures with each review of the NWRS.

Since then, consciousness of the seriousness of climate change increased, demanding a more pro-active and committed response to its potential impact. Through initiatives such as Towards a Climate Change Response Strategy for the Water Sector (47) and the Water Resource Classification System, DWA positioned itself more purposefully to meet the challenge of climate change adaptation.

The development of a climate change response for the water sector is a requirement of the White Paper on the National Climate Change Response (46).

Key issues

- There is a concern regarding the inadequate momentum towards building the water sector's climate response capability and commitment to timeous action.
- There is an urgent need for improved collaboration between DWA, DEA and other sectors to address climate change.
- IWRM processes are not fully adjusted to build the required resilience and adaptive capacity in society and ecosystems. This includes the presently ineffective implementation of IWRM.
- The inadequacy of the present weather, environmental, hydrological and hydro-geological monitoring systems to facilitate effective climate change management, is a major concern and requires urgent intervention.
- The vulnerability of rural communities to the changing climate and increasing incidence of natural hazards is a risk.
- The available human capacity relating to climate change adaptation is very limited.
- There are research gaps in current Water Sector Climate change programmes.

Vision and objectives

The Vision for the Climate Change Strategy is as follows:

> The vulnerability of people, the ecosystems and the economy for climate change is considered and integrated into both short- and medium-term water sector planning approaches.

In this respect, the key objectives of a climate change strategy for the water sector are the following:

- Integrating climate change considerations in the short-, medium- and long-term water planning processes;
- Implementing the best catchment and water management practices to maximise the degree of water security and resource protection under changing climatic conditions;

- Reducing the vulnerability and enhancing the resilience to water-related impacts of climate change in communities/sectors at greatest risk;
- Providing human, legal, regulatory, institutional, governance and financial resources and capacity to deal with the long-term effects of climate change;
- Undertaking focused monitoring and research in order to ensure the efficacy of water adaptation approaches over the long-term.

Strategic actions

- A balanced approach between preparedness and over-reaction must be maintained.
- The Water Sector Climate Change Response strategy needs to be finalised.
- As hydrological uncertainty is already part of the normal water business, the core of the responses to climate change will be addressed via existing programmes. These activities such as water planning, infrastructure investment, risk and disaster management as well as outcomes based development must be more robust and focussed.
- Responses to climate change must be addressed in catchment strategies, reconciliation strategies and investment planning.
- Invest in skills development and allocate resources for dealing with long term effects of climate change.
- Prioritise monitoring and evaluation with the help of all stakeholders under coordination and leadership of the DWA.

2.4 Technical Strategy 3: Disaster management

Introduction

Water-related disaster management is an important part of the South African water management framework. In terms of the National Water Act, disaster management includes the management of floods and droughts, the prevention of pollution and degradation of water resources and the promotion of dam safety. Failure of water supply has also been identified as a critical risk area for water security. Water-related natural hazards and disasters are, to a very large extent, attributable to extreme climatic events which are manifestations of climate variability, either natural or climate-change induced. These disasters can threaten life, health and livelihoods, especially the poor and vulnerable.

Disaster management intrinsically links with all other strategies contained in the NWRS 2. It should not be viewed as a separate requirement, but woven into the fabric of all strategic, tactical and operational elements of effective water resource management at national, regional and local levels.

The DWA strategic approach to disaster management is informed by various legislation. The National Water Act has an objective of contributing to public safety and security from water-related disasters. The National Disaster Management Framework (NDMF) is a legal instrument specified by the Disaster Management Act, (Act 57 of 2002) to address the need for consistency in disaster risk management across multiple interest groups. The National Water Act, sections 137 to 145 deals in general with water monitoring and information dissemination and in particular with water related disaster information in sections 144 to 145, more specifically in section 144 on 1 in 100 year flood-lines as the responsibility of local authorities.

Situation analysis

The DWA Disaster Management Plan, in line with Section 25 of the Disaster Management Act, has been updated and is being finalised (2011).

The DWA, participates in the Inter-Governmental Committee on Disaster Management, the National Disaster Management Advisory Forum and Joint Operation Centres and DWA Regional Offices participate in Provincial Disaster Management Advisory Forums and Joint Operation Centres.

Present disaster management is challenged by the lack of access to on-time information and dissemination as well as a lack of clarity on roles and responsibilities at all levels. This includes effective communication with water use sectors in respect of possible supply restrictions due to drought, flood and pollutions hazards.

A DWA Emergency Response Facility (Rapid Response Unit) is under development to address infrastructure damage and DWA has also been playing a leading role in establishing the SADC-HYCOS network for essential near real-time flow gauging points in the SADC region.

In the case of droughts, the DWA has developed guidelines for operation of water supply systems during droughts (48), and is developing improved operating rules for various water supply systems, including small and medium dams country wide.

Although only main river systems fall under the jurisdiction of DWA and can thus be regarded as the Department's funded mandate, the National Disaster Management Centre (NDMC) requested DWA to lead the total water spectrum. Clarity is also required on roles and responsibilities regarding water quality management and pollution control. In terms of disaster management, DEA was requested to be the lead agent with DWA in a supportive role.

In order to meets its obligations as lead agent, DWA has established a Flood Management Office responsible for the management of the Vaal-Orange River System, which covers about half of the drainage area of South Africa and directly affects at least four Regional DWA Offices. This service relies on a near real-time network of gauging stations in the catchments as well as a direct link to satellite data via the South African Weather Services. The DWA has a Flood Management Policy and standard operating procedures for the Vaal-Orange System that will also be published as a good Technical Guide to develop specific flood management procedures for the rest of the country's rivers. A Business Continuity centre for the Flood Management Office has also been established at the Vaal Dam.

Outside the Vaal-Orange System, the Regional Offices of the Department assume responsibility for limited flood management aspects in larger rivers within their administrative regions and Regional Disaster Management Plans have been developed in certain regions. Some provinces and municipalities have also developed Disaster Management Plans and executed disaster risk assessments, incorporating inputs from the water sector and water-related hazards.

In the case of dam safety, DWA has a Dam Safety Office to guide and oversee the design, construction and operation of all dams with substantial safety risks in South Africa and it has a Dam Safety Rehabilitation Programme in place. It also has Operating Rules and Emergency Preparedness Plans for all dams with a safety risk.

In the case of pollution, DWA has a current arrangement for all pollution incidents to be reported to DWA so that appropriate responses can be co-ordinated, in conjunction with the NDMC, with the relevant emergency services and disaster management centres. The intention is that this responsibility will ultimately be passed to the CMAs.

Key issues

The following key issues must be addressed to support the implementation of effective disaster management in the water sector at national level:

- There is no clear definition of the roles and responsibilities of all relevant role players in respect of all components of water disasters. DWA to unpack the complete framework and aspects with associated responsibilities such as regional flood management;
- The funding of disaster and disaster risk management initiatives is probably the biggest stumbling block and should receive special attention, looking specifically at “funded” versus “unfunded” mandates;
- The funding of the pro-active approach throughout the disaster management continuum (not only water-related disasters) propagated through current disaster management policies and practices is undefined, slow and bogged down by uncertainties around funding avenues and roles and responsibilities in this respect;
- Limited skills and capacity throughout the water sector, to facilitate effective disaster management;
- Lack of a suitable day-to-day information management platform to share experiences between the hierarchy of water managers, disaster managers and civil society;

- Current standard operating procedures and guidelines pertaining to disaster management in the water sector have not yet been documented and/or integrated.

Vision and objectives

The vision for water-related disaster risk management for the next five years is to:

> Develop and implement integrated, effective disaster risk reduction and disaster management throughout the water sector, thereby contributing to a reduction in water sector-related vulnerabilities and losses

The key objectives are as follows:

- Reduction of the water-related disaster risk by responding appropriately to drought and flood hazards, prevention of pollution and degradation of water resources and promotion of dam safety;
- Enhancement of disaster resilience through ensuring the preparation and implementation of the water sector disaster management plan within the National Disaster Management Framework to ensure coordinated actions by all role-players within government and outside;
- Facilitation of inclusion of water-related disaster management planning and allocation of associated resources (HR skills and budgets) in strategies and business plans of all water management institutions.

Strategic actions

- Prioritise and execute detailed disaster management risk assessments, planning, prevention, mitigation, response, recovery and reconstruction-related activities.
- Clarify roles and responsibilities for water-related disaster management
- Sign and implement Disaster management- related Mutual Aid Agreements and MOUs between role-players.
- Implement the co-operation, effective communication and information management for all institutions, stakeholders and role players.

- Develop an information sharing platform to support all aspects of water related disaster management continuum.
- Facilitate training, capacity building and research on disaster management in water sector institutions.

2.5 Technical Strategy 4: Groundwater development and management

Please note that this strategy is supported by a more detailed operational strategy.

Introduction

Groundwater in South Africa is an important resource for all sectors ranging from agriculture to domestic water supplies. Groundwater will make greater contributions to the nation's water supplies in future as surface water gets closer to the limits of its development and availability.

There is extensive potential available for further development of groundwater resources in South Africa (10). The development of this resource will be crucial for sustaining water security of small towns and villages, as well as augmenting water supplies to larger urban centres and agricultural development.

Situation analysis

Groundwater provides reliable, safe drinking water supplies to rural areas and many towns in South Africa. Even large cities such as the Tshwane metropolitan area are partly dependent on groundwater. Thousands of hectares of valuable arable land are also irrigated using groundwater, large numbers of livestock and game are supplied from groundwater and many mines and industries rely on groundwater for their water supply.

The DWA completed South Africa's first detailed National Groundwater Strategy (NGS) in February 2011 (35) following a three-year consultative process that included series of detailed studies

Artificial recharge is growing in importance in South Africa. Essentially, it is the process whereby surplus surface water is transferred underground to be stored in an aquifer. The

most common methods used involve injecting water into boreholes and transferring water into spreading basins where it infiltrates the subsurface. Underground water storage is an efficient way to store water because it is not vulnerable to evaporation losses and it is relatively safe from contamination. Internationally, artificial recharge is becoming an increasingly recognised form of water storage and conservation. DWA recently developed an Artificial Recharge Strategy as part of the NGS (49).

Key issues

Key to the sustainable use and management of groundwater resources in South Africa is implementation of the National Water Act and the NGS at local, regional and national levels. The following issues need to be addressed in particular:

- Poor coordination of groundwater development: the resource is often not given due consideration by planners and municipalities;
- Backlog in issuing groundwater licenses which means that water use is taking place without proper regulation. There are also challenges in dealing with illegal water use, and the possible penalties are not widely understood;
- Lack of verification of water use making effectively regulation of water use difficult. Although all users are required to register existing lawful use, and most have done so, only about 20% of this use has thus far been verified;
- Weak enforcement of water use licensing conditions. This is mainly due to the limited capacity within the DWA and especially concerns local government as a groundwater user;
- Waste discharge charge system, based on the polluter pays principle, is not yet implemented;
- Groundwater pollution such as Acid mine drainage (AMD) is not being addressed effectively. A comprehensive water policy framework is lacking that deals with groundwater issues at potential new mines, as well as abandoned and derelict mines. Furthermore, control of groundwater pollution is hampered by a limited (and in some cases deteriorating) groundwater monitoring network; and
- Inadequate regulatory oversight in the form of standards setting, monitoring of performance, and setting of prices of the groundwater component of infrastructure.

There is clearly a need to make increased and better use of South Africa's groundwater resources to avoid expensive water infrastructure developments, as well as to help to secure water supplies and improve access for communities to a safe supply of water. Better use of

groundwater will help solving problems of current water shortages and ensuring that water is also available to meet future increases in demand.

Vision and objectives

The Vision of the National Groundwater Strategy (NGS) is as follows:

> Groundwater is recognised, utilised and protected as an integral part of South Africa's water resource.

This strategy has the following objectives:

- Groundwater is recognised as an important strategic water resource in South Africa, within an integrated water resource management approach.
- The knowledge and use of groundwater is increased along with the capacity to ensure sustainable management.
- Better groundwater management programmes are developed and implemented at required water resource management levels, tailored to local quantity and quality requirements.

A series of themes with associate strategic actions are outlined below which are necessary to realise the vision for groundwater in South Africa. These measures should be championed by DWA, but will obviously require inter-departmental and multi-sectoral cooperation.

Strategic actions

The NGS is divided into a series of themes or chapters, each of which has a number of recommended strategic actions which address the challenges raised in each of the themes. The most important strategic actions for each theme are presented below:

Policy, Legislation and Regulation

- Process and evaluate all groundwater water use license applications within six months;
- Ensure that all larger groundwater users are registered and possess water use licenses;
- Verify existing groundwater use within a 5 year time period; and
- Ensure that borehole drillers are registered with DWA, and submit drilling data from all boreholes drilled.

Water Resources Planning

- Conduct groundwater resource assessments at a level comparable with other water resource assessments (e.g. assessment of surface water potential);
- Implement groundwater development programmes for domestic and productive water use to support national imperatives;
- Update figures on groundwater availability and use as new data becomes available;
- Establish guidelines for the groundwater content of Internal Strategic Perspectives and emerging catchment management strategies; and
- Develop and implement best practice guidelines on groundwater management and protection for the municipal, agricultural, energy and forestry sectors.

Human Capacity

- Develop adequate capacity within DWA and the sector to ensure effective its groundwater management;
- Develop and implement a national capacity building strategy;
- Mobilise private sector support where necessary to capacitate regional offices; and
- Implement practical, in-service training courses on priority aspects (e.g. licensing process, the Reserve, groundwater monitoring, etc) for DWA staff.

Sustainable Groundwater Management

- Ensure the implementation of existing strategies, regulations and guidelines on groundwater management such as the Artificial Recharge strategy and others; and
- Establish a Groundwater Resource Management section within DWA which will ensure support to water services institutions in the operation, maintenance and management of groundwater supply schemes. Functions must include the evaluation of artificial recharge and conjunctive use schemes.

Institutional Capacity

- Capacitate and provide adequate resources to the DWA Regional Offices to fulfill their mandatory water resource management functions;
- Improve cooperation and coordination within DWA, and between government departments and the private sector to leverage available capacity and resources;
- Incorporate the All Town Studies Reconciliation Strategies into the IDPs and WSDPs;
- Provide strategic support to water services institutions to develop business plans (i.e. WSDPs) for groundwater development, management and monitoring as well as for the operation and maintenance of groundwater infrastructure; and
- Clearly define and streamline roles and responsibilities for groundwater development and management, including monitoring of groundwater abstraction and quality, and improve the maintenance and operation of groundwater infrastructure across sectors.

Information Management

- Finalise the National Groundwater Archive (NGA) as well as the adoption of measures to incorporate privately held datasets, including the registration of drillers. Improve data accessibility, compatibility and exchange need, e.g. through standardisation of data submission forms; and
- Develop and implement an integrated groundwater information system to support water services provision at municipal level.

Groundwater Research

- Continue to support groundwater research capacity at tertiary institutions by DWA and the Water Research Commission (WRC), and prioritise research projects which directly address strategic national objectives, including issues identified as bottlenecks in groundwater management or delivery;
- Improve the dissemination and implementation of research products;
- Regularly assess the impact of research investment in groundwater; and
- Emphasise the strategic leveraging of resources between the WRC, DWA, NRF and the alignment of strategic objectives for groundwater management between the WRC and DWA, e.g. the development and roll-out of strategies supported by implementation programmes.

Communication and Awareness

- Develop a professional marketing and communication plan focusing on successful groundwater use and management

2.6 Technical Strategy 5: Water Resources System Operations

Introduction

The Water Resources Systems Operation Sub Strategy forms an integral part of the NWRS2. It is one of the strategies that will implement the operational aspects of the cross cutting core strategies as well as some aspects of a number of the technical implementing strategies. This strategy will therefore integrate and give effect to the combined directives of the guiding strategies and guide the development of operating procedures based on a "good practice" approach for managing water abstractions, transfers releases and restrictions in order to ensure the equitable supply of water and mitigation against risk of failure of water resources during drought conditions.

Situation analysis

Operating rules for water resources are instructions for implementing regulations of the resources in order to match availability with requirements. These rules are optimised by determining the best balance between the following, sometimes conflicting, requirements:

- Present and future availability of water based on the catchment hydrology and risks;
- The variability of water from year to year and possible restrictions during droughts;
- The optimal conjunctive use from a range of available water resources;
- Water conservation and demand management guidelines for the specific catchment;
- Water requirements by users as determined by the catchment strategy and licensing;
- The required assurances of water requirements;
- Resource quality objectives, reserve requirements and environmental obligations;
- Supply to local users and communities in the immediate vicinity of the system;
- Requirements specific to the infrastructure, its safety, capacity and physical limitations;
- Minimising losses (spillage and evaporation), and costs (pumping and maintenance);
- Meeting international obligations regarding quality, base flow, total releases and floods.

Operators of water resources infrastructure have failed in a number of cases to document and implement formal operating rules. This situation could deteriorate with the continued

decentralisation of infrastructure management to water boards, water use associations and local authorities.

A number of documents have already been developed to address the situation, namely *Guidelines for Water Supply Systems Operation and Management Plans During Normal and Drought Conditions* in October 2006 and the *Infrastructure Asset Management Policy for the Water Trading Entity* that was completed late in 2007. Lately, the department has also developed the *Departmental Disaster Management Plan* as well a guideline to Flood Management that should be available shortly.

The lack of adequate skills and human resources in most cases is also a serious problem.

Key issues

Water requirements are progressively increasing with lesser opportunities to supplement the present supply by extending the present infrastructural assets. For this, and a number of other reasons, the optimal operation of water resources infrastructure to address a number of sometimes conflicting requirements requires an increasingly sophisticated approach based on a wider range of increasingly more precise information.

Although there are still a number of simple or single systems operated, the general trend is for these systems to become increasingly complex, diverse and interconnected, which not only requires a standardised approach to their specific and customised operating rules, but it also providing increasing numbers of options and alternatives which need multi criteria decisions and decision support systems supported by a wide spectrum of information and communication systems..

The lack of a national guiding strategy to guide and manage the development, application and evaluation of water resources operating rules has already been identified at an early stage. Since the publication of the first NWRS, the Department has already developed and implemented the *Guidelines for Water Supply Systems Operation* mentioned earlier. As a priority, the operating rules for larger and more complex systems were first revised and updated according to the guidelines. These are the Western Cape Supply System, the Amatole Water Supply System and the Integrated Vaal River System.

The guidelines are based on a number of key principles based on normal climatic, drought and flood conditions, water quality requirements (mixing bad with fresh water), infrastructure and maintenance requirements, conjunctive use, resource protection, capacity building, stakeholder participation and communication.

Important features of operating rules developed under these guidelines are the resource and infrastructure configurations, the short and medium term water availability, the water

requirement schedules, a specific (customised) Operating Decision Support System, Annual Operating Rules (the AOR, an operating protocol for the hydrological year), monitoring systems, and Early Warning System, a specific "decision month" in which the water budget is presented to stakeholders and the institutional and communication arrangements which includes the Stakeholder Operating Forum.

The final, though very important feature of these rules are the arrangements for monitoring and auditing the assumptions under which the AOR was developed and includes the maintenance of proper records regarding resource levels, quality trends, abstractions, reserve compliance, returns flows and compliance with restrictions (when relevant), state of the infrastructure and the performance of the system, with appropriate feedback to the Decision Support System to indicate where actions are required.

Developing the operational rules for a specific system is guided by a set of 19 steps that integrates the water management tools that has been developed over the years within the new institutional framework which requires a decentralised and participatory approach.

It is further important that these guidelines are reviewed form time to time as their implementation takes place over a period of time and not only will new needs be identified to be accommodated in future, it will also identify shortcomings or oversights in the present approach. Feedback from the monitoring and information systems will be critical in such an approach.

Vision and objectives

Adequate operating rules for all water resources systems in South Africa to ensure efficient supply systems during normal, drought and flood conditions in full participation of all stakeholders.

- The systematic development and implementation of operating rules for al water supply systems in South Africa, including those shared with other countries.
- Review of the guidelines on a regular basis based on the national oversight over the operation of all water supply systems.
- Adequate monitoring and data collection to support the operation of the systems, auditing their operations and to review the adequacy of the guidelines.
- The development of an adequate and well-staffed establishment with the required skills to execute and supervise the various actions required in the operational plans.

Strategic actions

1. Implement the guidelines systematically for all water resources supply systems in South Africa according to a list of national priorities, including those shared with other countries where cooperative structures are required

2. Ensure adequate monitoring, early warning and decision support systems for each of the water supply systems with sufficient provision made for the orderly processing and secure storage of the data and information collected and processed.

3. Ensure that the data and information collected for each water supply system is captured and accessible at national level for performance auditing and the revision of the national guidelines when required

2.7 Technical Strategy 6: Desalination

Successful implementation of desalination is critical to our water future

National government recognizes that desalination will play an important role in South Africa's future water security. The DWA will ensure that desalination is properly considered as an option for meeting future water requirements in its integrated water resource planning processes, and will actively promote and support the development and implementation of desalination projects where these projects compare favourably to other alternative options, taking into account the benefits of the diversity of water supply in the context of increased climate change risk.

Integrating energy and water planning

National government, through the National Planning Commission, and together with DWA, DOE, DPE and Eskom, will ensure strong integration of the medium and long term energy and water planning. Particular attention will be paid to the potential for desalination of seawater for coastal cities in relation to a possible expansion of nuclear power generation, vis-à-vis other power generation alternatives and their implications for water planning.

Water quality regulations

Desalination treatment and use of desalinated water may in some instances involve re-use of effluents. The desalination of brackish water, mine water, industrial effluents, municipal treated effluents and seawater introduces new water quality issues. South African standards on reclaimed and re-use water quality are required for different categories of water use. The re-use water standards must be integrated with the other national guidelines and standards on water quality. Water quality issues pertaining to water re-use will be addressed in DWA's proposed water re-use strategy.

Streamlining regulatory approval processes

DWA will work with DEA and other relevant departments to develop an integrated and more streamlined and time-effective approach to regulatory approval of desalination of water. This requires a specific focus on seawater desalination, where current regulatory approval processes are unclear. DWA will develop a guideline on an integrated regulatory approval process which will include:

- The parallel and integrated consideration and approval of licences and permits in terms of the different Acts and associated regulations.
- The appropriate sequencing and scheduling of parallel authorization processes.
- The potential for a lead agent, being the Department of Water Affairs to coordinate and expedite the different regulatory authorization processes.
- The need for a unique public participation and stakeholder engagement process to support all the different authorization processes.

Research and development

DWA will work with the WRC, DST and DTI to support the development of desalination technologies where South Africa has comparative advantages, especially in desalination processes related to mining and industry, including investigating the establishment of a centre of expertise and excellence at one or more universities. The objective of the research and development will be to develop technologies and processes that can be commercialised and applied to the different scales of desalination projects.

