Integrated Water Quality Management
POLICIES AND STRATEGIES FOR SOUTH AFRICA

1.2.3 A REVIEW OF THE WATER QUALITY MANAGEMENT INSTRUMENTS IN SOUTH AFRICA

WATER IS LIFE - SANITATION IS DIGNITY

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Department:
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REPUBLIC OF SOUTH AFRICA

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Water Resource Planning Systems

Water Quality Planning

WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES FOR SOUTH AFRICA

A REVIEW OF THE WATER QUALITY MANAGEMENT INSTRUMENTS IN SOUTH AFRICA

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PREFACE

Background

South Africa is facing a multi-faceted water challenge, which, if not addressed effectively, has the potential to significantly limit the economic growth potential of the country, especially considering the levels of water scarcity, with frequent droughts, increasing water demands, and deteriorating resource water quality.

The deterioration in water quality is a factor of growing concern. Importantly, ***deteriorating water quality is an economic and developmental issue****, and should be addressed as such. Without a change in how water resources are managed, worsening resource water quality will continue to erode the socio-economic benefits from, and increase the costs associated with, the use of the country's water resources.*

In light of the above, the Department of Water and Sanitation (DWS) embarked on a journey to revise, update and consolidate its policies and strategies for managing the quality of the water in the Country's water resources and to develop a pragmatic plan for the conversion of the Integrated Water Quality Management (IWQM) Policy and Strategy into practice.

Integrated Water Quality Management Policy and Strategy

Since the inception of this initiative, several supporting documents were developed that aimed to establish the status quo with respect to water quality, its management practices and instruments, the challenges in South Africa and the institutional arrangements. ***A review of existing policies, strategies, and other relevant documents****, both locally and internationally was used to i) analyse the root cause of the water quality issues; ii) determine the gaps in the IWQM approaches that have been used; iii) understand impacts that emerging trends may have on water quality (e.g. climate change, unconventional gas exploration, amongst others) and iv) look for innovative practices for IWQM.*

Based on these learning's, the ***IWQM Policy*** *sought to amalgamate and describe an integrated, inclusive and adaptive approach to IWQM, that built on the tenets of sustainable development coupled with addressing the identified gaps in the policy framework. The IWQM Policy sets out the vision, goal, values, underlying principles and policy responses for managing the quality of our water in our surface and underground water resources.*

The ***IWQM Strategy*** *sets out those strategic actions which are required to be undertaken in order to realise the vision and goals for water quality in South Africa. It articulates the broader process of Integrated Water Quality Management and provides the prioritised strategic actions that need to take place over a short to medium term.*

The Implementation Plan *outlines the pragmatic approach to strategic implementation and clearly articulates roles and responsibilities for the implementation of key activities and provides the linkages and dependencies between these activities.*

The Monitoring and Evaluation Framework *articulates the indicators to be monitored to determine the progress of the actions to be implemented and provide the foundation required*

to manage water quality adaptively. It also outlines the reporting structures and processes to be followed.