Particular attention will be paid to the following areas:

- Acid mine drainage and other saline mine waters.
- Mining and industrial process effluents.
- Investigating the technical and environmental feasibility and preparing guidelines for the establishment of saline surface pans or lakes as regional facilities for brine disposal.
- Investigating the technical and environmental feasibility and preparing guidelines for brine disposal in deep underground mining voids and workings.

- Investigating the technical and financial feasibility of recovering useful and saleable products from desalination waste streams.
- Supporting research into and the development of more energy efficient desalination technologies.

Financing desalination projects

Water infrastructure in South Africa is mainly funded by a combination of loans raised on the basis of user charges (water tariffs) and government grants (primarily through the municipal infrastructure grants and regional bulk infrastructure grants). At present there is little private investment in water infrastructure.

Desalination projects, especially large scale projects, lend themselves to loan financing due to the secure nature of the revenue streams that can be generated from the sale of desalinated water. In an environment where government grants and borrowing capability are constrained, the option of using privately raised loan finance (that is, project finance) for the development of large-scale desalination facilities will be explored. Typically this can be achieved through design-build-operate type contracts (or variations of this type of contract) with the private sector.

DWA will also investigate the possible use of revenues raised through the Waste Discharge Charge System (once implemented) to fund or contribute towards the financing of desalination projects.

Who should implement desalination projects?

Trusted and capable water institutions are required to successfully plan and implement desalination projects. Such water institutions must also have the capability and credibility to operate and maintain desalination projects. The public trust in such institutions must be high, since these projects may impact negatively on water users if not properly operated and maintained.

Large metropolitan municipalities and water boards with a proven track record in the implementation of large water treatment projects must be positioned to implement

desalination projects. Selected local municipalities and district municipalities with a threshold of engineering operations and project management capacity on complicated water resource development and water treatment schemes may also be considered to implement desalination projects.

Mines and industry already have the capacity, knowledge and expertise to implement desalination projects. Public sector institutions/agencies must leverage on the South African private sector ability to implement such projects.

Careful consideration must be given to the mobilisation of private sector skills, experience and capacity in the implementation of desalination projects. This is especially the case for large-scale desalination installations. In the case of mine water, it makes sense to involve the private sector and to promote private sector participation in these projects.

Implementing large-scale sea water desalination projects

DWA will consider developing expertise for the implementation of large scale desalination projects, aim to maximize the use of project-finance in these projects (off-budget loan finance), ensure capable, credible, reliable and competitive technology suppliers are used, oversee the development of a standard contracting model for these projects and improve and optimize the contracting model over time, and ensure reliable operating arrangements.

Desalinating and treating acid mine water

DWA will work with DST, DTI, WRC and the private sector with the aim of South Africa becoming an international leader in the field of the treatment and desalination of acid mine water and related mining process waters, through applied research and investing in local technology. Treatment processes will seek to maximize the benefits from extracting useful by-products from the waste streams. The use of private sector finance and skills will be promoted, while protecting the public interest. Regional economies of scale will be sought where possible. Public-private partnerships will be developed to find and implement solutions.

Development of skills and local capacity

Competent project management, engineering, operations and maintenance expertise must be available to implement desalination projects. This is a relatively new technological field in South Africa, and professional and trade organisations, academic and training institutions must incorporate desalination science and technology into their curricula. Training of process operations staff, mechanical, and electrical and instrumentation maintenance staff in desalination technology is required.

Desalination plants require a substantial capital investment and competent and skilled operations and maintenance personnel are required to protect and extend the life of these assets.

Increasing public awareness and acceptance

DWA will:

- Disseminate information on water desalination to the public, and will prepare and distribute desalination information packs at water events such as the National Water Week.
- Incorporate desalination in general water use awareness campaigns.
- Motivate water institutions and professional and trade associations to disseminate information on desalination and to develop skills relevant to desalination projects.
- Encourage desalination project developers to make desalination related education and information materials available to the public.

Developing guidelines

The Department will develop additional guidelines for the implementation of desalination projects as necessary and appropriate. These guidelines will address topics, such as:

- Selection of appropriate technology and equipment.
- Capital and capital replacement costs.
- Operations and maintenance costs.
- Management, operations and maintenance staffing and resources requirements.

- Financing of projects.
- Tariff development and implementation.
- Public and consumer communications and outreach programmes.

2.8 Technical Strategy 7: Water Re-Use

Promoting sound decision making

The implementation of water re-use can take place at different scales or levels: at a local level involving a single facility such as a building or a factory, for a group or cluster of facilities, at a treatment facility level (for example, such as a municipal treatment works) or at a river system level (natural drainage areas/catchments). Decision-making will vary across these applications and could involve individual or groups of households or businesses, municipalities and national government (including entities owned by government).

The intent of the water re-use strategy is to encourage wise decisions relating to water re-use for all of these different decision makers. There are three important factors that can enable and support good decision making:

- A sound and clear policy and legislative framework, that is, decision-makers and water users know what their rights and obligations are, and what they can and cannot do.
- The benefits and costs are clearly understood, and prices and costs accurately reflect the relative benefits and costs between alternatives so that incentives are clear.
- Decision makers have access to relevant information and support to make informed decisions, with the necessary support and backup to implement water re-use projects.

Each of these aspects is addressed in further detail below.

Creating a clear policy and legislative environment

Water re-use projects typically involve a range of activities that are subject to regulatory authorization and control. These controls include, but are not limited to the National Water Act, Act 36 of 1998, the Mineral and Petroleum Resources Development Act, Act 28 of 2002,

the National Environmental Management Act, Act 107 of 1998, the National Environmental Management: Waste Act, Act 59 of 2008, the Water Services Act, 108 of 1997, the National Environmental Management: Integrated Coastal Management Act, Act 24 of 2008, and municipal by-laws.

The fact that these controls exist in so many different acts, and that regulatory approaches may differ between the acts, makes it difficult to implement water re-use projects confidently, speedily and cost-effectively. This makes water re-use projects less favourable compared to other alternatives, even where it is practical and cost-effective to re-use wastewater.

The Department will address this issue by:

- Developing clear and practical guidelines for typical water re-use projects on what regulatory approvals are needed, the status of reclaimed water in terms of right to use and how these can be obtained cost and time effectively (see 'guidelines' below);
- Working with other national departments to align legislation, reduce the regulatory burden wherever practical, and unblock regulatory obstacles to water re-use;
- Act as the lead regulatory authority to assist in working with other Departments in getting approval for justifiable water re-use projects;
- Working with municipalities to ensure that municipal by-laws support the appropriate re-use of water;
- Ensuring that the water quality standards implemented are appropriate in a context where water re-use is a strategic imperative (see 'reviewing water quality standards' below);
- Use the water licensing process as a key tool to promote water use efficiency; and
- Implement the waste discharge charge system.

The Department will also review water related laws and regulations to assess the need for revision driven by water re-use. Legislation may then be revised to accommodate the need to facilitate, streamline, encourage and control water re-use projects.

Reviewing water quality standards

Water quality standards for discharges into the water resource and water quality standards and regulations for different types of water use (for example minimum standards for potable

water use, irrigation use for food and non-food crops) play a large role in influencing water re-use decisions. It is important that these standards are not so onerous that they make treatment for re-use prohibitively expensive and not so lax that they compromise public safety and the environment. This is a complex area of regulation and a lot of attention has already been paid to this in South Africa.

The following standards exist:

- South African Water Quality Guidelines for a number of different water user sectors (59);
- Drinking water quality standards (SANS 241) (60) (61), and the
- General and Special Standards pertaining to the discharge of treated wastewater to the water resource.

These standards and guidelines were not specifically developed to address the issues associated with water re-use. Worldwide research into water re-use is producing new information, which needs to be considered in guiding and regulating water re-use projects. The Department will review and/or develop standards and guidelines for water re-use.

Water re-use projects may be implemented for a large spectrum of potential water users. The different categories / types of water re-use will require quantitative standards to define and manage their fitness for use. The standards must be developed to address the following aspects:

- Water quality variables of concern in a specific water re-use application;
- Quantification of risk and acceptable risk levels; and
- Monitoring requirements in terms of water quality variables, frequency and location of sampling / analysis.

Clear incentives

Water re-use projects are much more likely to be implemented where it is more cost-effective compared to other water supply alternatives. Households and businesses have limited budgets and will generally choose least cost options to meet their water use needs. Similarly, municipalities are resource constrained and typically opt for least cost choices

related to securing water supplies for their residents in order to limit water price and municipal rates increases.

Sound water re-use outcomes will arise where the relative costs and benefits of alternatives are not distorted. Where fresh water supplies are heavily subsidised, water users are much less likely to choose water re-use options even if these options are cost-competitive with the cost of securing additional fresh water supplies. Conversely, subsidising the re-use of water is unlikely to lead to least-cost outcomes and the efficient allocation of resources.

The Department will take the importance of price signals and incentives in water re-use decisions into account when reviewing the raw water pricing strategy.

Information to support sound decision making and implementation

The Department recognizes the important role that good information plays in supporting sound decisions. There are three aspects of information to consider: educating users with respect to the benefits and acceptance of water re-use; providing people who are considering water re-use with clear guidelines on how to implement water re-use projects, and sound methodology in the evaluation of options to balance water requirements and supply.

Methodologies for evaluating water resource development options

Water resource reconciliation studies undertaken for specific catchments and water systems in South Africa routinely consider conventional water supply augmentation options alongside water re-use, desalination and water conservation and demand management options.

The Department will continue to develop and refine the methodologies used to assess options to ensure that options are evaluated on a comparable basis and that the methodologies employed support sound decision making.

Guidelines for implementing water re-use projects

The Department will develop guidelines for the implementation of water re-use projects. These guidelines will support sound decision making and implementation. The guidelines will address the choice of technology, management and control, project implementation, operations and maintenance, project financing, development and implementation of tariffs and public and stakeholder education, engagement and consultation. Separate guidelines will be developed for different types of water re-use projects.

Technology selection

The selection and implementation of the appropriate treatment technology are key to the successful implementation of water re-use projects. It is strategically important to achieve this objective by:

- Selecting capable agencies/organisations with knowledgeable and competent staff to implement re-use projects;
- Planning and executing the procurement of technology with the appropriate emphasis on functionality and proven performance;
- Ensuring that local knowledge of and support for the technology are available; and
- Providing technology guidance and training to re-use project implementing agencies/organisations.

Public education and awareness

The concept and implementation of water re-use will require a focused and sustained public education program to develop and entrench awareness of the different facets of water use and specifically water re-use.

Multiple awareness creation and information campaigns related to a spectrum of water related matters are launched by the Department, public institutions and private companies each year. It is important to develop and incorporate communication material related to water re-use into these campaigns.

Public perceptions and opinions vary on the topic of water re-use, specifically as it relates to indirect or direct water re-use. A structured communication strategy must be developed and implemented based on:

- An understanding of the diversity of perceptions and opinions;
- Appropriate material to inform the public and stakeholders;
- Active communication and debate on the topic; and
- Targeted media coverage.

The overall objective of public awareness creation and information dissemination programs is to enhance the understanding and promote informed decision making related to water re-use.

The current public perceptions and awareness of the poor operation, maintenance and performance of municipal wastewater treatment plants pose a specific challenge. It will be difficult to gather support for water re-use within the current situation. The national efforts to address the poor performance of municipal wastewater and effluent treatment plants may have to show results on a consistent basis, before placing water re-use onto the national water agenda.

Technology innovation and development

A range of water re-use projects have been implemented in South Africa (see Appendix A). South Africa has the potential to be a leading innovator in water re-use technology, particularly in the area of the treatment of acid mine drainage. The Department will encourage the WRC to make water re-use technology development a key focus area, and encourage the development of centres of excellence at selected universities.

Capacity to implement

Competent implementing agencies

Water re-use projects have many sophisticated technical, engineering, financial, operational and maintenance aspects. A key consideration to any such project is the fact that the water typically has to be treated to improve its quality before it is fit for re-use by a downstream user. The downstream user must be guaranteed an appropriate quality of water to protect the designated use of the water. Re-use projects therefore require a high level of confidence in the implementation and operating agencies.

A public sector agency, such as a municipality or water board must have a minimum threshold of capacity and competency, (in terms of technical expertise, planning ability, project management capability, financial strength and rating), be a trusted water services deliverer and be accepted by the community and stakeholders as a reliable organization, before it can be considered as capable of implementing a water re-use project.

An agency/organisation must be able to demonstrate the capability to implement water re-use projects. It is therefore likely that the agencies and organisations with an acceptable capability and capacity profile to implement water re-use projects would be limited to metropolitan municipalities, water boards, larger local municipalities, private companies specialised in the water sector and public private partnerships.

Private sector management, engineering and financing capacity, as demonstrated by several successful water re-use projects in mining and industry is well established in South Africa. International interest in local water re-use projects has been expressed. The substantial private sector capacity must be leveraged in the implementation of water re-use projects.

The Department will investigate, together with established professional bodies in the water sector; the merits of establishing an industry-agreed evaluation/accreditation system for agencies/organisations implementing water re-use projects.

Developing the necessary skills for operating and maintaining water re-use systems

Water re-use projects will typically incorporate more sophisticated treatment technology and systems compared to conventional fresh water and groundwater treatment. Such projects will fail unless trained, knowledgeable and motivated operations and maintenance staff is available. It is strategically important to implement the following actions:

- Prepare an assessment of the current and future skilled and trained people needed to operate water reclamation, water recycling and water re-use projects;
- Encourage water services authorities and water services providers to consider and plan for the staffing and training needs to support water re-use projects; and
- Alert training and educational institutions in the water sector of growing needs for trained and skilled operations and maintenance staff.

The planning and implementation of water re-use projects must also include a comprehensive assessment of operations and maintenance aspects, including staffing, resources and system requirements.

Financing water re-use projects

Water re-use projects can be financed through the Municipal Infrastructure Grant, loans from development and commercial banks, project financing linked to public-private partnerships and through bonds issued by agencies such as the Trans Caledon Transfer Authority (TCTA). The waste discharge charge can also provide a source of funding for water re-use projects. This may specifically apply to indirect water re-use projects, where an upstream wastewater discharge containing residual waste is re-used by a downstream water user. The downstream user may have to implement relatively sophisticated and expensive water treatment technology and systems to produce water fit for use. The income generated by the waste discharge charge system may be applied to offset the incremental treatment cost associated with a re-use project.

Financing considerations are similar to those for other water resource development projects except that the risk profile of the project may be different.

Tariffs can be applied specifically for different water re-use applications. Tariff setting may be subject to the National Water Act (Act No. 36 of 1998), the Water Services Act (Act No 108 of 1997), the Municipal Systems Act (Act No. 32 of 2000) and the Public and Municipal Financial Management Acts (Act No. 1 of 1999), depending on the specific application.

Enforcement

The performance of existing wastewater treatment plants in terms of meeting discharge standards and reliability is critical to the successful application of water re-use in South Africa. These facilities discharge water that impacts on the safety, economy and fitness for use by downstream users. Strict enforcement of discharge standards, and addressing the management and performance failures of municipal run wastewater treatment plans is therefore critical to the future of indirect water re-use.

Recognition of Success

South Africa has implemented a number of successful water reclamation and re-use projects in diverse sectors of the economy. It is also necessary to recognize water re-use as an important aspect of the efficient and responsible provision of water services. Consideration may in future be given to “purple drop” recognition of safe and successful water re-use projects and operations, similar to the blue drop and green drop awards.

3. ENABLING STRATEGIES

3.1 Enabling Strategy 1: Water finance and funding

Introduction

Without adequate funding for the development and management of water infrastructure and improved revenue collection from water users, it will not be possible to achieve the national development goals, such the job creation targets of the New Growth Path which are heavily dependent on water availability (Agriculture, Mining, Manufacturing, etc.). The water finance and funding strategy underpins all the strategic goals of NWRS 2.

The National Water Act of 1998 makes provision for the three types of water use charges, namely, water resource management charge, water resource development and use charge, and charge for achieving equitable and efficient allocation of water. The objective of the water pricing strategy is to promote financial sustainability and economic efficiency in water use. The Act also makes provision for financial assistance in the form of grants, loans or subsidies.

The need to maximise the benefits arising from the use of existing water resources, to reduce losses and wastage, to increase efficiency of use, to develop new and more expensive sources (including, for example, the desalination of sea water), to re-use treated wastewater much more extensively, and to manage water quality more actively will increase both infrastructure and ongoing management and operating costs significantly in future.

Situation analysis

A Pricing Strategy for abstracting and storing water, and stream flow reduction activities was first established by the publication of Government Notice No. 1353 of 12 November 1999 and a revised Raw Water Pricing Strategy was published in 2007. Key changes are noted below:

Water resource management charges

The setting of charges and collection of revenue has not yet been delegated to CMAs as envisaged in the 2004 NWRS. In the 1999 Pricing Strategy, provision was made for phasing in the charges over a five year period for commercial irrigation, the subsidisation of charge at a decreasing rate for emerging farmers and a capping of price increases. The original intention was that the Water Resource Management Charge would be the primary source of funding water resource management costs but this has not yet been implemented.

Water resource development charges

In the 1999 Pricing Strategy, the return on asset (ROA) was applied only to government-funded water schemes and not off-budget funded schemes (that is, those managed by TCTA). In the amended 2007 Strategy, provision is made for the ROA charge to be applied to off-budget funded schemes once the loan on the scheme has been repaid.

Waste discharge charge

The 2004 NWRS noted that a system for charging for waste discharge was being developed as an instrument to encourage major polluters to find ways to reduce their impact on the resource. It set out the scope and broad approach to be adopted for these charges, including the components of the charges and how the revenue would be used. It was anticipated that the charges would be promulgated in 2006 (NWRS, 2004: 84), but to date this system has not yet been implemented.

Funding, implementation and financial management

A set of funding requirements (for infrastructure projects) were identified in the 2004 NWRS in relation to a proposed set of projects. A number of water infrastructure projects were initiated in the period and some have been completed. A comprehensive asset register was developed, and assets have been re-valued in terms of the current replacement cost and depreciated current cost (first in March 2000 and then again in March 2008). Progress has been made with the registration of water use and billing of water users.

Funding practice

The Pricing Strategy makes provision for a 4% return on the depreciated replacement cost of assets. Application of this to DWA's total water resource infrastructure assets would achieve an income of R2.2 billion per annum. However, actual revenue is much less than this due to

the fact that most irrigation users are exempted (except for new schemes for established commercial farmers) and also as a result of caps on annual increases applied to users. Hence, in practice, there is still a heavy reliance on the state funding of water resource infrastructure. The practical implication of this is that funds are typically insufficient to meet both expansion needs as well the rehabilitation of existing assets.

Revenue

The Water Trading Entity is responsible for the operation and maintenance of water resource infrastructure and revenue collection. Revenue from the depreciation, return on assets and operating components of water resource development charges, together with water resource management charges was R1.6 billion in 2009/10, up from R1.1 billion the previous year. Direct operating costs (excluding the depreciation charge) totalled R2.3 billion in 2009/10. In other words, revenues were insufficient to cover direct operating expenses before any capital charges are taken into account (depreciation of R1.4 billion and an estimated theoretical return on assets of R0.9 billion for non-irrigation assets).[2]

TCTA funds and implements elements of the National Water Resource Infrastructure, where the Department of Water Affairs has decided that the revenues generated by the consumer base are strong enough to repay the individual project borrowings, as well as the operational costs. Hence TCTA raises sufficient revenue to meets its costs, including its debt financing obligations. TCTA revenue from user charges in 2009/10 financial year was R2.7 billion.

Key issues

The following key issues must be addressed in order to achieve financial sustainability and efficient water use by all sectors:

- Current capital spending on infrastructure is inadequate;
- Financial management systems need further improvement;
- Water use measurements are not sufficient for revenue collection;
- Revenues are insufficient to meet costs;

[2] Assuming 40% of assets are for non-agricultural sector.

- Price capping has resulted in a revenue shortfall;
- Financial requirements will increase significantly in the future;
- The waste discharge charge system is yet to be implemented;
- The economic charge is yet to be implemented;
- Water tariffs do not reflect the full cost of water resource development and management.

Vision and objectives

The Vision for the strategy is:

A financially sustainable water sector

This can be realised through setting water tariffs that reflect the full cost of water while also making provision for subsidies for supporting productive use of water by the emerging farmers and poor communities. Significant increase in funding for water infrastructure and improvement in revenue collection will be critical to the achievement of this vision.

The specific objectives of the strategy are the following:

- *Water resource management activities are financially sustainable* - There is sufficient funding and revenue collection to support the development of water infrastructure, asset management, protection of water resources and other water management activities necessary to effectively manage water resources

- *Water is priced appropriately and subsidies are well targeted and sustainable* - Water pricing and subsidies are implemented in a way which raises the necessary revenues to ensure financial sustainability, provides appropriate signals with respect to the cost and value of water, and allocates subsidies effectively and is fairly based on a sound understanding of the social and environmental benefits of water use.

- *Water is valued and used wisely* - Water is priced in accordance with its social, economic and environmental value. Appropriate water conservation and water demand management measures are implemented. Users are aware of the value of water and know how to use

water wisely. Efficient and wise use of water is promoted and supported with appropriate incentives. Water and energy efficiency are integrated in all new property development projects to reduce both the water and carbon footprints.

Strategic actions

- Improve revenue collection to meet the operating expenses.
- Review of the pricing strategy to address the price capping, implementation of the waste discharge charge system and introduction of the economic charge.
- Include a charge for operation and maintenance and infrastructure expansion in the raw water tariffs so that a dedicated fund for asset management can be established.
- Pilot the implementation of the waste discharge system in highly polluted catchments.
- Improve financial management systems.
- Improve customer database management.
- Establish economic regulator.
- Develop appropriate funding models for the development of infrastructure.
- Implement appropriate economic instruments to promote water conservation and water demand management in all major sectors.
- Prioritise the investment in the refurbishment and upgrading of wastewater treatment plants in order to prevent pollution of water resources.

3.2 2. Enabling Strategy 2: Water sector capacity building

Introduction

Sustainable development and management of South Africa's limited water resources will not be achieved without the drive and support of a professionally competent and dedicated cadre of engineers, academics (natural and social sciences), technicians, managers and administrators. The water sector capacity building strategy is a cross-cutting strategy and is central to the achievement of all the strategic goals of the NWRS 2. It provides a basis for:

- Coordinated processes and initiatives with short, medium and long-term approaches that will result in a drastic decrease in skills shortage in critical technical and management areas;
- A responsive and flexible capacity building framework that will respond to an ever-changing and dynamic socio-economic and natural environment;
- An orientation to water resource management that relates to the demands for growth, development, sustainable livelihoods and human security in support of a stable democracy.

Situation analysis

Despite a decade of the implementation of the Sector Education and Training Authority (SETA) initiatives, numerous assessments, strategies and training initiatives, water sector skills shortages remain and the relevance, quality and sustainability of capacity building and training programmes are still questioned. Some of the challenges include the lack of a sector validated skills planning framework as well as inadequate coordination and quality assurance mechanisms. This has resulted in disparate databases for skills planning, a plethora of organisations and institutions that are developing and providing training courses and qualifications and certificates that often offer little by way of articulation, career progression and specific skills enhancement.

An assessment of progress in water sector capacity building since 2004 identified the following:

- The Water Sector Capacity Building Strategy that was planned in the 2004 NWRS has not made any significant progress in reversing the challenge of skills shortage in the water sector;
- The Framework Programme for Research Education and Training in Water (FETWater) and DWA bursary have made a contribution in building capacity to implement the National Water Act but these important initiatives are not enough to match the huge skills shortage in the water sector;
- The DWA Learning Academy was established and it has provided a model for wider application which needs to be expanded to build the skills required by the broader water sector institutions;
- The 2020 Vision for Water and Sanitation Education Programme in schools reached over 20,000 children and includes the Annual Baswa le Meetse Awards. However, there was a need for more support and funding to reach more schools, promote science and technical learning in water-related fields;
- The Masibambane Civil Society Support Programme has funded courses which include the following areas: advocacy, water resource protection, WC/WDM, water services regulation and sustainable livelihoods. Replication of these activities remains a challenge due to inadequate knowledge management, knowledge transfer and related capacity building mechanisms. Improvements in these areas can contribute significantly to water literacy and knowledge equity, as well as empower stakeholder groupings to participate in effective governance, protection and socio-economic aspects of the NWRS.

Key issues

The following key issues need to be addressed in order to achieve the vision and objectives of this strategy:

- Weak sector leadership: DWA needs to exercise its sector leadership role in the water sector capacity building through building the necessary partnerships to address the skills shortage problem which poses a threat to sustainable management of water resources in South Africa;
- The fragmented approach to Capacity Building &Training (CB&T) functions within DWA needs to be streamlined and capacity building initiatives must be extended to the broader water sector;
- There is a need to address the limited capacity of SETAs in general and the EWSETA in particular which represents a significant gap and risk area for water sector CB&T;

- The problem of the ageing workforce must be urgently addressed to prevent the loss of institutional memory, a concerted action is required to stem the loss of institutional memory within DWA and the broader water sector institutions;
- The lack of a coordinated approach to ensure alignment of the curriculum of Higher Education Institutions with the water sector skills and capacity needs must be addressed;
- Lack of focus on building of skills pipeline for water sector professionals;
- Accreditation of water sector training programmes and training providers needs attention.

Vision and objectives

The Vision of this strategy is as follows:

> All water sector institutions have highly skilled human resources that have the capacity to implement all the provisions of the National Water Act of 1998 and Water Services Act of 1997

The overall objective of this strategy is to put in place a well-coordinated, coherent capacity building system within 18 months after the adoption of the NWRS 2. This will be supported by the following specific objectives:

- Strengthening of the existing mechanisms and processes for DWA to provide strategic sector leadership in CB&T;
- Establishment of a sector supported institutional model for the effective coordination of institutional capacity building, education, training and skills development;
- Establishment of a skills/business intelligence hub for skills planning coordination, quality assurance and knowledge management;
- Expansion of the scope of DWA Learning academy to include training of water professionals for other water management institutions;
- Development of an education, training, and capacity framework that conceptually and practically integrates the various elements of the water-value-chain-pipeline approach;
- Development of an inclusive strategy for the professionalisation of water institutions and practitioners;
- Development and implementation of public awareness campaigns to make everyone aware of the value of water.

Strategic actions

- Implement leadership programmes for DWA to enhance their capacity to provide leadership to the water sector.
- Develop mechanisms for coordination based on strategic mandates secured from, and funded by sector partners and mechanisms for quality assurance.
- Coordinate the provision of quality training at all levels focused on agreed priority training/development matters.
- Develop appropriate criteria and mechanisms for provider accreditation, training certification and professional registration in the water sector.
- Keep all stakeholders and role-players informed of developments in water CB&T programmes.
- Ensure that the water sector has sector validated training at all levels focused on agreed priority training/development matters.
- Identify additional financial and human resources to expand the scope of DWA Learning Academy to provide training for other water management institutions.
- Facilitate the alignment of curriculum of Higher Education Institutions with the skills required to manage the entire water value chain.
- Set up a pool of training materials that meet the required quality standards.
- Provide strategic support to the Education and training Quality Assurance (ETQA), develop and implement criteria for maintaining the standards required by sector and regulation provisions.
- Support the implementation of formal mentorship programmes in DWA and sector institutions including professional associations.
- Develop appropriate materials and identify dissemination channels for public awareness campaigns on the value of water.

3.3 Enabling Strategy 3: Monitoring and Information

Introduction

Information on water is indispensable and will certainly be critical in future as more water is required to foster socio-economic development in developing countries. This is also important in the face of the world's increasing population, complexities and uncertainty brought about by impacts of climate change, and competing needs of different water users including the environment or aquatic ecosystems. The accuracy and reliability of information on availability, distribution, quantity and quality of water is dependent on appropriate, efficient and relevant monitoring systems, strategies, policies, legislation, processes and governance structures.

The National Water Act, 36 of 1998, Chapter 14 sections 137 to 145, Water Services Act, 108 of 1997 sections 62 and 67 to 70 and the National Water Policy for South Africa (White Paper) of April 1997 section 6.8 provide the legal framework regarding monitoring and assessment of water and development of monitoring systems and information systems required to generate data and information on water. Water data and information in this context refer to the availability, distribution, quantity, quality, use, cost of water and water authorization.

This chapter on monitoring and information sub-strategy of NWRS seeks to provide a plan of action on how monitoring, information and assessment of water can be carried out in the country. The sub-strategy monitoring and information will therefore provide *inter alia* a five year high level plan with the following outlined:

- Improvement and enhancement of water data and information
- Proposed investment in water data and information
- Generation and dissemination of water information products
- Monitoring governance
- Use of advanced and appropriate technologies in water monitoring and information
- Collection of water data and information
- Measuring and analysing of water
- Access to, and dissemination of water data and information
- Processing of data and information ,

Monitoring of water in this context takes into account the whole value chain i.e. the bio-geophysical and domestic aspects of water. Monitoring of water also makes provision for all levels such as local, regional and national and more importantly there will be categorization in terms of monitoring for regulatory, operational, ambient or status and litigious needs.

This sub-strategy therefore aims to improve, facilitate and coordinate the ongoing monitoring, recording, assessment and dissemination of data and information on water at all levels to organs of state, water management institutions and water users by the Department of Water Affairs (DWA) as the lead Department in the country for monitoring, in accordance with the National Water and Water Services Acts. The objectives of the monitoring and information will include the following:

- Rationalization of data and information on water
- Improvement of national data and information coverage
- Increase the efficiency, access to timely and related water data and information
- Development of mechanisms to ensure quality-checked data and information

Situation analysis

Monitoring

The 2004 NWRS set monitoring and information goals for five years, some of these were achieved (e.g. implementation of the toxicity, radioactivity and estuary programmes and groundwater quality), however, most of these goals were not achieved. Most hydrological datasets are still adequate, but the proposed increase in hydrological data of 5% envisaged in the 2004 NWRS could not be achieved.

A significant number of the rainfall gauging stations operated in South Africa by the South African Weather Services (SAWS) have closed down in the last 15 to 20 years. Although a MoU has been signed between DWA, the Department of Agriculture and the SAWS, it has yet to stop this trend.

Inadequate maintenance, vandalism and theft of monitoring equipment aggravated the situation and cooperation with private sector organisations in terms of data collection has not progressed as envisaged.

Data sharing

Data sharing between government departments on topics of mutual concern (e.g. mine closure, acid-mine drainage, climate change, etc.) needs improvement, as well as data sharing with the private sector.

The sharing of hydrological data and information with neighbouring countries in shared river basins (e.g. on flooding or climate change) is becoming increasingly important. Monitoring and information management in trans-boundary river basins for joint river basin management, however, has not yet been sufficiently synchronised.

Information systems

Information in the National Register of Water Use which contains details of water use registrations, water diversions and waste water discharges, is not complete in many areas and in many cases actual water use is not recorded. Verification and validation studies are being carried out on a catchment basis to improve on the data.

The 2004 NWRS envisaged a single extensive, integrated, accessible water information system, and although progress has been made, there are still many water information systems (both within and outside DWA) regarded as "stand alone" and with limited accessibility. The main national archives and monitoring databases are well maintained, extensive upgrades have been completed and a number of data retrieval functions have already been made available on the internet. A new approach has been initiated to develop integrated services and tools to supplement the existing monitoring support systems and databases.

Institutional capacity

Monitoring and information management structures in DWA have been strengthened by supplementing existing line function management with two levels of coordinating structures: the National Water Monitoring Committee at national level, and Integrated Water Monitoring Committees at regional level.

The 2004 NWRS already recognised that resources (staff, skills, funding and equipment) for monitoring were inadequate, and that there is a particular need for training of water resources managers. To date, however, there has been a pronounced decline in technical skills and the number of staff supporting the national and regional monitoring programmes. Funding for these programmes has also shown a dramatic decline, although some funds were made available to alleviate the most critical problems on an *ad hoc* basis.

Key issues

- Various water resources management challenges require new systems for data collection, more innovative use of existing systems and a better handle on unpredictability and uncertainty. Such challenges are climate change, water conservation and demand management, revenue collection, compliance and enforcement with regulation, the need for high assurance supplies, a decline in the quality of wastewater treatment plants and water quality problems.
- There is very little awareness of the need for water-related data as a "strategic asset" whose ownership is vested in DWA and broader information products, that are useful for decision makers, are experienced as cumbersome or non-existent.
- Water managers and other stakeholders have no easy access to timely, actual and reliable water data.
- There are backlogs in data capturing, including the scanning of paper records.
- The deterioration of physical data acquisition infrastructure (e.g. river weirs, gauging stations and rainfall stations) is a cause for concern.
- National reports on water storage do not include the data and information of all reservoirs.
- Many borehole drillers are not registered and there is no regular collection of borehole information.
- Irregular collection of data on water use and wastewater discharge. The Verification and Validation studies on water use in the context of water allocation reform have only been carried out on a limited basis.
- Very valuable additional water data sources are not accessible to DWA because of lack of cooperation between sectors, different spheres of government and limited cooperation with the private sector.

Vision and objectives

The Vision of this strategy is as follows

> Integrated monitoring and information management systems that support sustainable water resource management

The objectives of this strategy are:

- Awareness raising on the importance of investing in collection and management of high quality water-related information for supporting water resource management;
- Development and implementation of a national monitoring and information management plan for the entire water sector;
- Establishment of an integrated water information management system that is easily accessible to government institutions and other sector users;
- Ensuring that the largest possible collection of high quality data and information for supporting scientific research, regulation, monitoring and compliance enforcement are identified and made accessible to public and private institutions;
- Investment in building technical expertise needed to collect, analyse the water information and to produce reports for decision-makers;
- Allocation of appropriate budgets for monitoring infrastructure and information management.

Strategic actions

- Develop and implement a national information and educational campaign on water monitoring and information management.
- Establish fully functional regional information centres with a client orientated approach.
- Refine, finalise and implement a 5 year strategy for coordinated and integrated monitoring at national, regional, catchment and local levels.
- Standardise and optimise monitoring programmes and maximise the utilisation of resources allocated to these programmes through a cost-benefit approach.
- Design and implement quality management, including annual auditing, for each type of monitoring system.
- Develop the necessary models for dealing with water quality parameters apart from salinity.
- Ensure that data are captured into a national system using web-enabled data capturing systems where appropriate.
- Build integrated water information and dissemination systems that facilitate sharing of water quality and quantity information with government, private sector and the general public.
- Develop and implement national monitoring and information management governance in the sector under DWA leadership
- Address research needs on water monitoring and improve on distribution of information from such research.
- Increase investment in gauging stations and operational infrastructure to improve rainfall data monitoring as well.

- Redesign structures of professions and occupational classes in monitoring and information management and coordinate the formal and informal training to address the current limitations in available skills.
- Ensure the continuation of monitoring and data acquisition programmes by providing funding and required skills.
- Establish a system to monitor and manage maintenance plans for monitoring infrastructure.

3.4 Enabling Strategy 4: Research and innovation

Introduction

The NWRS 1 acknowledges that research has been a fundamental contributor to understanding South Africa's water resources and developing many of the techniques and tools used for water management, and it has also informed the development of national water policy and enabling legislation. However, the NWRS 1 did not include any strategic objectives and actions for water research and innovation (R&I).

Currently, the water sector in South Africa faces new and urgent challenges. Of these, the most pressing is the scarcity of the resource and the deterioration of the quality thereof. These challenges facing the water sector leave us with no other alternative but to invest in the future through the development of R&I in the water sector.

R&I creates and activates the knowledge that South Africa needs to compete in the global economy. It leads to new, exciting products and processes that help the country prosper, raise our standard of living and address challenges within the water sector. R&I are not like any other solutions for the future. They are the main - and sometimes the only – tools available to build tomorrow's world. We must therefore create the necessary conditions and incentives to generate enthusiasm for it across our nation.

Situational analysis

Publicly-funded water R&I in South Africa has benefited enormously from a stable funding source, namely the water research levy, administered by the Water Research Commission (WRC) and currently amounting to approximately R150 million per annum. The total level of water-related R&I funding (public plus private) is thought to be considerably higher, amounting to roughly between R250 and R350 million per annum for the sector as a whole.

Most of the water research funded by the WRC and other funding agencies is conducted at universities, science councils, parastatals, private sector organisations, water utilities and NGOs. Many water sector role players make large significant and independent contributions

to the national body of water-related research and innovation, such as the water companies, ESKOM and mining and agricultural companies. In addition, government organisations which spend money on innovative technologies and campaigns are playing a key role in research and innovation in the water sector in South Africa.

In addition, the "information technology" revolution has become a reality. It has already transformed our daily lives. Therefore, water resource management should include research and innovation within the field of information technology.

Prioritising R&I within the water sector will provide solutions to the urgent environmental situation by investigating and implementing the "green" technology that all citizens want.

Key issues

The following key issues need to be addressed to ensure effective implementation of the R&I strategy:

- Fragmentation and mis-alignment between the water sector R&I strategy, national science and technology, the national R&D strategy and the National System of Innovation
- Reliance on international research and innovations, while there are local solutions available (sometimes outside the recognised formal sector)
- Innovations do not spontaneously, or necessarily, arise from the progress of fundamental research. Researchers must be trained and encouraged (including financial incentives) to contribute to establishing the necessary link between their work and the response to the water sector's expectations and needs
- Currently, there is an associated risk of over-reliance of water-related R&I on public funding
- Many research and innovation products are never communicated and/or used by the water sector for their intended purpose
- There is currently no consolidated database of players, programmes, investments and activities concerned with the creation, adaptation, packaging and dissemination of water related R&I for the South African water sector.

Vision and objectives

The vision for this strategy is:

Research and innovation are central to the achievement of water security for South Africa through improved knowledge management and technology that supports sustainable water resource management

The objectives of the strategy are as follows:

- Lead and direct solution-orientated research and innovation targeted towards challenges experienced within the water sector
- Align the water sector R&I strategy, national science and technology, the national R&D strategy and the National System of Innovation.
- Promote maximum research impact, by providing mechanisms for support and uptake of innovative solutions within the water sector
- Ensure inclusive, coherent and well-coordinated participation by all role players in water-related R&I
- Ensure that water sector R&I is adequately resourced and that resources are used efficiently and effectively

Strategic actions

- The Department to take a lead role in directing and supporting research and innovation to address specific water sector challenges
- Develop a framework for monitoring and evaluation of R&I progress and uptake/use
- Promote innovation and technology in the private and public sector by making funds available for pilot projects, support knowledge sharing and continue to award outstanding achievement in various forums
- Utilisation of indigenous knowledge to enhance water resource conservation and management
- Researchers must be trained and encouraged (including financial incentives) to contribute to establishing the necessary link between their work and the response to the water sector's expectations and needs

- Establishment of a comprehensive inventory of players, programmes, investments and activities concerned with the creation, adaptation, packaging and dissemination of water related R&I for the South African water sector.
- Establish a viable funding model for the sourcing and allocation of financial resources to water sector R&I
- Effective utilisation of mobile technology and satellite imagery in resource monitoring, compliance monitoring and enforcement activities
- Establish public-private partnerships to secure funding for water-related R&I

4. IMPROVED GOVERNANCE STRATEGIES

4.1 Governance Strategy 1: Water allocation reform and equity

Introduction

Equitable access to water, or to the benefits derived from using water, is critical to eradicating poverty and promoting economic growth. Little substantive progress on the Nation Water Act pillar of equity (redress of race and gender water allocations for productive economic use) has been achieved since its promulgation. Proactive steps are required to meet the water needs of historically disadvantaged individuals (HDIs) and the poor and ensure their participation in productive use of water. To elevate the public and political profile of the Water Allocation Reform (WAR) programme it requires linkages to broader government and private sector programmes of redress in land, agriculture and business. Compulsory licensing is required in stressed catchments to ensure that water is made available for HDIs. This requires implementation plans.

Situation analysis

The National Water Act makes provision for achieving equity in water allocations by authorising water users, primarily using licenses (s40 – 52) and general authorisations (s39) for the water uses described in s21. The DWA established the Water Allocation Reform programme to fast-track equity and redress, primarily social (race and gender) equity but informed and supported by sector (economic) equity needs relative to their benefits, as well as other considerations. The WAR programme, which includes Compulsory Licensing, was developed to take proactive and purposeful action towards addressing matters of social equity on a structured basis at all levels of government. The programme was implemented to ensure that the historical issue of race and gender inequities did not become protracted and contribute to socio-political instability and decline in economic prosperity of the country, especially at regional and local levels.

At the time of publication of the NWRS 1 in 2004, the WAR framework was being developed. Its political endorsement and formal launch took place in April 2005. The Draft Position Paper for WAR was extensively consulted and endorsed by the public in 2005/2006 (40). A Tool-kit for WAR in support of implementation was developed and remains a working reference and operational guideline document to be regularly updated (41). Since 2006, each regional office of the Department has also developed WAR Implementation Plans for the catchments under their control. A WAR Strategy was concluded in 2008 (42).

To date, WAR has not been effectively aligned to strategic regional imperatives established through processes such as Provincial Growth and Development Plans, Water Sector Plans or Municipal Integrated Development Plans and Water Service Development Plans.

Notices announcing Compulsory Licensing were gazetted in August 2010 for the Mhlathuze and Jan Dissels catchments in KwaZulu-Natal and the Western Cape, respectively. The final allocation schedule for the Tosca Molopo area of the North-West Province in the Lower Vaal WMA was gazetted in July 2011, with the issuing of licences as the only remaining step to complete Compulsory Licensing in this area.

A number of water use validation and verification projects have commenced in the water management areas, the largest and most ambitious being the project for the entire Vaal WMA.

It is envisaged that the roll-out of the DWA Agricultural Water Use Development Finance programme will contribute significantly to the WAR programme through its impact on subsistence and small-livelihood enterprise water uses, especially in South Africa's rural areas.

Key issues

The National Water Act has made a major shift from an approach to water management in South Africa that was effective in servicing a minority of the country's water users to water management that addresses the needs of all South Africans. The following key issues must be addressed in order to achieve the objectives of the water allocation reform strategy:

- Failure to prioritise areas of intervention that reflect socio-political imperatives of transformation in government plans;
- Inadequate stakeholder involvement;
- Slow implementation of water allocation reform.

Vision and objectives

The Vision of Water Allocation Reform is as follows:

> Ensuring that historically disadvantaged South Africans enjoy access to water for productive economic purposes, or reap the benefits from water use to prosper socially and economically

To fast-track the water sector reform agenda in South Africa to create and ensure sector stability in support of socio-economic development and sustainable water resource use, the following strategic objectives are set:

- Elevate the public and political profile of the programme and its linkages to broader government and private sector programmes of redress in land, agriculture and business;
- A better understanding of the water use situation and water availability in different catchments in the country;:
- Establishing partnerships with key role-players and ensuring effective involvement of relevant stakeholders in the implementation of the WAR;

Strategic actions

- Endorse and publish WAR Implementation Plans and ensure the consequent mobilisation of materials, resources and finances to realise programme implementation.
- Regular publication of programme progress updates and general communiqués in conjunction with formal programme reporting (DWA, Ministry, Parliament).
- Establish and ensure linkages with other government and private sector initiatives, especially local and provincial development planning, land and mining reform projects and agricultural development support.
- Commence and complete water use validation and verification projects country-wide.

- Address unlawful water uses and update the DWA databases (especially WARMS) with correct water use information for water management and revenue collection purposes.
- Assess the value addition of water use in various catchments (Catchment Assessment Reports).
- Set up memorandum-of-agreements, publicise the need for compliance to economic sector transformation charters, facilitate water user institutional collaboration and transformation and engage with individual and collective HDI beneficiation initiatives.
- Determine customised race and gender targets per project area, on the basis of the prevailing dynamics of the area under consideration. The national WAR target should be the minimum to be achieved and any deviation below this must be adequately substantiated.
- Roll-out WAR in selected areas, prioritise in terms of the current water situation (especially demand) and prospects for future development.
- Develop, approve and execute implementation plans.

4.2 Governance Strategy 2: Regulation of water resources

Introduction

An effective water resource regulatory framework is a fundamental requirement for a water secure future for South Africa and the achievement of all strategic goals of the NWRS 2. DWA's role as a sector leader and regulator is central to the achievement of effective water resource regulation. The strategy outlines how the water sector is currently regulated and identifies key issues that should be addressed to implement effective regulation of a very complex sector.

Situational analysis

- Illegal abstraction of water by farmers from the infrastructure built and paid for by domestic and industrial water users of the Vaal River System;
- Mines allowed to operate illegally while they were waiting for water use licences;
- Pollution of water resources by effluents from malfunctioning wastewater treatment works and acid mine drainage; this has negative impacts on the health and livelihoods of downstream water users that rely on raw water;
- Poor water quality increases the incidence of waterborne diseases, poses a threat to aquatic ecosystems and negatively affects the export of crops irrigated with polluted water.
- Inadequate oversight over water institutions to ensure good governance and performance

The following aspects of water resources regulation have contributed to the inadequate regulation of water resources::

- *Lack of functional CMAS to take on bulk of local catchment regulation*- due to the slow process in establishing CMAs the enormous task still rests almost in total with DWA without capacity to fully execute.
- *Verification of water use* - Although all water users are required to register existing lawful use (in terms of Water Act of 1956), and most have done so, only about 20% of this use has thus far been verified; this makes it difficult to effectively regulate water resources.
- *Licensing* – Due to the slow process of licensing water use under the National Water Act of 1998, so far only about 10% of water is used in terms of licenses issued under the National Water Act. 57% of water services authorities did not have appropriate licenses for wastewater treatment works in 2007.

- *Enforcement* - Very limited capacity exists within the department to carry out this task effectively. Consequently this lead to weak enforcement of water use license conditions as well as water users continually ignoring directives as issues is weak.
- *Pricing* – The Raw Water Pricing Strategy sets out the government's approach to pricing raw water which makes provision for full cost pricing for non-agriculture water users, including depreciation and a return on assets. Agricultural water users, in general, do not pay a return on assets and the depreciation charge is capped, consequently, the irrigation charges are significantly low. The water conservation charge (intended to reflect the value of water itself) that is provided for in the National Water Policy has not yet been implemented. The waste discharge charge system, intended to implement the polluter pays principle, has also not yet been implemented.
- *Regulation of water resources infrastructure* - Currently, DWA owns and manages water resource infrastructure with an asset value of some R100 billion; there is no regulatory oversight for this function in the form of standards setting and monitoring of performance against the set standards.
- *Dam safety* - DWA is responsible for building and operating dams, as well as regulating dam safety in the absence of an independent regulatory oversight of dam safety.

Key issues

- DWA's role as a sector leader and regulator (including oversight over water institutions) with a clear separation of policy, regulation and shareholder functions within DWA
- Decentralisation of water management and governance functions to CMAs as envisaged in the National Water Act
- Efficient water use authorisation process
- Execution of regulatory function (especially enforcement) by DWA and CMAs
- Proper integrated monitoring and information management system for supporting the regulation of water resources;
- Credibility based on actions in media and public

  Inadequate awareness of water users and the general public of the importance of compliance with water regulations and their roles and responsibilities

Vision and objectives

The Vision of this strategy is to:

Sustainable water management through effective regulation

Strategic actions

- Clear separation of regulation branch from policy development and operational activities within DWA to promote transparency and "arms length" independence of the regulator;
- Development of all regulatory instruments and institutional capacity needed to implement regulation of water resources;
- Have fully functional CMAs that can do bulk of regulation at catchment level and transfer regulatory responsibility to CMAs as soon as possible
- The DWA regulatory branch to oversee effective regulation by CMAs at catchment level as well as execute performance of national water infrastructure branch
- Promotion of co-operation between water resource (DWA and CMAs) and environmental regulatory (DEA) roles focusing on areas of convergence to optimise use of limited regulation capacity.
- Develop all the necessary regulation instruments;
- Create a dedicated water use authorisation (including issuing of licences) unit within DWA
- Accelerate and streamline the issuing of licenses to all registered water users in order to support economic growth and improve regulation of compliance with license conditions by all water users;
- The application system for water use authorisations (also known as licences) must be drastically improved so that all applications are dealt with within 3 months.
- Implement an electronic "on-line" system
- Support the establishment of fully functional monitoring and information management systems to enable the regulator to have access to high quality information for regulating water use by all sectors;
- Strengthen cooperation between DWA and DEA in the implementation of water resource regulations in areas of convergence to optimise use of limited regulation capacity
- Raise credibility of DWA as regulator by immediate action against transgressors; make key rulings public, by being objective and through short turn-around times.
- Involve the public and civil society as partners for regulation.
- Ensure proper coordination between WS Regulation and WR regulation as regulation of WWTWs and water use efficiencies at municipal level have a direct impact on the resource
- Strengthen cooperation between DWA and DEA in the implementation of water resource regulations in areas of convergence to optimise use of limited regulation capacity.

4.3 Governance Strategy 3: Water Sector Institutional Arrangements

Please note that this strategy is supported by a more detailed framework.

Introduction

Appropriate institutional arrangements are critical to ensure effective water resources management. Successful implementation of the NWRS 2 depends on effective, well-resourced institutions and a strong regulatory framework and oversight function.

Situational Analysis

The National Water Act fundamentally transformed water resources management. The Act provides for the establishment of new institutions, and the transformation of existing institutions, to assist the Department of Water Affairs (DWA) to give effect to its core mandate – the development, protection, conservation and allocation of water resources, and regulation of water services and water use. One of the Act's objectives is to progressively decentralize water resources management. An important motivation for this is to enable stakeholders to participate more effectively in the management of water resources.

National Water Resource Strategy (NWRS) of 2004 set out an institutional vision and framework for the sector in more detail, based on the 1997 Water Policy and the Act.

However these initiatives ran into a series of challenges, and eventually ground to a halt after only two CMAs had reached a stage of initial functionality (another 6 had been established on paper only). In the two CMAs that have been established, slow delegation of functions, and delayed transfer of funds have impeded the effective functioning of these institutions.

Challenges in relation to WUAs arose from the difficulties of achieving demographic representation in management committees in the case of previous irrigation boards, and lack of capacity to support the establishment of WUAs for resource poor farmers. Similarly, initiatives to transfer management of government water schemes has met with challenges of labour disputes in relation to conditions of services. An additional challenge is the inability

of the Department to use these schemes means to achieve social and economic development.

Several Water Boards (WB's) have performed poorly, due to poor governance and low levels of financial viability. This has been compounded by poor performance by many municipalities, including high levels of debt to Water Boards. This has resulted in poor relationships between the Water Boards and their Municipality customers. This is compounded by the separate reporting lines, with the municipalities reporting to COGTA and the Water Boards to DWA.

Decisions how many Water Board should exist and the geography they should serve, have been reneged upon for some time. Improved support to rural municipalities in particular, improved ability to stretch funding and technical resources across disadvantaged areas; less institutions for the Minister to regulate and oversee; improved economies of scale.

At present the Department manages most of the national water resources infrastructure while the TCTA finances and project manages specific water projects as per Ministerial directives. These projects are financed off-budget and the investment costs are repaid through user charges. In this regard, the establishment of a ***government component*** within DWA that houses the current functions of the infrastructure branch and the water trading entity and other relevant functions (such as hydrometry and certain monitoring functions, human resource management and IT) is recommended. Combining these functions and creating a Government Component within the Department, financially ring-fenced and run on business principles, is an important first step in improving the situation.

In response to the slow progress in institutional reforms, together with the uncertainty arising from this situation, DWA initiated an Institutional Reform and Realignment Project in December 2010. The purpose was to establish an appropriate institutional design for the sector and to facilitate its implementation through appropriate institutional reforms and realignment.

Progress in implementing this vision and framework is summarised below.

Vision and Objectives.

The Vision of this strategy is:

> To create sustainable water sector institutions that will facilitate effective service delivery while supporting government's transformational objectives

This vision will be achieved by the separation of policy making, shareholding and regulation to ensure that there will be effective governance in the sector. The department will also seek to facilitate institutional integration to ensure that functions are allocated to institutions that are best placed to undertake them, to optimize the sector capacity and, to facilitate economies of scope and scale.

The key objectives of the institutional framework to support this vision are described below:

- The overall trusteeship of the water value chain is with the Minister of Water Affairs. The Minister is responsible for efficient and effective water institutions to give effect to her public trusteeship of the water value chain.

- The Department will set policy, regulate, and provide support to water management and water services institutions to achieve their constitutional and legislative mandates in the water sector.

- The ownership, financing, development, management and operations and maintenance of national water resources infrastructure will be strengthened by merging or ring-fencing WTE and NWRI branch into one Departmental or Government component.

- The development, financing, management, operation and maintenance of regional bulk water and wastewater services will be strengthened through the consolidation of existing water boards and other suitable institutional capacity as appropriate.

- Water resource management for each of the nine newly defined water management areas will be strengthened through developing and consolidating catchment management capacity into nine economically and institutionally viable catchment management agencies. The reduction in the number of water management areas will not compromise stakeholder engagement in decision-making.

- Water user associations will facilitate the management of local water resources infrastructure by users for their mutual benefit and assist with local water resource management functions where appropriate.

- The development and management of the four international river basins will be undertaken by trans-boundary water management institutions.

- Water research, information and knowledge management will contribute to improved water resource management and sustainable water service provision.

- Economic regulation is to being explored and by the end of 2014 a decision will be taken around appropriate institutional design, which will ensure that water provision and services is provided in an efficient, fair and sustainable manner, while bearing in mind social priorities set by policy makers. The main objectives for regulation can be broken into three elements: To enable the public sector to achieve long-term policy objectives, to protect consumers from abuse by service providers who wield monopoly power and to protect water service providers from undue influence.

Management of water resources at a catchment level

The first edition of the National Water Resource Strategy (NWRS) established 19 water management areas (WMAs) and proposed the establishment of nineteen Catchment Management Agencies (CMAs) to correspond to these areas. Since then, viability assessments with respect to water resources management, funding, capacity, skills and expertise, and regulation and oversight have undertaken. Consequently, the current draft NWRS Edition 2 recommends the consolidation of the 19 WMAs into nine, and a corresponding reduction in the number of CMAs. The Minister pronounced the establishment of nine CMAs in nine WMAs on 19 March 2012.

Currently eight of the original nineteen CMAs have been gazetted, of which two are operational. The eight CMAs will need to be re-configured to align with the nine water management areas.

The nine WMAs proposed by the IRR are Limpopo; Olifants; Inkomati-Usuthu; Pongola-Mzimkulu; Vaal; Orange; Mzimvubu-Tsitsikama; Breede-Gouritz and Berg-Olifants, as reflected in Figure 18.

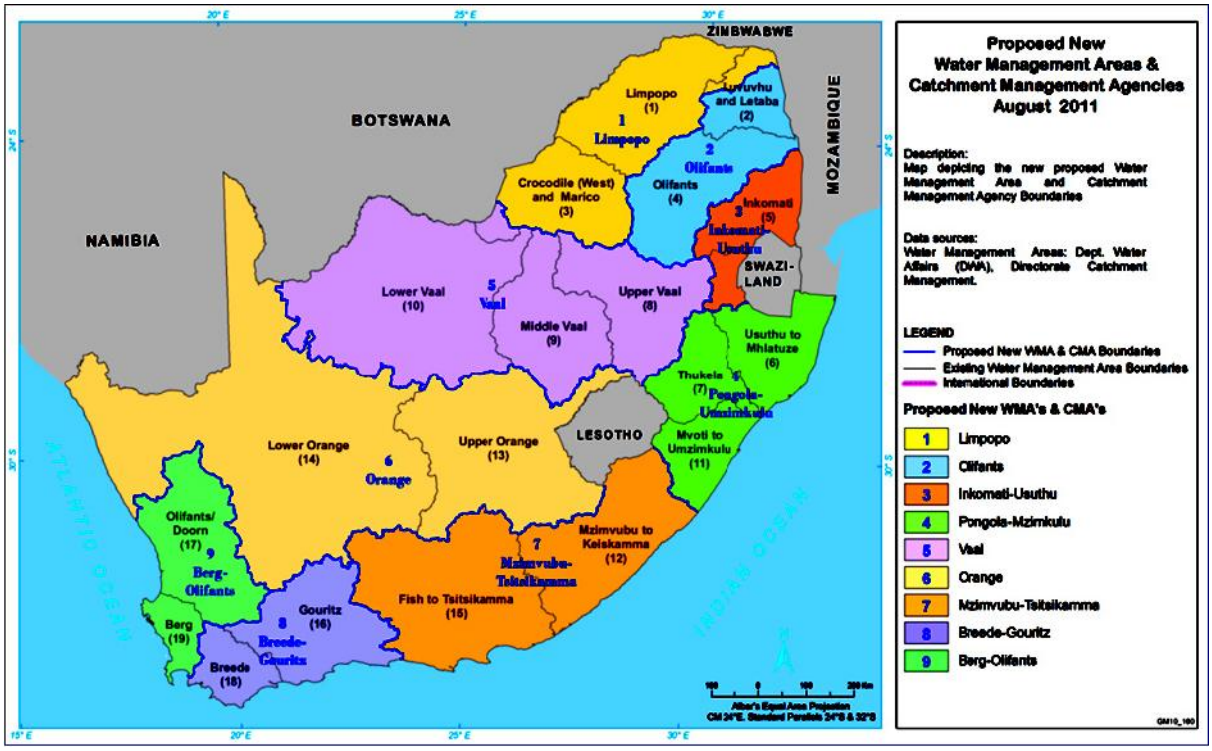

Figure 18: Proposed new water management areas

The establishment of CMAs will enable the promotion of equity through more effective water resources management and greater responsiveness to the needs of poor and marginalised communities arising from the closer links with stakeholder groups in the water management area. In addition, the Department will continue to have a significant role in ensuring that the voice of small users and disadvantaged communities are heard and in ensuring that the CMAs address redress and equity as priorities.

The existing two CMAs (Inkomati and the Breede-Overberg) will receive first priority to be realigned into the Inkomati-Usuthu and the Breede-Gouritz CMAs respectively.

A key driver of the national water policy and the National Water Act is the need to achieve equity in access to water for productive purposes, and equity in the benefits derived from water. This requires a profound change in the allocation and use of water in the country and access to the economic development of the country, with a particular focus on improving the situation of poor black communities who have been disadvantaged by the racial-spoils system of apartheid. Quality can only be managed jointly with quantity; economic considerations must be weighed together with social and environmental ones; groundwater has to be managed with surface water, and international water allocations cannot be considered in isolation from the domestic context. This complexity, together with a context of resource scarcity and the need for trade-offs between competing uses, strongly points to the benefits of managing water at the catchment level.

Managing National Water Resources Infrastructure

At present the Department manages most of the national water resources infrastructure while the TCTA finances and project manages specific water projects as per Ministerial directives. These projects are financed off-budget and the investment costs are repaid through user charges.

Key areas of concern are poor financial management of the Water Trading Entity, low revenue collection, poor customer management (including poor customer data), delays in procurement of key maintenance contracts, high staff turnover, loss of skills and low staff morale.

DWA must initiate immediate steps to improve the performance of the national water resources infrastructure management function and the related financial management aspects (the Water Trading Entity). From an institutional design point of view, this can be facilitated through the creation of a government component within DWA. The main advantages of this are increased accountability and transparency. These should provide important incentives for improved performance. Government policy now allows for the establishment of government components inside a government department.[3] These components have functions conferred, assigned, or delegated to them, subject to approval by Parliament.

Managing local water infrastructure (water user associations)

WUAs are member-based local-level institutions intended to support the management of local water resources in the common interest of members. Most but not all WUAs serve the irrigation community. They are area-based and are intended to include all users of a common resource, both consumptive and non-consumptive.

The functions undertaken by water user associations are at a local level and, in terms of the principle of subsidiary, it is not appropriate for these functions to be undertaken by DWA or CMAs.

The development and transformation of WUAs, either through the transformation of irrigation boards through broader representivity, or through the establishment of new WUAs comprising resource poor farmers, has been very slow. Slow transformation of irrigation boards has been due

[3] Public Service Amendment Act, 2007 operationalised 1 April 2008 with the publication of Chapter 6 of the PSR)

to a number of factors: difficulties in achieving the MANCO representivity targets, unresolved concerns regarding the transfer of private assets and liabilities to a wider grouping, and bureaucratic delays by the department.

Transformation of the rural economy is profoundly dependent on the re-allocation of land and water rights, and this underpins the transformational role of WUAs. The role of WUAs should, therefore, be situated within an integrated land-water-agrarian reform as a flagship programme of government. In this context, a differentiated approach is required to WUAs.

DWA and CMAs, working with agriculture and the Department of Rural Development, need to work closely with WUAs for resource poor farmers to provide technical and financial support, access to markets, capacity building etc. DWA should also ensure effective support for the establishment of WUAs for resource poor farmers, and for the allocation of water to these farmers.

The transformation of irrigation boards should be accelerated through a structured programme so that they can be brought under the ambit of the NWA and the transformational requirements of the developmental state and the National Water Act.

The management of regional water infrastructure and the future role of regional water boards

While most water boards have been established for pragmatic reasons and many have had a history of good performance by both local and international standards, there are three primary drivers for change:

(1) The weak performance in the management of water supply and sanitation services by many municipalities compromises the extension of services to those without, and most often results in unreliable and unsafe services;

(2) Gaps in the existing institutional and financial framework – responsibilities for water resources development at the local and regional level, and for regional bulk services outside of the existing water board service areas are not clear;

(3) Governance and performance-related problems for some of the existing water boards.Many options were considered however the differentiated establishment of l water boards is preferred as it is not considered necessary to establish of water boards in all areas (wall-to-wall), but it is rather appropriate to establish them on a case-by-case basis as and where necessary based on a needs analysis specific to the regions concerned. The recommendation is made, that the realignment and reform of the 12 Water Boards into eight should be completed by March 2016..

The mandate of water boards should be expanded to explicitly include the development and management of both regional water resources and regional bulk water services and wastewater infrastructure (primary activity). The water boards will also play a strong role in supporting municipalities through their secondary activities by providing services on their behalf and/or providing services to municipalities in terms of contracts. This should be done through a competitive tendering process.

Strategic Actions

- Fast track the establishment of the CMAs in priority catchments and delegate water resource management functions to the CMAs.
- Build the capacity of CMAs and develop decision support tools to enable them to play their role in regional development planning and decision-making processes.
- Transform irrigation boards into WUAs and ensure that they play a progressive and transformative role in the water sector
- Delegate local water resource management functions to WUAs that have capacity to perform these functions.
- Support the establishment of new WUAs as vehicles for building capacity of emerging farmers.
- Allocate resources for supporting the establishment of Catchment Management Forums (CMFs) to facilitate stakeholder engagement in water resources management.
- Develop a policy framework for coordinated and structured approach to the provision of financial and technical support to CMAs.
- Develop a water governance framework for effective oversight and support of CMAs.
- Promote awareness of the role of water as a strategic resource amongst politicians, other decision-makers and planners.
- Ensure that the integrated planning of water for development is implemented at all levels of the hierarchy of planning processes.
- Develop effective coordinating structures to enable DWA to exercise its leadership role in integrated development planning in all spheres of government.

- Develop and implement a turnaround strategy for the management of the National Trading Account to improve billing and revenue collection.

4.4 Governance Strategy 4: International Water Management and Cooperation

Introduction

The strategy on International Water Management and Cooperation outlines how South Africa will cooperate with its neighbouring countries in management of shared river basins for the benefit of all people. It also sets objectives and actions to be implemented to influence the African and global agenda on water management.

The South African government cooperates on water management issues with several countries within the SADC region, the rest of Africa and international water management agencies. Issues of cooperation range from water sharing agreements in international river basins shared with neighbouring SADC countries to participation in multilateral forums and engagement through bilateral arrangements for sharing technical resources with developing and developed countries.

The South African government pursues its interest in water management within the continent through its participation in the African Ministerial Council in Water (AMCOW) and other key strategic water forums. South Africa is a signatory to the SADC Revised Protocol on Shared Water Courses, therefore it has an obligation to fulfil its obligations through cooperation with its neighbours in the management of international waters.

South Africa shares four major river systems (**Error! Reference source not found.**9) with six neighbouring countries, namely, the Orange/Senqu system shared with Lesotho, Botswana and Namibia; Limpopo system shared with Botswana, Zimbabwe and Mozambique; Incomati system shared with Swaziland and Mozambique; and the Usutu/Pongola-Maputo system shared with Mozambique and Swaziland.

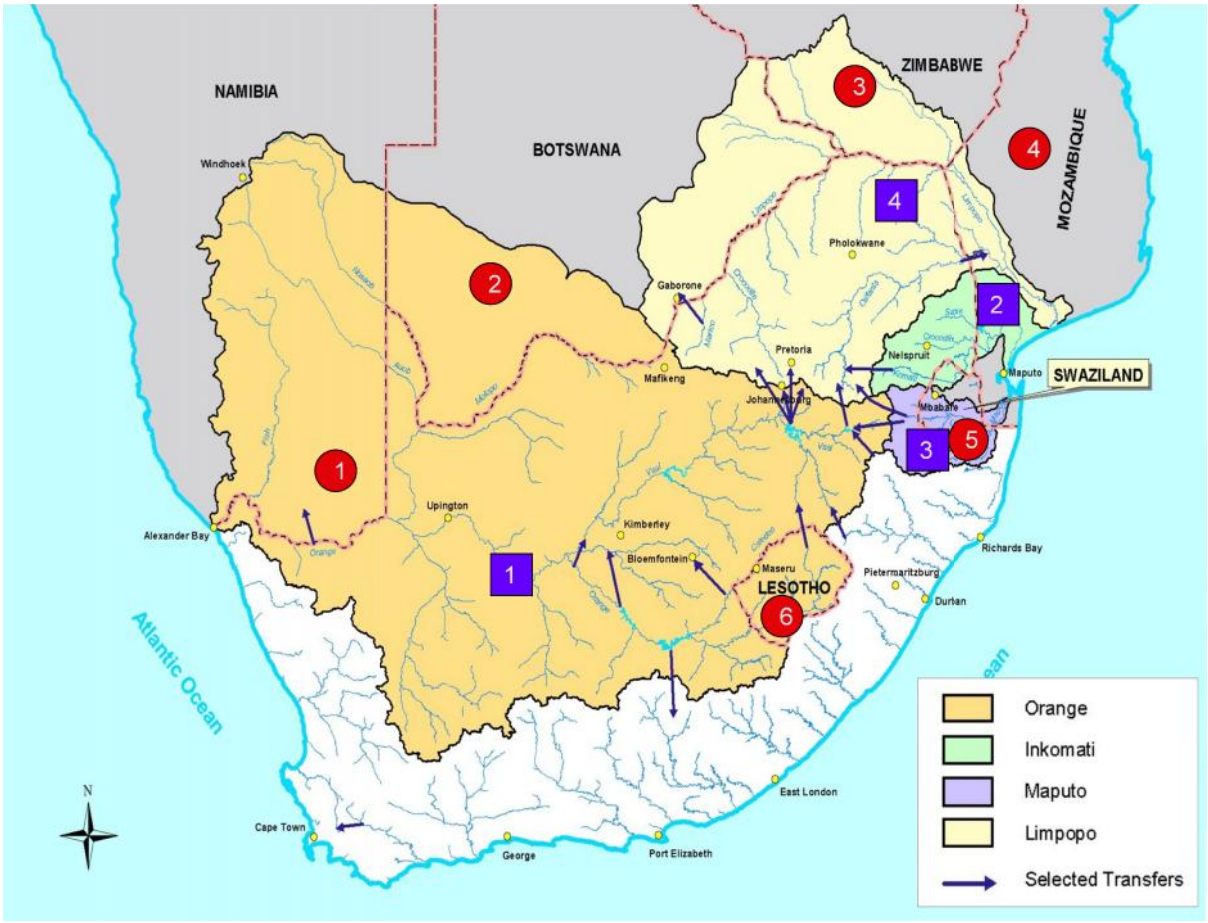

Figure 19: International River Systems

Situation analysis

The NWRS 1 set out an indicative programme for the establishment of international water management institutions, the completion of river basin studies and the establishment of water sharing agreements. In this regard, six studies in two river basins (Orange-Senqu and Inkomati/Maputo were in progress (50)) and a range of agreements were finalised with institutions engaged in the management of the shared river basins. South Africa has also been involved in a number of water resources management and infrastructure projects through international water management institutions.

DWA entered into a number of agreements on shared watercourses and river basins with its neighbouring countries, which have not been implemented due to the following constraints:

- DWA's capacity to manage these agreements;
- Financial resources and efforts associated with the management of bilateral and multilateral agreements;
- Capacity of the water sector to respond to the opportunities flowing from the agreements;
- As part of its commitment to the realisation of the goals of the New Partnership for Africa's Development (NEPAD), the South African government through DWA collaborates with all regions, countries and multilateral organisations to improve access to safe and reliable supply of drinking water for all people in the African continent.

South Africa engages with a range of countries on bi-lateral agreements. These bi-lateral agreements are fairly broad in their scope and are generally guided by the Country's foreign policy agenda. Cooperation on water related issues is therefore just one of the many issues covered in these agreements. South Africa has signed agreements with Russia, China and Rwanda. These bi-lateral agreements provide opportunities for identifying and adopting best practice and for cooperation for mutual benefit on water related matters.

South Africa has also entered into bi-lateral agreements with international donor agencies. The water sector has benefited considerably from these partnerships; for example, UKAID, DANIDA, USAID, and AUSAID amongst others have funded infrastructure and institutional development projects in South Africa.

Key issues

The following key issues must be addressed in order to achieve the goals of the international water cooperation strategy:

- *Significant gap between policy and practice within the African continent* - This gap can be attributed to the widespread lack of skills, weak institutional capacity and financial resources in most African countries. There is need to enhance joint management of shared water courses in order to improve the lives of ordinary citizens in the SADC region including South Africa; to continue to improve South Africa's influence in continental platforms such as

AMCOW and NEPAD with the aim of ensuring water security for SADC and the rest of the continent.

- Positioning of water at the centre of policy debates in the global system of governance for the benefits of South Africa and the rest of the continent – DWA needs to influence the UN system so that it can become more responsive to development areas such as Food Security, Energy Security, Climate Change and Conservation of Biodiversity.
- *Ensuring that the SA water sector benefits from south-south strategic global relationships* – The acceptance of South Africa by BRIC countries has created opportunities for strengthening cooperation with these countries in order to address common socio-economic challenges. DWA must ensure that the water sector benefits from these high-level intergovernmental relationships.

Vision and objectives

International water management and cooperation contributes to water security, social and economic development for South Africa, its neighbours and the rest of the African continent and it also raises the profile of South Africa as a global player

The following strategic objectives and actions have been extracted from the DWA International Water Cooperation Strategy 2011-2015 Draft:

- Advancement of the African agenda on sustainable development (Africa multilateral and bilateral cooperation);
- Advancement of water agenda in the global system of governance and water diplomacy in support and economic relations (multilateral cooperation);
- Advancement of strategic global bilateral relationships (south-south and north –south relations;
- Strengthening of regional water institutions, e.g. River Basin Organisations.

Strategic actions

- Utilise the SADC platform as a preparatory process for AMCOW participation, including key global multilateral engagements.
- Continue participation and coordination of the water sector in key strategic global water issues.

- Prioritise multilateral water related engagements.
- Prioritise strategic partners through mapping of RSA water priorities and re-establish relationships with traditional donors where cooperation has been happening on an ad hoc basis
- Establish strategic RSA/EU water sector partnership and Memorandum of Understanding.
- Develop donor engagement strategies and related guidelines for the purpose of approaching the donors in a focused manner.
- Enhance cooperative management of the shared watercourse for the purpose of economic growth and improvement of lives of ordinary people in SADC region.
- Continue with the enhanced sustainable management of the aquatic and terrestrial environment; integrate management and development of the region's water resources.
- Fund water resources management and development in the region for the benefit of the South African water sector.
- Strengthen governance and capacity in SADC and regional water institutions and enhance relations on shared watercourses

PART C: SPATIAL PERSPECTIVES

A PLANNING APPROACH TO THE NINE WATER MANAGEMENT AREAS AS RE-DEFINED FOR SOUTH AFRICA

This chapter provides a brief synopsis of the water resource situation pertaining to each of the nine Water Management Areas as re-defined in this Strategy. The summaries are not complete in themselves, but are intended to supplement existing information already contained in the Department's Internal Strategic Perspectives, in the various Water Resource Reconciliation Studies undertaken by the Department over the last five years, other published and readily available information, and information contained elsewhere in this National Strategy. The chapter brings the situation up to date (2011), alongside new perspectives as these have evolved to match that situation.

The review of each WMA reflects on the unique aspects of the area and seeks to provide the strategic view pertaining to that specific WMA. Not all WMAs are discussed here to the same level of detail. Major systems such as the Vaal System have received more study and are better known, and it is the lesser WMAs that may be discussed at a higher level of detail.

The generic threads that weave through the entire South African water resource situation are finally pulled together.

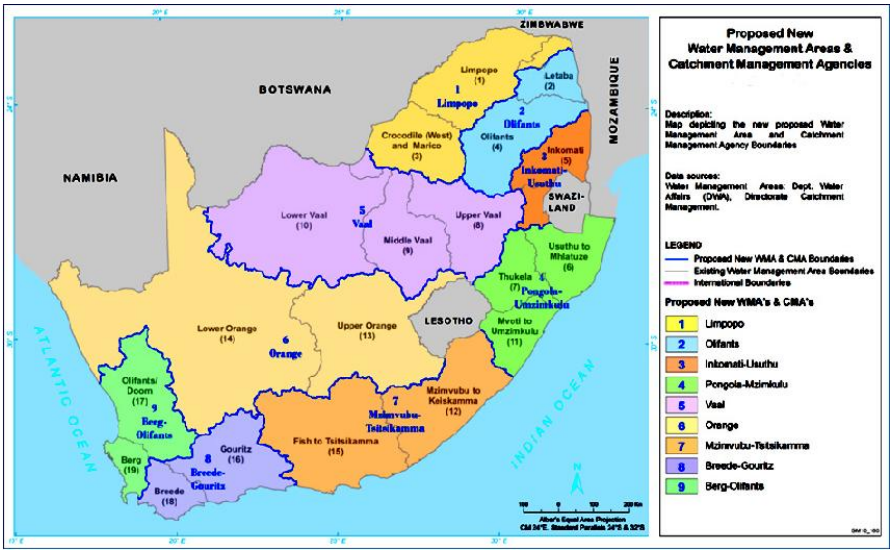

Figure 20: Map of the Proposed 9 Water Management Areas

Table 11 THE PROPOSED NINE RE-ALIGNED WMAS IN ORDER OF DISCUSSION

	WATER MANAGEMENT AREA	Comprising …
1	Vaal	Upper, Middle and Lower Vaal WMAs
2	Orange River	Upper and Lower Orange WMAs
3	Limpopo	Crocodile-Marico WMA, Limpopo WMA, Luvuvhu River
4	Olifants	Olifants WMA and Letaba River
5	Inkomati-Usutu	Inkomati WMA and Usuthu River (without Pongola)
6	KZN	Usutu-Mhlathuze WMA (including the Pongola but excluding the Usuthu), Thukela WMA, Mvoti-Mzimkulu WMA
7	Mzimvubu-Tsitsikamma	Mzimvubu-Keiskamma WMA, Fish-Tsitsikamma WMA
8	Breede and Gouritz	Breede WMA and Gouritz WMA
9	Berg and Olifants-Doring	Berg WMA and Olifants-Doorn WMA

1. The Vaal Water Management Area

Comprising the original Upper Vaal, Middle Vaal, and Lower Vaal WMAs

The Vaal River System supplies the water resource needs of 60% of the national economy and serves 20 million people. This is the economic heartland of South Africa; water resources are limited and must be secure. The Vaal River System is linked to all of its adjacent WMAs, and planning ensures that water will be made available into the long term.

Area of Supply

The area supplied stretches well beyond the catchment boundaries of the Vaal River and hence the WMA. There are parts of the WMA that are self-sufficient in water and not supplied directly by the system; all, however, are part of system resource use. The Vaal River System has been integrated into the water resources of the Crocodile (West), the Orange, the Thukela, Olifants and Usuthu rivers. System supply reaches most of Gauteng, Eskom's power-stations and Sasol's petro-chemical plants on the Eastern Mpumalanga Highveld, the North-West and Free State goldfields around Klerksdorp and Welkom respectively, the North-West platinum and chrome mines around Rustenburg, iron and manganese mines in the Northern Cape, Kimberley, several small towns along the main course of the river, as well as several large irrigation schemes.

Vaal System Reconciliation

The water resources of the Vaal River catchment are handled almost entirely within the *Vaal River System Large Bulk Water Supply Reconciliation Strategy (2009),* and the complexities of the water resource situation are not described in detail here. Key points are highlighted:

- All water resources within the catchment are fully used and no further development of any of the tributaries can be contemplated.

- The Upper Vaal River, with Eskom and Sasol the dominant water users, is now in balance given the recently completed 115 km pipeline, with a capacity of 160 million m^3/a, from Vaal Dam to a distribution structure at Knoppiesfontein, near Secunda. It is unlikely that new power stations will be constructed on the Highveld, but existing stations may be refurbished and used for longer than previously planned, with coal imported from the Waterberg coalfields. Some of these power stations will ultimately be closed down and water used by them should then become available, but this cannot be quantified, or planned for, at the current time. Coalmines in the Upper Vaal catchment generally have a problem of too much water (infiltrating groundwater) and have to de-water. These mines do not place additional supply demands on the Vaal System, although they can, and do, compromise water quality.

- The economy of the Vaal River catchment, and much of South Africa, has been built on mining for over 130 years. One consequence has been the growing problem of acid mine drainage[4], particularly in Gauteng. While this could not be foreseen until relatively recently, this is a consequence that must be avoided as new mines continue to be developed, with coal mining in Mpumalanga (Upper Vaal) the most serious future risk to water quality.

- The Vaal Gamagara scheme, abstracting water from the Vaal River just below the Harts River confluence, has a main pipeline distribution network of 370 km, taking water as far as Black Rock in the Kalahari. This scheme is of great importance to the Northern Cape, supplying domestic, industrial and mining water. Transfer of water to Botswana is also being investigated.
- From a study on the ecological Reserve currently being finalised for the Vaal River it has been determined that, for the most part, both the mainstem and its tributaries get sufficient water; sometimes too much.

It is important to recognise that water in the Vaal River Catchment may be re-used several times, with water used high up in the system (Upper Vaal Catchment) cascaded down through the Middle and Lower Vaal regions and ultimately into the Orange River as return flow. Water quality does deteriorate but is managed by dilution. One implication of the downstream dependence on upstream return flows is that volumes will diminish with increased re-use and other water use efficiencies. This must be considered where allocated available water downstream includes significant return flow volumes.

[4] Note that the problem is one of acidity and salinity

Water Resource Strategies for the Vaal WMA

Key water resource strategies in the Vaal Catchment are:

(i) The elimination of unlawful water use
(ii) The implementation of Water Conservation and Water Demand Management
(iii) The treatment and re-use of mine water as well as sewage effluent return flows
(iv) Implement surface water options
(v) The use of groundwater
(vi) Implement the Vaal River Integrated Water Quality Management Strategy
(vii) Review the use of water for irrigation and allow for movement of this water towards other sectors.

(i) The elimination of unlawful water use

Unlawful water use is a major issue in the Vaal WMA. Validation and Verification[5] has progressed very well and the necessary legal steps are being taken to bring this water back into the system. Control will always be required.

(ii) The implementation of Water Conservation and Water Demand Management

Saving water is essential if water resource reconciliation is to be achieved in the Vaal System. All Municipalities must take WC/WDM seriously and all parties and institutions must engage in this. WC/WDM is being addressed in Gauteng Province through the implementation of "Project 15%", with the target of cutting water losses by 15%. An important step, and unique to Gauteng, is the setting up of a Project Management Unit (PMU) covering all the metros.

(iii) The treatment and re-use of mine water

The immediate advantages of water treatment are:

a. The acid mine drainage problem is resolved
b. Water is made available for use - close to the source of requirement
c. The quality of the water in the receiving rivers is improved, which also means that smaller releases from Vaal Dam are required for dilution, and

[5] Validation: Assessing the volume of registered water vs. actual (1998) water use.
Verification: Determining the lawfulness of the water use (as it would have been lawful in 1998).

d. The cost of the reclaimed water is also unlikely to be higher than that of water secured through the next most feasible development option.

Since the commencement of mining in the 1880s, water has been pumped from the underground workings into the Vaal River system to permit work to continue. By the early 1980s the levels of salts from this discharged mine drainage, added to the growing burden from domestic sources, became too high and fresh water from the Vaal Dam has been used for blending and dilution to bring the river back to an acceptable quality. Large scale closure of mines in the Witwatersrand began in the 1970s and deep mining in the Western Basin halted in 1997, reducing the volumes of pumped mine water effluent into the Crocodile River. The impact on water quality in the Crocodile River lessened until these mines started decanting in 2002. As a short-term solution the addition of lime can quickly neutralise the acidity in the water, and some heavy metals can be removed, but this does not reduce the salinity, and this is what most urgently needs to be addressed. The long-term plan is to build the capacity to desalinate mine water decant by 2014/15, and to use this water for domestic and industrial purposes[6].

Mines in the Central and Eastern Basin (*inter alia* Grootvlei) have also ceased pumping – and this water will also need to be desalinated and made available for re-use.

(iv) Surface water options

Phase 2 of the Lesotho Highlands Water Project (LHWP - Polihali Dam) is currently being implemented and will deliver water by 2020. Further supply from surface resources should only be required after 2035, with additional augmentation possible from either the Thukela or Orange Rivers but at sharply rising cost. The required additional water needs to be held in reserve in both of these systems.

(v) The use of groundwater

Groundwater is a key development option for smaller towns in the Vaal WMA, especially across the dry Northern Cape. Accessible groundwater should always be utilised, even where surface water is available, in order to reduce the demand on surface supplies. Conjunctive

[6] The technology to desalinate polluted mine water can allow for the constituent salts to be separated out for commercial use; only a small amount of sludge is produced, and this can be contained in slimes dams.

use is often the sensible approach. The reduction in surface water use reduces the need to import very costly, and sometimes very scarce, additional supplies. Local groundwater is almost always a cheaper source than new imports of surface water.

Many towns in the Northern Cape rely on dolomitic groundwater this as their main source of water. So too, many rural communities in the area rely solely on groundwater for their everyday domestic and agricultural water supply needs. Mining expansion programmes planned in the Northern Cape are dependent on water being available both for mining and for related increased demands for domestic water supply. Current water supplies consist of local groundwater resources (boreholes and mine dewatering), and bulk water supplies from the Vaal Gamagara (VGG) Pipeline Scheme. The recently completed feasibility study to augment/upgrade the VGG pipeline supply capacity to meet increased water demands has indicated that the success of this endeavour is dependent on the extent to which existing and newly identified groundwater resources can be integrated into the upgrade.

(vi) Implement the Vaal River Integrated Water Quality Management Strategy

The *Vaal Integrated Water Quality Management Plan Study (2009)*, noted that all users - domestic, industrial and mining - contribute to the complex water quality issues. Managing water quality is therefore a joint responsibility in the Vaal Catchment. The salinity problem has been shown to have the biggest impact on the future security of water in the Vaal River System, and the strategy highlights this by promoting the treatment and re-use of both mine and domestic sewage effluent.

In addition to salinity problems, there are other water quality issues such as nutrient enrichment resulting in eutrophication, and microbiological contamination from untreated effluent causing health problems. Resource Water Quality Objectives (RWQOs) were set as part of the Integrated Water Quality Management Plan for the Vaal River. These set a high standard for water quality but a strategy on how to manage and limit the impacts of mining, with precautionary actions for new developments, must be developed and implemented without any delay if the ecological functioning of the Vaal River System is to be maintained. If these many issues are not addressed, deteriorating quality will diminish the utilisable volume of water in the Vaal System.

(vii) The use of water for irrigation

The cost of transferred water has become unaffordable for irrigation and no additional water has been allocated to this sector since the first large transfer schemes from the

Thukela in the early 1970s. Water to redress inequities will now have to come from savings from existing irrigation allocations. Furthermore, as transfers become even more expensive in future it may become necessary to move some of the existing irrigation allocations into urban use. This issue is not being actively pursued at present.

The Ecological Reserve

The biggest issue regarding the ecological Reserve is one of unseasonal over-supply - about which not much can be done. This is for example the case downstream of Vaal Dam. So too, the Ash and Liebenbergsvlei rivers get constant high level flows from the Lesotho Highlands Water Project (LHWP). Negotiations with Lesotho are aimed at bringing some variation into the transfers once the second phase of the LHWP starts delivering water. Under certain operational conditions, the Wilge River receives large releases from Sterkfontein Dam during the winter months. The possibility of changing the operating rule to mitigate this is being investigated.

2. The Orange River Water Management Area

Comprising the original Upper Orange and Lower Orange WMAs and the Upper Molopo, which was part of the Crocodile West and Marico WMA.

The Orange River is the country's major artery and a resource that must be managed with great care. The available yield for this system has been fully allocated, and there is no prospect of additional water for allocation without storage volumes being increased. This will come at significant cost.

The Current Water Balance In The Orange River

The Orange River is a major resource, with a number of big dams capturing and storing a large volume of water for use.

The use of this water includes:

- Transfers from the Senqu to the Vaal River and Gauteng through the Lesotho Highlands Water Project (LHWP)
- Transfers to the Eastern Cape (the Fish-Sundays scheme, with 50 000 ha under irrigation, and onwards as far as the Nelson Mandela Bay Municipality)
- Bloemfontein, and some mines and small towns along the river
- Major irrigation schemes along the river (~112 000 hectares)
- Water for the irrigation of 12 000 hectares of land by resource poor farmers. This was set aside in 1998, although very little of this water has been taken up
- As an international (shared) river, the needs of South Africa's neighbours must be accommodated.

The current water balance calculation takes account of the future needs of Bloemfontein, the additional water that will soon be needed by the Nelson Mandela Bay Municipality (NMBM), and the water needed to irrigate the 12 000 ha for resource poor farmers - if and when this is taken up.

Some important elements in the current situation include:

(i) The Lesotho Highlands Water Project – Phase 2

Phase 2 of the Lesotho Highlands Water Project, construction of the 2 200 million m^3 Polihali Dam and linking tunnel to Katse Dam, is set to commence in 2012 with completion in 2020. From this dam it will be possible to supply a total of 15 m^3/s (475 million m^3/a), with 8 m^3/s (250 million m^3/a) available to the Vaal River and Gauteng. Additional storage in the Orange River will be required to allow the additional 7 m^3/s (225 million m^3/a) to be transferred. Until this is created, the yield in Gariep Dam is effectively reduced and shifted upstream to Polihali Dam and water will have to be released from Polihali Dam to maintain the yield for users downstream of Gariep Dam.

(ii) Supplying Bloemfontein

Bloemfontein is the only city situated within the WMA, and sufficient water from the Orange River system has been reserved to meet its requirements. A water resource reconciliation study for the Mangaung Metropolitan Municipality has recently been undertaken[7]. With the Welbedacht Dam in the Caledon River (a major tributary of the Orange) having lost much of its capacity through siltation, Bloemfontein is now supplied with about a third of its water via the Knelpoort Dam, an off-channel storage facility with water pumped from the Caledon River. Pumping capacity to Knelpoort can be increased, so that a new dam is not necessary.

(iii) The ecological Reserve

Whilst the Orange River is considered to be 'in balance', the ecological Reserve is not being fully met.

A perspective on the future

There is still more water potentially available out of the Orange River, but this requires significant additional storage infrastructure. The perspective in the NWRS of 2004 was that the Vaal River System, supplying the economic heart of South Africa, relies on this water -

[7] *Development of Reconciliation Strategies for Large Bulk Water Supply Systems: Greater Bloemfontein Area*

and that this must be reserved to meet needs as these unfold. This perspective is maintained in this version of the NWRS and will guide the Orange River Reconciliation Study, which the Department is about to engage on, as discussed below.

Orange River Reconciliation Study

A detailed water resource reconciliation study for the Orange River System is to commence in 2011. This will reassess all possible future demands that could reasonably be supplied from the Orange River, and the ultimate yield potential of the system through the addition of various options, but with full consideration of the ecological requirements and international obligations. Recommendations will then be made about the utilisation of this strategic resource. Some of the current thinking is presented here:

Storage options in the Orange River

The most suitable option for added storage appears at present to be the construction of the Boskraai Dam (potential capacity 8 000 million m^3/a) at the confluence of the Orange and Kraai Rivers near Aliwal North. This dam would help in providing for the ecological Reserve, and would mean a much higher utilisation of all Orange River water. The planned Reconciliation Study will need to confirm that there is indeed enough water in the system to justify a dam this large, and to plan for the future use of this water.

Groundwater to meet town and mining requirements

There is a transfer from the Henkries pump-station on the Orange River to Springbok (130 km) and to the West Coast mines (Kleinzee 120 km). The transfer pipeline, built in the 1970's, urgently needs replacing, unless it is found that groundwater is able to meet these needs.

Most Northern Cape towns and mining enterprises within the Orange River WMA are dependent on groundwater. There are problems with the natural quality of the water, especially with high salinity, but new desalination technologies make the use of this groundwater much more feasible and small-scale desalination plants can make this water acceptable for use.

Water for solar energy generation

Water for power generation is a national strategic requirement that must be provided for. Solar thermal power plants require significant volumes of water for cooling, of a similar order to that required by a coal-fired station. With solar power stations logically located in the Northern Cape, water will have to be provided if needed but, as with new power stations elsewhere inland, cooling will have make use of "dry-cooling" technology. If this water is required before new yield is created through the building of dams (LHWP's Polihali Dam, in 2020) water may have to be moved from unutilised allocations, or traded from existing users.

However photovoltaic solar power generation requires very little water and the introduction of this technology, as it continues to improve, would decrease the demand for water for power generation in this area.

The Orange as International River

South Africa is the major user of the Orange River and has invested heavily in developing the water resources of the basin. The Katse and Mohale dams have been built as part of the Lesotho Highlands Water Project and the Polihali Dam is to be built over the period 2012 to 2020. The Gariep and Vanderkloof dams dominate the upper Orange River in South Africa.

The Orange-Senqu Commission (ORASECOM), established in year 2000, provides the four sharing countries (Lesotho, South Africa, Botswana, Namibia) with the opportunity for cooperation on basin-wide issues. There is, for example, a monitoring programme and early warning system aimed at detecting change to aspects such as water quality. Lesotho is developing the Lesotho Lowlands Water Supply Scheme. Namibia has irrigation schemes in the Fish River, some irrigation along the north bank of the Orange, and has indicated its intention to increase this. South Africa and Namibia are investigating the feasibility of a dam at Vioolsdrif, which would deliver water to Namibia and help in the management of South Africa's water use by storing the river's water for the second time (i.e. after release from Gariep / Vanderkloof dams), closer to downstream users.

3. The Limpopo Water Management Area

Comprising the original Crocodile (West) and Marico WMA (but excluding the Upper Molopo), the original Limpopo WMA, and the Luvuvhu catchment (previously part of the Luvuvhu/Letaba WMA)

This is a large and complex Water Management Area. Much of the area has a low rainfall and there are significant inter-dependencies for water resources between catchments and with neighbouring WMAs. This discussion offers a situation assessment for each of the many independent catchments, from west to east, feeding into the Limpopo mainstem.

The Marico Catchment

The Marico River catchment borders Botswana to the northwest and the Vaal WMA to the south. In the east the Marico River joins the Crocodile-West River to form the Limpopo River. The catchment is a large, relatively flat basin with a low rainfall. There are no upstream mountain catchments and surface water is limited. The watershed shared with the Middle Vaal region is dolomitic and groundwater is important, with springs, or eyes, providing river baseflows. These groundwater catchments are not clearly defined and are partially shared with the surface water catchments of the Middle Vaal.

The Marico is a predominantly rural catchment. The main economic activity and major water use is irrigated agriculture. Settlements include the towns of Zeerust and Marico, along with many rural villages. There is some mining activity but this shows little real growth. Growth in the area is primarily in and around Mafikeng which, although situated in the Molopo Catchment, is supplied from dolomitic aquifers in the Marico. The possibility of bringing water from the Vaal system to Mafikeng has been explored but does not appear promising due to the costs involved. Local sources (groundwater) and WC/WDM are immediate options for Mafikeng.

Water supply is very limited in the Marico, and sources are over-exploited, with resources fully developed. The system is under severe water stress. Two major storage reservoirs, the

Marico Bosveld Dam in the upper catchment and the Molatedi Dam further down-stream, regulate most of the flow in the Marico River. The Molatedi Dam is large but fills very rarely. There are several other dams, including the Klein Maricopoort (supplying Zeerust), Pella, Kromellenboog and Sehujwane Dams, with water used for irrigation and domestic use. Smaller farm dams are used for irrigation, stock watering and game farming. The Molatedi Dam also supplies water to Botswana in terms of an international agreement.

There are no opportunities for new dams. A recent review of the hydrology, "Updating of the Hydrology and Yield Analysis of the Marico River Catchment", shows that there is less water in the system than had previously been determined. Yields are therefore lower than were planned for when allocations were made and the system is in deficit. The recalculation of available yield means that there is less water available – and this applies to all users. The DWA has done a Reserve determination study for the Marico Catchment. This recommended that the Present Ecological State (PES) be maintained for Marico River. The importance of implementing an ecological Reserve monitoring programme was highlighted. Allocations from the Molatedi dam total 23 million m^3/a yet only 15 million m^3 is available. There are also shortages upstream. The obligation to Botswana, calculated on the previous hydrology, will also have to be reduced if the system is to be balanced.

Groundwater is relatively abundant but its use in the dolomitic areas has reached its limits and is impacting on surface water availability. Irrigation using groundwater from the dolomites must be brought under control to ensure sustainable yield. This almost certainly means limiting some users. The hydrological analysis of the catchment has recommended that this area be prioritised for Validation and Verification of use.

Transfers of water into the Marico from other catchments are unaffordable and local solutions will have to be found from amongst the following:

- Water Conservation and Water Demand Management
- Removal of alien vegetation in targeted quaternaries
- Validation and Verification of lawful water use, and water use compliance control
- Further groundwater resource development for areas located outside of dolomitic compartments
- The possible use of water currently allocated to irrigation in order to meet priority domestic demands
- The implementation of the operating rules developed for surface water resources
- A reduction in the allocation from Molatedi Dam to Botswana.

The Crocodile West Catchment

The Crocodile West River catchment is characterised by the sprawling urban and industrial areas of northern Johannesburg and Pretoria, extensive irrigation downstream of Hartbeespoort Dam, and large mining developments north of the Magaliesberg. Rand Water, with the Vaal River System as source, supplies the bulk of the urban water requirements for this area. Substantial volumes of return flows generated in the urban centres enter the Crocodile River, resulting in a surplus of water in the basin. This surplus offers a resource that can be used to support development in the Lephalale area of the Waterberg, in the adjacent Mokolo River catchment. Both the quantity and quality of water in the Crocodile River are a challenge to the requirements for the ecological Reserve.

The existing Reconciliation Strategy for the Crocodile Catchment has three main components:

- The Rand Water service area (including the Crocodile catchment south of the Magaliesberg) will continue to be supplied from the Vaal River System
- Areas north of the Magaliesberg will utilise the increasing return flows from treated effluent from the metropolitan area as the future source of water
- The Lephalale area must optimise the utilisation of local resources, but surplus water in the Crocodile River System is available for transfer.

With regard to the transfer of water to the Lephalale area, there have been significant planning changes since 2010. Fewer power stations are to be built, and the Sasol coal-to-liquid project has been put on hold. Expected long-term water requirements have dropped from 147 million m^3/a to 49 million m^3/a. Although there will be more mining of coal (with beneficiation requiring water) and other developments, the most immediate local short-term requirements can be met from the Mokolo Dam.

However, assurance of supply to the two major power stations, of great importance to South Africa, can only be achieved with the provision of a back-up supply of water from the Crocodile System. While the initial planned pipeline capacity will be scaled down, water from the Crocodile River catchment must still be reserved for Lephalale, although the exact quantity and timing of this requirement are not known at present. Provision must be made to supply at least one more power station, as well as for coal mines that may both export coal and supply the Mpumalanga power stations to extend their operational life spans.

Projected future increases in domestic return flows, and the reduction in requirements in the Lephalale area, mean that there will now be a surplus of water in the Crocodile West system, and it is no longer necessary to seek additional effluent transfers into the Crocodile River to make up the previously anticipated deficit.

The focus of the Crocodile West Reconciliation Strategy is to get better estimates of the requirements in the Lephalale area, and to reserve that amount in the Crocodile. This would come from the available surplus. Only water still in surplus after this can be made available for re-use in Gauteng. Both the Tshwane Metropolitan Municipality and Magalies Water are planning to maximise the re-use of effluent. Careful coordination can ensure that all return flows are beneficially used.

At the present time, with the large volumes of return flows into the Crocodile West, the management of the water quality in system is an obvious priority to ensure usability. Re-use of this water would probably require partial desalination, especially as return flows dominate the total flows in the river, with insufficient fresh water for dilution.

Using groundwater to supply downstream rural areas (i.e. to the north) will provide water of a higher quality, and is likely to be more cost effective than using surface water.

The Matlabas Catchment

The Matlabas catchment has limited water resources and no significant dams. The catchment is in deficit but requirements are low. With very little potential for growth, this is not critical. There is some opportunistic irrigation using very low assurance surface water but the most reliable supply is from groundwater, although boreholes are low yielding.

The Mokolo Catchment

The Mokolo River is fed by run-off from the Waterberg Mountains with one major dam, the Mokolo Dam, situated in the lower reaches of the river. Irrigation in the Mokolo catchment upstream of the dam has declined over the years due to the shift towards game farming,

and this has meant an increase in the yield of the dam. The Mokolo catchment is largely rural, except for the Waterberg coalfields in the vicinity of Lephalale. Here there is huge development potential but growth expectations have been significantly downscaled since 2010 (see also discussion on Lephalale under the Crocodile West catchment). Although fully allocated, the Mokolo Dam can meet the bulk of current need. The one key additional requirement is to provide assurance of supply to the Matimba and Medupi power stations. The only suitable option for this is to bring in water from another source and hence the planning for a pipeline from the Crocodile West system. Design of this pipeline will pay attention to future needs projections.

There is little opportunity for other development of the water resources in this system. It is technically possible to raise the Mokolo Dam but this would bring with it all the downstream and international supply problems associated with the construction of a new dam. Groundwater can supplement the resource supply to Lephalale, and should always be considered in supplying rural communities.

Lephalala Catchment

The Lephalala catchment supports a rural farming community, with the middle reaches of the catchment set aside as a nature conservation area. There has been very little development of water resources beyond farm dams and weirs for irrigation. Irrigated agriculture is supported primarily by surface water abstraction in the upper reaches, and through the abstraction of alluvial groundwater in the lower reaches of the catchment.

As a largely unregulated river the Lephalala supplies flood flows to the Limpopo, but even without major dams all low flows are captured and utilised. Construction of a large dam is not practical, and local needs will have to be met, as in the past, from local resources and from groundwater.

Mokgalakwena Catchment

The water resource in the Mokgalakwena catchment has been fully developed. There are two significant dams, the Doorndraai Dam (supplying Mookgophong and Mokopane) and the Glen Alpine Dam, supplying downstream irrigation needs. Water allocated to emerging farmers from Glen Alpine Dam has not yet been taken up and should now be utilised in

supplying growing domestic requirements. Modimolle gets its water from the Roodeplaat Dam in the Crocodile West catchment. The Nylsvley wetland is upstream in the Mokgalakwena catchment – a valuable conservation area and source of water to downstream users.

Mokopane is the centre of mining activity and now requires additional water. While the Doorndraai Dam was used for irrigation, a big portion of that scheme has already been taken up by Mokopane. The area has gained economic importance due to the rapid expansion of mining and more water will now have to be transferred in to support this as a matter of priority. New mines will be supplied from the Flag Boshielo Dam in the Olifants River (see discussion on the Olifants River Water Supply System).

With the exception of Mokopane and transfers of water to meet the needs of the upper reaches of the Mokgalakwena, the catchment will have to rely on its own resources.

The Sand River Catchment

The Sand River is aptly named. The catchment has limited surface water and is heavily dependent on transfers from neighbouring systems. It does, however, have good groundwater reserves although these have been fully- and possibly over-exploited.

Polokwane LM, in the upper catchment, is reliant on water from the Letaba River (Ebenezer and Dap Naude dams), and from the Olifants River (Flag Boshielo Dam), together with local groundwater resources. Polokwane also recycles effluent water though an innovative artificial recharge scheme. Polokwane is a growing city and will require more water from the Olifants River in future.

Louis Trichardt and environs (Makhado LM) draws on the Albasini Dam in the Luvuvhu catchment, and will in future take water from Nandoni Dam, also in the Luvuvhu. The town recycles effluent for urban irrigation; this will increase as a resource and will have to be considered for industrial and even domestic use in the future. Groundwater is also important.

There are large groundwater irrigation areas, such as around Dendron and Vivo, in the central and northern Sand catchment. The challenge for these schemes is sustainable use, and farmers need to work this out together. Communities are also groundwater dependent but there does not seem to be conflict with agriculture in the use of aquifers.

Game farming predominates in the north of the catchment, in which the Mapungubwe National Park is also situated. There is no surface water and no large-scale irrigation. Coal mining potential in the vicinity of Louis Trichardt and Musina will only be realised if water can be leveraged from local sources – either through groundwater or by shifting agricultural water use into the mining sector.

The Nzhelele River Catchment

The Nzhelele is a rural catchment draining northwards into the Limpopo. The catchment economy is dominated by irrigation, with some forestry on the slopes of the Soutpansberg Mountains. There is a small industrial area known as the Makhado Centre. The catchment is regulated by two dams, the Nzhelele Dam and the much smaller Mutshedzi Dam, used for irrigation and domestic supply. Groundwater sources are suitable to meet the needs of all villages. The catchment is stressed even without implementation of the Reserve. Both dams could technically be raised to increase capacity but this would be very difficult to justify in the face of international obligations. Some of the allocated irrigation water has also not yet been taken up. Further to this there are very significant losses of water, especially from the Nzhelele canal system. Validation and Verification of water use is to be undertaken as a first step in seeking to balance water availability with requirements. Water use efficiency measures have to be implemented, after which a reduction of existing allocations is the only reasonable measure to achieve this balance.

There is potential for coal mining in the middle and upper reaches of the catchment. This will require that water be found locally – either groundwater or existing agricultural water. The transfer of effluent water from Louis Trichardt is not supported by DWA as this water could otherwise be used by the town, and its use elsewhere would effectively mean that a transfer from Nandoni Dam to Louis Trichardt would be required. All the available water in Nandoni Dam is needed to supply demands in the Luvuvhu catchment, as well as parts of the much-stressed Middle Letaba.

The Nwanedi Catchment

The Nwanedi catchment has some irrigation from two small dams and run-of-river yield. There are also good groundwater resources. The system is over-allocated but, as in the Nzhelele, not all allocations are being put to use.

The approach in both the Nzhelele and the Nwanedi catchments has to be to reduce water use losses, improve efficiencies, and put unused water to work.

The Luvuvhu River Catchment

The Luvuvhu River, rising off the south-eastern flanks of the Soutpansberg, is one of the only well-watered catchments within the Limpopo WMA. The catchment is now very densely populated. Villages are amalgamating and upgrading and the landscape can be described as a "rural megalopolis". Thohoyandou hosts the District Municipality, and is the regional 'service centre'. The economy is driven by irrigation, along with commercial forestry.

A number of dams have been built in the Luvuvhu catchment and there is no scope for further storage. The Albasini Dam is over-allocated and, along with reductions in canal losses, some curtailment of irrigation may be necessary in order to balance requirements with availability. The most recent new dam is Nandoni Dam, completed in 2005. This was intended, *inter alia*, to supply regional bulk water to Thohoyandou, Malumulele, and Louis Trichardt. There is still some unallocated water in Nandoni Dam but this will be required for local domestic growth. This water is the last local source and should not be transferred elsewhere without a serious weighing up of the implications. The urgent needs in the Middle Letaba have nevertheless led to the current construction of an emergency water supply scheme from Nandoni for Giyani. In the medium term local water sources in the Giyani area (primarily groundwater) will have to be developed to meet local needs as the Nandoni Dam will be hard-pressed to meet other immediate needs in the Luvuvhu. Groundwater is important in supplementing irrigation downstream of Albasini Dam (conjunctive use), and in providing water to rural communities in the vicinity of Thohoyandou. The control of invasive alien vegetation is also important in this catchment.

The Mutale River joins the Luvuvhu from the north, just above the Pafuri floodplains, from where it flows into the Limpopo before this enters Mozambique. The Mutale River is largely

unregulated and still in a relatively natural state. The NFEPA Report[8] recommends strongly that it be maintained as a natural system. Any development of the river would also have to be negotiated internationally.

A *Reconciliation Strategy Study for the Luvuvhu and Letaba Water Supply System*, aimed at finding the best utilisation of water resources, has been commissioned by the DWA.

The Limpopo Main Stem

The Limpopo River once flowed perennially but is now highly seasonal. The mainstem supplies a narrow agricultural strip and some mining activity. Weirs across the upper reaches of the river are used to store some water, while further downstream water is drawn from large sand aquifers in and next to the riverbed. Both the Venetia diamond mine and the town of Musina are supplied by alluvial sand aquifers. Mainstem water resources are fully developed and any expansion or new development will have to get its water from other existing sources – typically by buying out irrigation water.

The Ecological Reserve In Limpopo Catchment Rivers

Development in these catchments started over a hundred years ago and flow in the tributaries of the Limpopo River has greatly diminished. When farmers on the Limpopo main stem finally got electricity, pumping directly from the river increased significantly. Flows became intermittent and weirs were built across the riverbed, especially in reaches above the confluence with the Shashe River. Water was, and is, pumped from these weirs, which have no control structures to release flows. Lower down, water is drawn from the alluvial sand aquifers directly underneath and along the river.

There have been Reserve determinations in the Crocodile West, the Marico and the Mokolo. It is not in any way practical to release upstream flows for the management of low flows in the Limpopo. Water released from the tributaries might reach the main stem but would never get beyond the first weir. The low-flow status quo of the Limpopo mainstem has changed irreparably, and a true Reserve can now never be achieved. Botswana does not

[8] National Freshwater Ecosystem Priority Areas (Water Research Commission 2011)

have legal obligations to the Reserve of this common river, complicating the task. It is nevertheless recommended in the NFEPA report that a portion of the Marico River be protected in its current, relatively pristine condition. The Mutale River should also be preserved as a natural system.

4. The Olifants Water Management Area

This comprises the original Olifants WMA as defined in the NWRS of 2004, together with the Letaba River system (previously part of the Luvuvhu/Letaba WMA)

This is a highly stressed WMA, fast growing in terms of population and need for improved services. There is very little opportunity for further water resource development and no realistic opportunity to import significant volumes of additional water from elsewhere.

The Letaba And Shingwedzi River Catchments

The Shingwedzi River, which joins the Olifants downstream in Mozambique, is situated almost entirely in the Kruger National Park. It is of local importance but does not deliver significant sustainable yield to the overall system.

The Letaba River catchment is drained by the Groot Letaba River and its major tributaries - the Klein Letaba, Middle Letaba, Letsitele and Molototsi rivers. The Letaba joins the Olifants River just upstream of the border with Mozambique. The catchment of the Groot Letaba is well watered in the upper parts, where the river rises in the Drakensberg. The Middle Letaba River is a tributary of the Klein Letaba and these rivers are quite different from the Groot Letaba, having very dry catchment areas. Regular water shortages over a number of years have brought about what is commonly known as “the Middle Letaba crisis”.

Some of the Letaba River’s water is used to supply Polokwane, with transfers from the Ebenezer and Dap Naude dams. There is also a small transfer to users around Gravelotte, in the Olifants River catchment. The key dams are the Middle Letaba, Ebenezer and Tzaneen dams.

Major urban areas are Tzaneen and Nkowakowa in the Groot Letaba catchment and Giyani in the Klein Letaba. Tzaneen is built upon commercial agriculture, with a growing base of emerging farmers. Irrigation in the Groot Letaba is supplied primarily via the Tzaneen Dam.

Water resources from the Tzaneen Dam have been over-allocated, resulting in high risk to farmers, and the ecological Reserve is not being met. The Groot Letaba River Water Development Project is aimed at resolving these shortages, including the needs of the Reserve. Necessary additional storage opportunities include the raising of Tzaneen Dam and the construction of the Nwamitwa Dam, downstream on the Groot Letaba. Both of these projects are ready for implementation and waiting for national Treasury approval.

The Middle Letaba Dam was constructed to meet the needs of both irrigation and the town of Giyani, but the dam is unable to meet the growing domestic need. High water losses are a major contributor to the problem with half of the water never reaching its destination or achieving its intended use. The linking canal from the Middle Letaba River to Ntsami Dam leaks much of this water and repairs must be undertaken. Water losses in Giyani itself are also far too high. Whilst a temporary transfer has been authorised to supply Giyani out of Nandoni dam in the Luvuvhu River, DWA will not change the status of this temporary allocation until both WC/WDM and all other sources of water within the catchment have been fully explored and implemented. (As noted in the discussion for the Limpopo WMA, all water from Nandoni Dam is required to meet local needs in the Luvuvhu Catchment, and everything should be done to ensure that Giyani becomes self-sufficient).

Many high-yielding boreholes have been drilled in the Giyani area but a large number of these are no longer operational. These boreholes should be equipped and linked up to a bulk supply system, with water distributed from central reservoirs to allow for a proper management programme and operational rules. This would offer a sustainable water supply at a high level of assurance. Further groundwater augmentation opportunities should be investigated in all Letaba river catchments

A reconciliation strategy study for the Letaba-Luvuvhu is to be commissioned by DWA in 2011.

The Olifants River Catchment

The water balance situation

The Olifants River originates on the Mpumalanga Highveld, flowing northwards before curving in an easterly direction through the Kruger National Park and into Mozambique where it joins the Limpopo River. Water requirements have increased substantially in recent

years, with the mining sector growing particularly rapidly. The system is highly regulated, with the most significant dams being the Witbank, Middelburg, Bronkhorstspruit, Mkhombo, Rust De Winter, Loskop, Flag Boshielo, and Blyderivierspoort dams. Groundwater is also important as a resource. Significant volumes of water are transferred from the Vaal, Usuthu and Komati River Basins to supply power stations located in the Upper Olifants. Available water resources are nevertheless not sufficient to meet the requirements of users and this is one of South Africa's most stressed catchments in terms of both water quantity and water quality.

The ecological Reserve, as defined at present, cannot be met. The ecological requirements are highlighted by the position of the Kruger National Park at the bottom end of the catchment. The Kruger National Park and other wildlife reserves and recreational facilities are important tourist destinations and significant income generators for the country.

Water quality

Water quality problems are serious, often originating from identifiable point sources. The treatment of effluent and mine water is already being implemented in Emalahleni, providing an important source of utilisable water.

Infrastructure development

The de Hoop Dam is currently under construction, mainly aimed at supplying mining and domestic water. However, even with the de Hoop Dam in place the system will still have a large deficit.

The only options for additional dams have been identified low down in the system (Sekukuhuneland and in the Lowveld) but it is highly unlikely that construction will be feasible both from a cost benefit perspective and in view of downstream international obligations. To import water from other catchments (e.g. the Vaal) is technically possible but would be very expensive.

Reconciliation options for the Olifants

Any new development in the Olifants River Catchment will have to consider resource scarcity and cost. This could well constrain development, particularly in terms of timing.

A Water Resource Reconciliation Strategy Study for the Olifants River Catchment is to be completed in 2011. From this study it is already apparent that solutions to the water resource shortages within the Olifants Catchment will have to come from within, and there is no easy supply option.

Reconciliation options are being evaluated to alleviate the deficit that still remains after the completion of De Hoop Dam. Suggested interventions include:

(i) Implementation of Water Conservation and Water Demand Management in all sectors (improve operating rules, eradicate unlawful water use, remove invasive alien plants, water use efficiency, etc)
(ii) The use of mine water and treated effluent
(iii) Development of groundwater resources, notably for mining
(iv) Water Trading: water saved through agricultural efficiencies could be moved into the mining and industrial sectors

Options for reconciling the water balance include a re-evaluation of the Reserve requirement. It may be possible to achieve the ecological goals with less water than previously considered necessary. This is currently being investigated as part of the reconciliation study.

5. The Inkomati – Usutu Water Management Area

Comprising the original Inkomati WMA and the Usutu River system (excluding the Pongola Catchment)

The Inkomati WMA, as defined in the NWA of 1998, has an established Catchment Management Agency (CMA), with a draft Catchment Management Strategy (CMS). This CMS now needs to be amended to represent and meet the needs of the larger revised WMA, which includes the Usutu River catchment.

Transfers of water into this WMA from elsewhere in South Africa are not feasible given distance from all other sources. Opportunities for new dams are very limited, beyond some possible storage to meet growing domestic needs. Water resource deficits will have to be met from within the WMA through more efficient use of the limited resources.

The Inkomati – Usutu WMA can be subdivided into four distinct areas:

1. *The Sand and Sabie River Systems*
2. *The Crocodile River (East)*
3. *The Komati and Lomati River Systems*
4. *The Usuthu River Catchment*

Sand And Sabie River Systems

Sand River catchment

The Sand River Catchment is largely ex-homeland area with large concentrations of people living in a semi-rural context. The Sand River has very little mountain catchment area producing runoff and is generally poorly watered. While there is some groundwater still available for domestic use, all other available water from within the catchment has been used and the area is dependent on transfers from the Inyaka Dam on the Mariti River (Sabie system). Backlogs in domestic supply have not been cleared and the population continues to grow. The ecological Reserve is also not being met, negatively affecting river systems and downstream game reserves, including the Kruger National Park. Water requirements exceed not only the available supply but also the potentially available supply. Water resource reconciliation options for the Sand River catchment include:

i. Water Conservation and Water Demand Management in both the domestic and irrigation sectors.
ii. There is some potential for water resource infrastructure development but options have both environmental and international implications. The construction of the New Forest Dam on the Mutlumuvi River, aimed only at meeting domestic requirements, could be considered. Any new dam development would have to be negotiated with Mozambique.
iii. A significant volume of water is allocated to irrigation but water distribution to schemes like New Forest, Dingleydale and Champagne are in a poor state and the level of inefficiency is high. It will not be possible to justify a new dam, even for domestic use, when so much water is being visibly wasted. Achieving efficiencies and moving some of this water into the domestic sector is an important option.
iv. The provision of surface water from the Inyaka Dam (completed in 2002) has led to the abandonment of groundwater supply schemes in many villages. However, the conjunctive use of surface and groundwater is essential if all requirements are to be met, and if risks in the failure of supply are to be reduced. Existing groundwater resources must be refurbished and properly operated and maintained, and new groundwater sources developed.

Sabie River catchment

The Sabie River is in a better condition than most river systems in the country. The catchment is in balance, with water availability matching requirements and with the ecological Reserve being supplied. However, there is no water to spare. The Inyaka Dam on the Mariti River was expected to bring about some surplus, but water availability has proved to be just enough to meet existing requirements. Domestic requirements are on the increase and some of the allocations for the currently abandoned irrigation schemes like Calcutta and Lisbon may have to be re-allocated to meet the future needs of the domestic sector.

Not all domestic water use abstractions in the Sabie and Sand catchments have been licensed and control over actual requirements and use must be asserted.

Reconciliation options for the Sabie River include:

i. Water Conservation and Water Demand Management in both the domestic and irrigation sectors.
ii. Allocated but unused irrigation water could be transferred to domestic use. If this approach is adopted then ineffective irrigation schemes should not be refurbished and the uptake of scheme

water should not be encouraged; even actively discouraged[9]. Tourism in the Sabie catchment may already be making use of some "irrigation" water (this being a *de facto* transfer by users themselves).

iii. Opportunities for the conjunctive use of groundwater must be explored.

The Crocodile River (East)

Water from the Crocodile River has been over-allocated and water requirements regularly exceed available supplies. This is managed largely by users themselves through voluntary water restrictions. The ecological Reserve[10] is not being fully supplied, and it is difficult to meet international obligations.

Existing dams in the Crocodile River catchment cannot capture and control all potentially available water, so in theory there is some potential for additional storage – but dam sites are few and far from ideal, and would be expensive to develop. Any impact of additional storage on South Africa's ability to meet international obligations would also have to be negotiated.

The Nelspruit/ KaNyamazane complex, capital of Mpumalanga, is one of the fastest growing centres in the country. Water management in some areas is very poor and losses extremely high, so whilst the area needs more water this must first come through implementing Water Conservation and Water Demand Management (WC/WDM) measures to reduce losses and wastage. The DWA is embarking on a water resource reconciliation strategy for Mbombela. Moving water from irrigation to urban, industrial and domestic use, and increased storage will also be examined as options.

[9] The "use it or lose it" policy has resulted in significant additional uptake – with users trying to secure a right to the resource. Water lost through resultant inefficiencies needs to be recouped.

[10] Note that the ecological Reserve (also known as the Environmental Water Requirement or EWR) in the Crocodile River has not been signed off and interpretation is also proving a problem. Should the full existing ecological Reserve be signed off then there will be no room for further development of surface water sources.

The Komati And Lomati River Systems

The Komati and Lomati River system is currently in balance owing to the relatively new Driekoppies and Maguga dams. This has been a good example of resource sharing between South Africa and Swaziland. There is however currently no water available for additional use and irrigation water allocations will have to be used to meet domestic water requirements - both to eradicate service backlogs and to meet growth requirements.

The upper Komati remains an important source of water for power generation on the Highveld, with Eskom requiring the full yield from both the Vygeboom and Nooitgedacht dams. This use has strategic priority. Long-term planning was for this water to become available for reallocation with the phasing out of the Highveld power stations as local coal supplies diminish. However, Eskom is now considering the possible importation of coal from Lephalale to keep the power stations in operation for longer than originally intended. The current allocation must therefore be retained for this purpose. The development of any further storage on the Komati River would be very expensive and is not currently considered a viable option.

The Usuthu River Catchment

The Usuthu River in South Africa is close to being fully utilised and approximately in balance, with just a small quantity of water still available for domestic use. As in the case of the Komati, much of the available water from the Usuthu catchment (Jericho, Westoe, Heyshope and Morgenstond dams) is transferred out of the catchment for use by Eskom power stations on the Highveld. This requirement is likely to stay in place for the foreseeable future. The upper Usuthu is not a densely populated area and the topography, poor soils, altitude, and distance from markets are a limitation on growth and development. Afforestation is the dominant land use but expansion remains limited by water availability. There is very little irrigation, which also means that there is not much opportunity to trade irrigation water back into domestic or other use.

Low future growth means that it should be possible to maintain the *status quo*; no major development plans are possible. Swaziland is also very dependent on the Usuthu River, and relies on responsible upstream use by South Africa.

6. Kwazulu-Natal Water Management Area

Comprising the original Usutu-Mhlathuze WMA (excluding the Usuthu Catchment), the Thukela WMA, and the Mvoti-Mzimkulu WMA

The KwaZulu-Natal KZN Water Management Area comprises a number of medium to very large catchments with all the rivers flowing directly into the sea, apart from the Pongola River that joins the Maputo River in Mozambique. There are some water transfers across catchments. The most important sharing of water is the use of the Thukela System to supplement the Vaal System, with more water reserved for expected long-term requirements. The most critical water supply issue in the WMA is in meeting the growing requirements of the KZN Coastal Metropolitan Area, which includes Durban and its environs. The KZN Coastal Reconciliation Strategy published in 2010, is a key source document.

This strategy review considers the situation within each individual catchment.

The Pongola Catchment

The Pongola system is dominated by the massive Pongolapoort Dam (full capacity 2 267 million m^3). The catchment is in balance upstream of the dam, with the Bivane Dam providing irrigation water to sugar cane farmers.

The Pongolapoort Dam still has some available surplus water, all of which has been earmarked for use benefitting the local population. There are a number of considerations associated with the utilisation of water from the Pongolapoort Dam:

(i) The Pongola is a shared river with international obligations
(ii) A significant volume of water must be released for social and ecological purposes
(iii) Mozambique is very sensitive to high flows in the Maputo River System. Great care is required when making flood management or ecological/social releases
(iv) For dam safety reasons involving the capacity of the spillway, the dam must be operated at a reduced full supply level. The provincial road currently routed over the dam wall would have to be re-routed if the dam is to be utilised to its full potential

(v) Schemes to utilise available water have not been successful, including a recent proposed plan involving 40 million m^3 of irrigation water per year.

There is sufficient water available from Pongolapoort Dam to meet domestic and significant irrigation needs in the area, but this water has not been utilised yet. Even with the reduced full supply level there is still some 50 million m^3/a available for use.

The Mkuze

Water in the Mkuze River catchment is very intensely utilised both by forestry and for irrigation purposes. Low flows, particularly, are over-utilised. There is a 32,6 million m^3 transfer out of the Pongolapoort Dam into the Mkuze catchment for irrigation and domestic purposes. There is no suitable site or opportunity for a large dam on the Mkuze River and therefore little regulation (storage) of the river flow. Upstream water use, poor catchment management, and erosion in the catchment exacerbate the fresh water deficit and other ecological problems experienced by the estuarine Lake St Lucia, a World Heritage Site. However, the fact that no dams have been built does mean that Lake St Lucia still receives the bulk of the floodwaters.

The Mfolozi River

The Mfolozi River catchment has very few dams and is therefore, like the Mkuze, largely unregulated. Suitable instream dam sites are few and such dams would have to be very large to accommodate the high silt loads. There are some opportunities for smaller off-channel dams but these would be costly, with water unlikely to be affordable by irrigators. Off-channel storage is an option should the water be required for Richards Bay, situated in the neighbouring Mhlathuze catchment. The proposed re-routing of the Mfolozi River to discharge back into the lower end of Lake St Lucia, as it once did naturally, needs consideration.

The Klipfontein Dam, high upstream in the White Mfolozi River supplies both Vryheid and Ulundi. There are increasing water requirements in both of these towns and one option is to increase yield by raising the wall of the dam. This would be very expensive. While major further surface water infrastructure (storage) development is possible in the Mfolozi, there is not yet a big enough need to justify this.

The hydrology of both the Mfolozi and the Mkuze rivers is poorly known and the first step would be investment in improving this knowledge before any large development projects can be seriously considered.

The Mhlathuze Catchment

The available water in the Mhlathuze catchment has been over-allocated to users but the full allocations have not been utilized and the system is therefore rarely subject to restrictions. There is an augmentation transfer out of the Thukela River that is activated when the level in the Goedertrouw Dam drops below a critical level. This provides a high assurance of supply to Richards Bay. The Mhlathuze Catchment has been a pilot for Water Allocation Reform, aimed at bringing about equity in allocations. This should also correct existing over-allocations.

With Richards Bay a strategic and growing economic node, the options required in securing and optimising the use of the water resource is critical and the Department is to undertake a full water resource reconciliation strategy study starting towards the end of 2011.

The Thukela Catchment

The Thukela River is the largest river in the KZN WMA. The river is extensively utilized for transfers into the Vaal System, and also to other catchments both to the north and south in order to support economic growth in KZN. Existing transfers include:

(i) The Thukela-Vaal transfer scheme - for augmenting the Vaal River system
(ii) Zaaihoek Dam in the Slang River (a tributary of the Buffalo River) - for Eskom power generation on the Highveld
(iii) Transfer to the Mhlathuze – for augmenting Richards Bay's industrial water supply
(iv) The Mooi-Mgeni River transfer, currently being increased with the construction of Spring Grove Dam – to supply eThekwini Metropolitan Municipality
(v) Construction of the North Coast Pipeline by Umgeni Water to supply water from the Thukela River to the Kwadukuza area will start shortly.

Within the Thukela catchment itself the river supplies water to the Ladysmith and Newcastle complexes, as well as the Sappi pulpmill downstream at Mandini.

The available water resource as it stands at present (i.e. until further dams are constructed) is close to being fully utilised. There is still potential for building large dams to augment transfers to the Vaal system. Planning for these dams on the Thukela (the proposed Jana and Mielietuin dams) has meant that water from the catchment has been reserved for future augmentation of the Vaal System. Some tributaries are already fully utilised or in deficit including the Little Thukela, the Sundays, and the Mooi rivers. The Buffalo River has a small surplus that could be utilised by Newcastle and surrounds for domestic and industrial use.

Decisions on when additional transfers to the Vaal system will be required from the Thukela River will become clear only with time and a better understanding of the growth in future requirements. In later years, when the Vaal System requires further augmentation, the coastal areas could switch to desalination of seawater or re-use of water, with the stored water in the Thukela transferred to the Vaal System. If further transfers are delayed very far into the future it may become necessary to build a dam somewhere on the Thukela to support supplies to the KZN coastal metropolitan area together with development along the North Coast.

Mvoti-Mgeni-Mdloti Catchments

Water requirements of the KZN Coastal Metropolitan Area (Durban-Pietermaritzburg and Kwadukuza in the north to Amanzimtoti in the south), are still increasing. These needs have led to the Mgeni System and the smaller Mdloti River being fully developed. These systems are already in deficit and will be augmented primarily with water from the Spring Grove Dam on the Mooi River, to be completed in 2013.

The recently completed Kwazulu-Natal Water Reconciliation Strategy gives detailed information on how future water requirements can be accommodated.

Water Conservation and Water Demand Management and the Re-use of Water are essential strategies for the KZN Coastal Metropolitan Area. WC/WDM is the fastest way to reduce requirements, with almost immediate returns on investment. The re-use of water must be

more actively implemented for the Durban area as return flows are otherwise lost to the sea. Re-use schemes can typically be implemented over three years.

Further sources will have to be found to augment supplies after 2023. The construction of a dam on the Mkomazi is a major option for Durban and the South Coast, and development of the Mvoti River a significant option for the North Coast area. Seawater desalination may be of particular importance to the KZN Coastal Metropolitan Area because of very rapid growth and the high economic and environmental cost of additional surface water development.

Mkomazi

The Mkomazi is one of South Africa's last large free flowing rivers. The river has potential for large-scale water resource development, but a dam would come at a high environmental cost. The Mkomazi River is considered a logical source for the Durban metropole but should be carefully compared and costed against desalination of seawater before a decision is taken.

An off-channel dam near the coast would serve to meet Sappi Saiccor's water requirements, along with the needs of other local coastal users.

Mzimkhulu Catchment

There are no big dams on the Mzimkhulu River and existing storage provides for only limited regulation. The system is approximately in balance at present but has deficit hotspots - notably Port Shepstone. Here off-channel storage is being investigated to overcome a periodic urban water supply problem.

A water resource study of the Mzimkhulu catchment has been recently completed. This indicates that growth, particularly in the agricultural and forestry sectors, needs further water resource development. There are opportunities for this, but these have yet to be costed. Infrastructure costs may mean that the water provided is unaffordable. The area has been identified for forestry expansion and this should be possible provided the forestry sector build compensatory dams, off-channel, to offset the impact of afforestation on the

water resource, especially on low flows. Forestry has the advantage that compensatory dams do not need to be as closely linked spatially to the development scheme, as in the case of agriculture. Great care must be taken in development of the Mzimkhulu River, which has been highlighted in the recent NFEPA report[11] as being of high importance for protection from major development. Construction of dams in the upper catchment and in the main stem of the river should thus be avoided.

Summary Approach For The KZN Water Management Area

Water resource planning and management in the KZN WMA has long been dominated by the relative abundance of surface water. However, as the above situation shows, there is very little water to spare. Most catchments are, at best, in balance and many tributaries are already in deficit. There are more opportunities for the development of storage infrastructure in KZN than in most other WMAs, but few that appear economically viable. Water has been reserved for major development in the Thukela catchment, but for transfer to the Vaal System. The KZN Coastal Metropolitan Area can be supplied through a complex combination of implementing Water Conservation and Demand Management measures, water re-use, developing additional storage both to the north and south, and seawater desalination.

Twenty per cent of all the groundwater in South Africa is to be found within the KZN WMA, yet this resource is underutilised in the region. There must now be significant investment in the exploration and development of its potential, especially in augmenting supplies to villages and smaller towns.

[11] National Freshwater Ecosystem Priority Areas

7. The Mzimvubu - Tsitsikamma Water Management Area
(EASTERN CAPE RIVERS)

Comprising the original Mzimvubu-Keiskamma and Fish-Tsitsikamma WMAs.

The Mzimvubu-Tsitsikamma WMA covers practically the entire Eastern Cape Province and includes a number of very large and vastly different catchments, from the arid Karoo in the west to sub-tropical in the northeast.

The water resource situation is described for:

(i) The Mzimvubu catchment
(ii) The Mthatha catchment
(iii) The Mbashe and Kei catchments
(iv) The Amatole system (supplying the Buffalo City Metro Municipality)
(v) Albany Coast and the Bushmans River catchment
(vi) The Fish and Sundays River systems
(vii) The Kouga, Kromme, Gamtoos and the Algoa Water Supply System

The Mzimvubu Catchment

(including the coastal catchments between the Mtamvuna and the Mzimvubu rivers, i.e. the PONDOLAND CATCHMENTS)

Surface water development

The Mzimvubu and Pondoland catchment areas have a relatively high mean annual runoff but the water resource remains largely undeveloped and no large dams have been constructed. The Mzimvubu Development Study was completed in 2010 as part of the quest for new opportunity. This study identified a number of technically feasible dam sites and some potential for irrigation. A feasibility study for the Zalu Dam that will supply water to Lusikisiki and environs is underway, while a full feasibility study on a potential large dam for irrigation on one of the major Mzimvubu River tributaries is due to start soon.

There are no large centres of urban/ industrial demand within easy reach of the Mzimvubu River that could carry the cost required to build dams for water supply. The prospect of transferring water into the Orange and Vaal catchments has been examined over many years, but, with other plans in place to supply inland requirements, this transfer will not be needed for a long time to come.

Afforestation and dryland cropping

The Mzimvubu catchment is very suitable for afforestation and this is an effective way of putting water to use. Even a large area under forestry will utilise only a small portion of the available water in the catchment.

Along with afforestation the major development potential in the Mzimvubu catchment lies in dryland (rainfed) cropping - typically dryland maize production - with an estimated potential of 400 000 ha. Both forestry and dryland crop farming are direct forms of rainwater harvesting and the most efficient form of agricultural water use. Forestry and rainfed agriculture are seen as the most effective ways of capitalizing on the relatively abundant water resources of this catchment.

Rainwater harvesting through effective land management, field design and the construction of tanks and small dams is particularly important as a strategy in support of irrigated agriculture in the Mzimvubu catchment.

The Mzimvubu River has a very high environmental status (NFEPA Report 2011). The area also has high tourism potential. Responsible forestry, rainfed agricultural development and rainwater harvesting all fit well with environmental and tourism development goals.

Land management

Sedimentation of rivers and dams is a major problem in the region due to wide-spread dispersive soils. Past erosion control works have helped with stabilisation but there is a need for the implementation of innovative land care programmes on a substantive scale. These could include the clearing of invasive alien plants and the introduction of land rehabilitation programmes aimed at providing watershed services by reducing erosion.

Groundwater development

There is a very high need for basic water services within the Mzimvubu catchment. The former Transkei Department of Works sunk boreholes in almost every village. These served well when regularly maintained. The Water Services Authorities have not devoted capacity to borehole management and maintenance, and many boreholes and schemes dependent on well fields have now failed.

Water resources to supply water services needs in the Mzimvubu and Pondoland catchments can best be met by giving attention to groundwater abstraction, out of both existing and some additional boreholes, particularly in mid- and downstream catchment areas. In headwater areas where groundwater potential may be low, the topography is less incised and there is sufficient surface water available for small off-channel storage dams to meet local needs.

The Mthatha Catchment

Water resource supplies are dominated by the Mthatha Dam, which currently has some unallocated capacity. There are exceptionally high losses of water (~ 50%) in supplying the town of Mthatha and the peri-urban areas. DWA considers the current allocation of water to the town to be more than adequate, and will not increase this allocation until losses have been brought under control through implementing effective WC/WDM measures.

Most of the water from the Mhtatha Dam (85 million m^3/a) is currently being used to power Eskom's First and Second Falls hydroelectric schemes. As an alternative to hydropower generation some of this water could be made available for domestic distribution to rural areas. With Eskom planning to phase out the base load scheme and only supply peaking power, there is a strong possibility that this can be negotiated.

The Mbashe And Kei Catchments

The Mbashe River has sufficient water to supply all current requirements for water services. There are a number of dams of significant size, including the Xonxa, Lubisi and Qamata dams. The Ncora Dam on the Black Kei River is used to transfer water from the Kei catchment into the Mbashe catchment for the Collywobbles hydroelectric power station. These dams were originally built to support large-scale irrigation but the irrigation schemes were never fully developed and therefore do not make full use of the water. Although these schemes are currently being revitalized, there is still unused water that has been or could be re-allocated for primary use (i.e. for domestic requirements) by surrounding villages. This primary use is a very small part of the total quantity of stored water available for economic development and use. Existing schemes must be utilized efficiently and optimally before any new water storage infrastructure is considered.[12]

Waterdown Dam is the biggest dam in the Kei catchment and the key water source for Queenstown, situated 60 km away. The 40-year old pipeline urgently requires refurbishment. The water requirements of users currently supplied from the dam exceed the yield of this dam and additional water is urgently required, with supplies to Queenstown very vulnerable. A water transfer from the Xonxa Dam in the Mbashe catchment has been approved and now only awaits the allocation of government funding for construction to start.

The Kei is a dry catchment, especially the Black Kei – with the area being transitional between the wetter east and the arid western (Karoo) landscapes. The Kei River itself is large as a system, but flows are irregular and intermittent. Most of the Kei catchment (Queenstown excepted), is rural in character and towns and villages can all be supplied from existing schemes if these are properly refurbished and maintained, with augmentation from new boreholes, well fields or small off-channel dams where the run-off is adequate.

[12] The Department of Agriculture is left with only 16 Agricultural Engineers and cannot manage the many schemes left within its care.

Amatole System

The Amatole System supplies water to the Buffalo City Metro Municipality (BCMM), incorporating East London, Mdantsane, King William's Town and Bisho. A Water Resource Reconciliation Strategy for the Amatole Bulk Water Supply System was completed in March 2008 and a Strategy Steering Committee subsequently established to monitor implementation and update the Strategy. There are five major dams in the System, ensuring that almost all available local surface water is captured. There is virtually no potential for new surface water development in the close vicinity of the City supply area. Improvements in operations management, some infrastructure upgrades, the implementation of Water Conservation and Water Demand Management measures, and the re-use of water should be sufficient to allow for short to medium term needs, particularly given the expected low population growth trajectory. Desalination of seawater is another important future water augmentation option.

There are no large-scale surface water sources available to meet the needs of the rural areas, and nor are these required. There is potential for additional groundwater development that, together with some small surface water developments, would be sufficient to supply towns and villages. There is potential for limited additional afforestation in the Kat River catchment. The Keiskamma catchment is fully allocated, without water to spare. There is an urgent need to clear both of these catchments of invasive alien plants as a water conservation mechanism.

Albany Coast And The Bushmans River Catchment

This area includes Grahamstown and a number of coastal resort towns. Rainfall is low, surface water scarce, and coastal towns faced a "water crisis" during the severe drought of 2009/10. Grahamstown's local water supplies are augmented by Orange River water via the Orange-Fish transfer scheme. A seawater desalination plant has been erected at Bushmans River Mouth and was recently upgraded. The feasibility of abstracting and desalinating water from the Lower Fish River, saline due to upstream irrigation run-off and natural salinity, and supplying this to coastal towns, is being investigated. Further development of local groundwater sources, rainwater harvesting, and re-use of water are also possible options.

Fish And Sundays River Systems

The Fish and Sundays catchments are very dry, with 94% of all currently available water transferred in from the Orange River. The key economic activity has been agriculture, with about 52 000 hectares under irrigation. This is very important in the economy of the Eastern Cape but there are sustainability issues. Irrigating with water transferred from the Orange River has mobilised naturally occurring salts in the soils of the upper Fish and Sundays catchments, resulting in salinity of the rivers downstream. Additional irrigation using Orange River water in the upper Fish and Sundays River catchments will inevitably result in added salinity in existing downstream schemes, damaging and possibly ruining these. Water has been earmarked for 4 000 ha of irrigation for emerging farmers, but this should only be used in the lower reaches of these catchments, for example at Barkly Bridge in the Sundays catchment and Tuyefu in the lower Fish River catchment, because of the risk of increased salinization. The irrigation of feed crops in the upper Fish River at Cradock for the production of biofuels cannot be supported from the country's very scarce water resources.

The upper reaches of the Sundays River is in the Great Karoo, and very dry. Towns mainly rely on groundwater supplies and any new development will also be dependent on groundwater. Rainwater Harvesting (RWH) becomes very important, with roof tanks necessary to supplement groundwater supplies, whilst also reducing the dependence on a single resource. Water here is too scarce to consider any further irrigation development. This also applies to the upper Gamtoos River.

Kouga, Kromme, Gamtoos And The Algoa Water Supply System

The Algoa Water Supply System provides water to the Nelson Mandela Bay Municipality (NMBM, including Port Elizabeth-Uitenhage-Despatch), the Gamtoos Irrigation Board, and to several smaller towns in the Kouga Municipality. A Water Reconciliation Strategy was completed in 2010 and a Strategy Steering Committee established in 2011 to oversee and monitor the implementation of the Strategy. The system receives water from the Kouga, Gamtoos and Kromme catchments, which also support a significant area under irrigation. Despite several dams (the Kouga, Loerie, Churchill, Impofu, and Groendal dams), local sources are still unable to meet the growing water requirements of the area and about 30% of the total available water supply currently comes from the Orange River.

Port Elizabeth-Uitenhage is unusual in South Africa in that the industrial water requirement is a larger proportion of urban water use than in other cities. All of the domestic and industrial effluent that can be recycled for re-use can be taken up by industry, so water does not have to be treated to the standards required for potable domestic purposes.

The Nooitgedagt low-level scheme is being implemented to bring in significant additional Orange River water to the NMBM, and some groundwater is available to Uitenhage. There are some prospects for additional local surface water development - mainly in the Kouga River. Industrial re-use of water can stretch resources a long way and, as a coastal city, desalination is a potential long-term future option for Port Elizabeth. As with all urban complexes, reduction in requirements through effective implementation of Water Conservation and Water Demand Management measures is essential.

8. The Breede and Gouritz Water Management Area

Comprising the original Breede and Gouritz Water Management Areas

The original Breede WMA has an established and functioning Catchment Management Agency. This will need to be expanded to be representative of the newly defined Breede and Gouritz WMA.

The water resource situation is briefly described for each of the three major sub-areas making up this new WMA. These are:

(i) The Outeniqua Coastal Area
(ii) The Karoo and Klein Karoo (including the Gouritz)
(iii) The Breede and Overberg catchments

This is a very largely rural WMA with very few surface water development opportunities, and thus requiring a multi-faceted strategy. Small towns will almost all have to develop local water resources to allow for growth.

The Outeniqua Coastal Area (Stilbaai to Plettenberg Bay)

These coastal catchments are ecologically sensitive, with many short, steep rivers of high ecological value. There are some small to medium-sized dams, such as the Wolwedans Dam supplying PetroSA and Mossel Bay Municipality, and the Garden Route Dam, supplying George and environs. Surface water resources have been almost fully developed and any prospective schemes will be economically and ecologically expensive. Alternatives need to be thoroughly explored.

This is a major growth area, popular as a retirement location. There is growth in year-round water requirements, with the area's importance as a holiday destination also resulting in

very high seasonal peak usage. The system is generally in balance but water requirements can exceed availability at peak times. The use of available sources of water must be optimised in the light of the limited storage capacity, and peak seasonal water requirements call for a unique strategy. There must be an emphasis on Water Conservation and Water Demand Management, the desalination of seawater, the use of treated water, and increased groundwater use. This mix of actual and prospective approaches includes:

- Water Conservation and Water Demand Management - fundamental in all sectors and situations to reduce losses and wastage.

- Possible small dam infrastructure including: the raising of the Garden Route Dam, a dam on the Knysna River to augment supply to Knysna, an off-channel dam supplied from the Keurbooms River for augmenting Plettenberg Bay's water supply, the raising of the Klipfontein Dam to augment the supply to Mossel Bay, and a dam on the Malgas River to augment supply to George.

- Desalination of seawater or brackish water: Small desalination plants were installed at Sedgefield, Plettenberg Bay and Mossel Bay during the severe drought of 2009/10. Originally intended to alleviate drought shortages, these desalination plants should be operated full-time to meet the base requirements, as these plants deteriorate when standing idle. This would reduce the need for water from storage in dams during off-peak times, ensuring its availability during times of peak water requirements.

- Groundwater is the most promising sustainable, long-term and affordable water resource development opportunity. Groundwater from the Table Mountain Group Aquifer in the Outeniqua Mountains should be able to supply coastal as well as inland towns and villages, along with some irrigation. Groundwater of poorer quality is available in smaller quantities on the coastal plains but this water will require treatment.

- Users, and especially holiday users, could be required to install rainwater tanks in order to reduce peak water requirements.

The Karoo And Klein Karoo

The area is vast and dry, with some water coming off the southern slopes of the Swartberg range. To the north, Beaufort West is the largest town in the Karoo, and largely dependent

on groundwater. Beaufort West also has a recently commissioned water reclamation plant, providing potable water for domestic supply. Whilst groundwater is the key resource for almost all Karoo towns, rainwater harvesting using roof water tanks is important in maximising water resources available for domestic. In Prince Albert a pilot groundwater artificial recharge scheme was constructed, storing water sourced from mountain streams for use during the dry summer months.

South of the Swartberg Mountain range the main drainage is from the Olifants River, flowing west past De Rust and Oudtshoorn before joining the Dwyka River to form the Gouritz River, which itself has very little water despite its imposing canyon. The Olifants River has been seriously over-exploited for irrigation, and is ecologically compromised. The Klein Karoo Regional Water Scheme, which relies on a groundwater wellfield, is unable to meet the growing needs of Oudtshoorn, Dysselsdorp and surrounds and the area is seriously water stressed. There is no additional surface water development possible in the Little Karoo, except perhaps for a small dam in the Swartberg Mountains to augment Oudtshoorn Municipality's needs. The groundwater potential of the Table Mountain Group Aquifer does seem to be large enough to significantly augment the supply to these towns, and this option is now being pursued.

There is a lot of good land available throughout the Gouritz Catchment, but irrigation is limited due to sparse and highly variable rainfall, with runoff only occasionally sufficient. There are some rural irrigation schemes, such as at Zoar and Dysselsdorp, but these barely provide enough water for subsistence farming. Existing resources have been over-allocated and further dam development is not possible, with runoff insufficient even to fill existing storage regularly. Irrigation over much of the area is primarily through opportunistic use for lucerne – relying on floodwaters and soils with good water retention capacity. This is very low assurance use, with sufficient floodwater available only once every few years. It will be very difficult to implement development schemes aimed at emerging farmers who lack the resilience to manage such high uncertainty.

The Breede River And Overberg Catchments

The Breede River is already intensively utilized, with large dams such as the Brandvlei and Theewaterskloof dams, a number of medium to small dams such as the Koekedouw Dam near Ceres, the Eikenhof Dam near Grabouw and the Elandskloof Dam near Villiersdorp, and a very large number of farm dams. The water from these dams has three major uses:

(i) extensive areas of irrigation within the catchment itself – primarily for high value crops such as deciduous fruit, especially grapes
(ii) domestic and industrial use within the catchment
(iii) large transfers to the Berg River catchment to supply the Cape Town Metropolitan Area and irrigation farmers along the Berg River. About 22% of the yield in the Breede River catchment is currently transferred to the Berg WMA and Cape Town.

In some stretches of the river the ecological Reserve is not being fully met. The water resources of the Riviersonderend River are fully developed but the eradication of invasive alien plants would go some distance towards providing the water necessary to meet the ecological water requirements in that river.

By building more dams the resource could be developed further and more water could be transferred to the Berg catchment, or used in the Breede catchment itself - taking full consideration of the environmental and financial implications. Feasibility studies of interventions identified in the Western Cape System Reconciliation Strategy are being conducted to determine the cost of further water resource development in and transfers to the Berg River, and these costs will be compared to other options available for augmenting water supplies to Cape Town, such as re-use of water and desalination. At the same time the Breede Catchment Management Agency advocates, in its recently completed Catchment Management Strategy, for the use of the remaining water in the Breede catchment itself. It is the function of the Department of Water Affairs to make the final decision on the best use of this water in the national interest. This National Water Resource Strategy retains the option to transfer further water to the Berg WMA, but a final decision will only be made after the costs and benefits of all options have been properly considered. So, too, development will not be allowed in the Breede catchment without full consideration of the environmental costs, and until the needs of the two catchments have been carefully compared.

Brandvlei Dam could be raised but this cannot be justified while so much water is being lost through inefficient distribution via earth canals. The town of Worcester has sufficient water from local sources.

Salinisation through irrigation is also a major problem throughout the Breede catchment, severely impacting on the water quality in the middle and lower reaches of the river, and this would only be exacerbated by further upstream developments.

The Breede Valley is bordered by mountains of the Table Mountain Group sandstones, which have huge potential for groundwater development, both for augmenting municipal supplies and for irrigation use. In the Hex River valley the extensive groundwater resource has to a large extent been over-exploited, but with good management these problems should be overcome.

The catchment of the Palmiet River (Elgin / Grabouw) is intensely farmed in the upper and middle reaches, producing fruit for export, with irrigation water coming mostly from privately owned dams. Water can also be transferred from the Palmiet River to Cape Town via the Rockview and Steenbras Dams. The lower reaches of the Palmiet River have long been highly protected as part of the Kogelberg Biodiversity Reserve and the ecological status of this river must be maintained.

The Overberg catchments are used primarily for dryland farming - canola, grains and clovers as well as livestock. The Ruensveld East and Ruensveld West Rural Water Supply Schemes are operated by Overberg Water, supplying domestic and stock water where the groundwater resource is inadequate or of unusable quality. The Buffeljags River near Swellendam still has water available for the development of about 140 ha of irrigation, and this has been set aside for emerging farmers.

Groundwater is important throughout the Overberg, including supplies to coastal resorts, but salinity is a problem. It would be significantly cheaper to desalinate this groundwater than it would be to desalinate seawater, and this is a potential option. Hermanus already gets high quality water from the Table Mountain Group Aquifer. Further development of this resource must be investigated, as this town and surrounding resorts will be requiring additional water supplies in the near future.

9. Berg and Olifants-Doring Water Management Area

Comprising the original Berg WMA and the Olifants-Doorn WMA

The water resource situation in this WMA is discussed under (i) The Berg River Catchments, where focus is placed on the 'Western Cape Water Supply System', and (ii) The Olifants and Doring River catchments - with resources managed as a single system. It is expected that climate change will have particular impact on this WMA.

Both the Berg and Breede Rivers have now been almost fully developed through the need to supply the City of Cape Town. Little or no more water can now be expected from the Breede River system. Long-term thinking must consider that water will only become scarcer and much more expensive. The Olifants-Doring System does not have the water, and it is too distant, to provide any solutions for Cape Town.

Berg River Catchments

The Berg River catchments comprise the Berg River itself, along with a number of smaller coastal catchments. Water resources are planned for and managed through the Western Cape Water Supply System. This serves more than 3.2 million people, providing water to the City of Cape Town, Overberg, Boland, West Coast and Swartland towns, as well as to irrigators along the Berg, Eerste and other local rivers. The Berg River catchments are only able to meet a part of their total water requirements and there is a very strong linkage to the Breede River system, with a high level of water transfer from that system to meet the needs of the City of Cape Town.

The Berg River Dam is the first major dam in SA that has been designed and constructed to make full provision for the ecological water requirements of the river.

The Western Cape Water Supply System will be in deficit by 2013 unless water conservation and water demand management measures are successfully implemented, especially in the City of Cape Town. Water Conservation and Water Demand Management can delay the

need for the next augmentation scheme to 2019. Decisions on the implementation of further supply options must be taken in 2013.

Options for sourcing additional water for the Western Cape Water Supply System (WC WSS)

(i) The immediate priority is to use less water by improving efficiencies and curbing losses and wastage. Options for actually increasing water supplies to the economic heartland of the Western Cape include (ii) Some surface water developments (Breede and Berg rivers) (iii) Groundwater (from the Table Mountain Group Aquifer and from coastal aquifers) (iv) The re-use of water, and (v) The desalination of seawater. Water shortages and salinity in the Lower Berg / West Coast area bring into focus the debate on the importance of agriculture to jobs and the local economy vs. the water it requires. Costs and benefits must be very carefully weighed before water is moved out of agriculture to support urban and industrial requirements.

(i) Water Conservation and Water Demand Management (WC/WDM)

Water either conserved or not used is not strictly speaking a source, but success in the implementation of Water Conservation and Water Demand Management measures by all water user sectors is essential if water restrictions are to be avoided. The Western Cape System could soon come under stress given the continued rapid growth of the City of Cape Town, which has an estimated immigration influx of approximately 50 000 people p.a. and is also committed to improving service levels to the poor. WC/WDM has to be addressed both by the Municipality (curbing losses due to leaking distribution systems, high pressures, and poor plumbing in RDP housing projects), and by users (water saving and efficient use). It is essential that adequate funds and manpower be secured to fully implement the City of Cape Town's 10-year WC/WDM Strategy.

WC/WDM measures are being implemented in all towns in the area, with the most rigorous implementation in the Cape Winelands DM. Here great effort is being made to improve the operation of WWTWs to improve the quality of effluents discharged to the rivers, and to install or replace bulk water meters enabling better management of losses.

(ii) Surface water storage infrastructure

Infrastructure options include:

- Augmentation of the Voëlvlei dam through pumping water directly from the Berg River, with a potential raising of the dam as a later phase.
- The Michell's Pass Diversion in the upper Breede River, with transfer to Voëlvlei Dam.

Other than the prospect of raising Voëlvlei Dam, no other significant storage schemes are planned in the Berg River catchment. The possibility of raising the wall of the Lower Steenbras Dam will be investigated in a future study under the WC WSS.

(iii) Groundwater

Increasing groundwater supplies is an important option, and utilisation of the Table Mountain Group Aquifer is likely to increase from pilot to operational level. The impacts of this utilisation will have to be carefully monitored.

The coastal groundwater aquifer serves Atlantis on the West Coast; this incorporates the oldest artificial groundwater recharge scheme in the country. The Langebaan Road Aquifer serves the Saldanha area. Artificially recharging this aquifer with surplus winter water has not yet proven successful due to agricultural drilling damaging the integrity of the aquifer.

(iv) The re-use of water

Water re-use can provide a large source of water for all coastal cities. In the case of the City of Cape Town most treated effluent is discharged into rivers or directly to sea through marine outfalls. There are few industries that could make use of treated water, so most of the available effluent would have to be treated to potable standards. The feasibility of developing this potentially large source of water is to be studied by the City of Cape Town.

(v) Desalination

The City of Cape Town is undertaking a feasibility study into desalination to supplement the water resource. A desalination plant can be implemented relatively quickly should surface water options not prove feasible, or in the event of technical difficulties in the re-use of water. Desalinated water is also a resource that is not subject to the vagaries of climate change.

The Olifants And Doring River Catchments

This area comprises (i) the well-watered valleys of the Olifants River catchment with extensive commercial irrigation sourced from the Clanwilliam and Bulshoek dams, and (ii) the arid Doring River catchment. Associated with these catchments is (iii) the highly developed Sandveld area forming the western coastal boundary of the original Olifants-Doorn WMA.

The Olifants River is highly impacted by abstraction for irrigation in the upper reaches. The reservoir of the Clanwilliam Dam also drowns a long reach of the river. A Preliminary Comprehensive Reserve has been determined for the Olifants River with the recommendation is that it is impractical to try and restore the river to a more natural system, and that water should not be taken back from existing lawful users for this purpose, due to the negative impact this will have on the area's economy. However, to make up for this, no further development should be allowed in the Doring River, which joins the Olifants River below the Clanwilliam and Bulshoek dams. The only exception to this could be for small off-channel dams in the Koue Bokkeveld, which can be filled using high levels of winter water. The protection of the Doring River is aimed at securing the ecological integrity of the lower reaches and estuary of the Olifants River, the latter being a major permanently open estuary and fish breeding area.

The Sandveld is drained by the Verlorenvlei, Langvlei and other smaller rivers. The Verlorenvlei is an internationally declared Ramsar site. There is a long recognised problem of over-abstraction of groundwater for irrigation, threatening both the Verlorenvlei and other wetlands, as well as the sustainability of all agriculture in the region. An effective management plan for this area still needs to be implemented.

Options for sourcing additional water in the Olifants-Doring

(i) Infrastructure storage

The Olifants River has one major dam, the Clanwilliam Dam, serving large-scale downstream irrigation and various towns. Major rehabilitation work is required on the dam's structure to meet modern dam safety standards and construction work is planned to start in 2012. With this work required, the simultaneous raising of the wall becomes economically attractive and it is proposed that the dam should be raised by 13 metres. The additional yield will increase the assurance of supply to existing irrigation farmers and towns, and will also provide bulk water to emerging farmers. Agreement on a funding model for the raising of the wall is still required.

(ii) Groundwater

Groundwater, although not of a very good quality due to high salinity, is important especially to higher lying towns such as Nieuwoudtville. Vanrhynsdorp has accessible groundwater in a developed well-field, but currently uses only Olifants River canal water, due to its better quality.

(iii) Desalination

Lamberts Bay is now augmenting its supplies by desalinating water abstracted from beach wells.

Climate Change

The Berg and Olifants-Doring WMA is seen as the most likely of all South African Water Management Areas to experience declining rainfall through climate change.

Temperature and evaporation will increase, as also will the variability in rain events. All these factors could affect the available yield of water in Western Cape dams and rivers, in addition to increasing water requirements. This uncertainly adds urgency to the need for diversification in water resource solutions including the implementation of WC/WDM, the re-use of water, and to complete the studies into the feasibility of desalination as an augmentation option for the City of Cape Town.

Plans must be prepared for the situation where Climate Change starts to impact on the availability of water. However the size of this impact and the timing are very uncertain. Appropriate monitoring, especially of rainfall, and rigorous analysis of this data, is required before very expensive infrastructure is built for mitigation.

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APPENDIX

National Water Act: Chapter 1 - Interpretation and Fundamental Principles

Purpose of the Act

2. The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors -

(a) meeting the basic human needs of present and future generations;

(b) promoting 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 floods and droughts,

and for achieving this purpose, to establish suitable institutions and to ensure that they have appropriate community, racial and gender representation.

Public trusteeship of nation's water resources

3. (1) As the public trustee of the nation's water resources the National Government, acting through the Minister, must ensure that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner, for the benefit of all persons and in accordance with its constitutional mandate.

(2) Without limiting subsection (1), the Minister is ultimately responsible to ensure that water is allocated equitably and used beneficially in the public interest, while promoting environmental values.

(3) The National Government, acting through the Minister, has the power to regulate the use, flow and control of all water in the Republic.

Appendix B

National Water Act: Chapter 2 - Water Management Strategies; Part 1 - National Water Resource Strategy

Establishment of national water resource strategy

5. (1) Subject to subsection (4), the Minister must, as soon as reasonably practicable, by notice in the *Gazette,* establish a national water resource strategy.

(2) The notice must state the address where the strategy may be inspected.

(3) The water resources of the Republic must be protected, used, developed, conserved, managed and controlled in accordance with the national water resource strategy.

(4) A national water resource strategy -

(a) may be established in a phased and progressive manner and in separate components over time; and

(b) must be reviewed at intervals of not more than five years.

(5) Before establishing a national water resource strategy or any component of that strategy in terms of subsection (1), the Minister must -

(a) publish a notice in the *Gazette* -

(i) setting out a summary of the proposed strategy or the component in question;

(ii) stating the address where the proposed strategy or the component in question is available for inspection; and

(iii) inviting written comments to be submitted on the proposed strategy or the component in question, specifying an address to which and a date before which comments must be submitted, which date may not be earlier than 90 days after publication of the notice;

(b) consider what further steps, if any, are appropriate to bring the contents of the notice to the attention of interested persons, and take those steps which the Minister considers to be appropriate; and

(c) consider all comments received on or before the date specified in paragraph *(a)*(iii).

Contents of national water resource strategy

6. (1) The national water resource strategy must, subject to section 5(4)(*a)* -

(a) set out the strategies, objectives, plans, guidelines and procedures of the Minister and institutional arrangements relating to the protection, use, development, conservation, management and control of water resources within the framework of existing relevant government policy in order to achieve -

(i)the purpose of this Act; and

(ii) any compulsory national standards prescribed under section 9(1) of the Water Services Act, 1997 (Act No. 108 of 1997);

(b) provide for at least -

(i) the requirements of the Reserve and identify, where appropriate, water resources from which particular requirements must be met;

(ii) international rights and obligations;

(iii) actions to be taken to meet projected future water needs; and

(iv) water use of strategic importance;

(c) establish water management areas and determine their boundaries;

(d) contain estimates of present and future water requirements;

(e) state the total quantity of water available within each water management area;

(f) state water management area surpluses or deficits;

(g) provide for inter-catchment water transfers between surplus water management areas and deficit water management areas;

(h) set out principles relating to water conservation and water demand management;

(i) state the objectives in respect of water quality to be achieved through the classification system for water resources provided for in this Act;

(j) contain objectives for the establishment of institutions to undertake water resource management;

(k) determine the inter-relationship between institutions involved in water resource management; and

(l) promote the management of catchments within a water management area in a holistic and integrated manner.

(2) In determining a water management area in terms of subsection (1)*(c)*, the Minister must take into account -

(a) watercourse catchment boundaries;

(b) social and economic development patterns;

(c) efficiency considerations; and

(d) communal interests within the area in question.

Giving effect to national water resource strategy

7. The Minister, the Director-General, an organ of state and a water management institution must give effect to the national water resource strategy when exercising any power or performing any duty in terms of this Act.