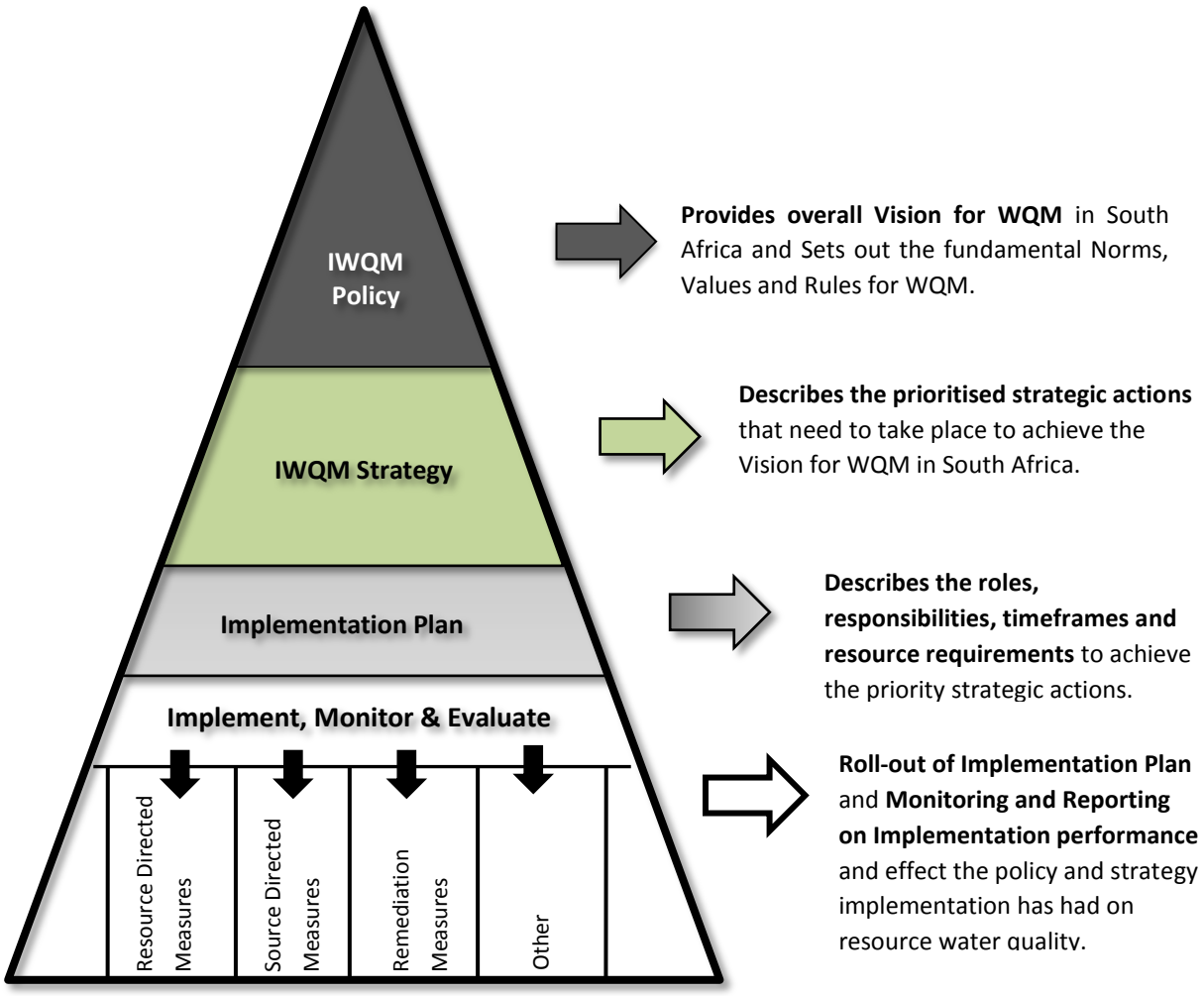

Figure P-1: Relationship between Policy, Strategy, and Implementation

The assessment phase of the project informed all three areas as reflected above.

Stakeholder Engagement

Given that the management of water quality constitutes an effort that is serviced and maintained by various role-players, a key element of the development of the IWQM Policy, Strategy and Implementation Plan is the involvement of relevant role-players, at a level where they may provide strategic and operational direction in the conceptualisation and finalisation of key areas and outputs. Consequently, a Stakeholder Consultation and Communication Strategy was developed to inform, consult, involve, collaborate and where possible empower the relevant key players by providing a strategic framework to: -

- ***Engage in policy and strategy development processes*** *of the key issues, priorities, guiding principles, and approaches regarding the IWQM Policy and Strategy.*
- ***Enhance the product*** *through inputs from stakeholders;*

- ***Establish Ownership and buy-in*** *of both the process and outcomes to ensure that stakeholders can relate and identify with the IWQM Policy and Strategy;*
- ***Facilitate Implementation:*** *a key result under this objective is the implementation of the Policy and Strategy. This will involve iterative process of learning-by-doing approach so that the implementation of the Policy and Strategy can serve as both a refining process and a learning curve;*
- ***Provide capacity development*** *and support through strategic collaborative efforts. This ensures that the necessary skills and capacities are shared between and among stakeholders;*
- ***Create awareness*** *and enhance the level of understanding on issues about the IWQM Policy and Strategy, in order to improve and strengthen active stakeholders' participation in WQM;*
- ***Consider appropriate mechanisms*** *for communication and publicising of the IWQM Policy and Strategy.*

Based on the fact that IWQM has environmental and social impacts, among others, it was imperative that consultation not be a single conversation but a series of opportunities to create an understanding about WQM amongst those it will likely affect or interest, and to learn how these internal and external parties view the initiative and its associated risks, impacts, opportunities, and mitigation measures. Listening to and incorporating stakeholder concerns and feedback is highly considered as a valuable source of information that can improve the design and outcomes of policy and strategy and help identify and control external risks. It is envisaged that the consultations done during this initiative form the basis for future collaboration and partnerships.

The Stakeholder Consultation and Communication Strategy focussed internally to relevant Government Departments and externally to targeted stakeholders.

- ***Internal to Government*** *- The purpose of targeting members within the Government Departments and its institutions (CMAs, Water Boards and other water management institutions) was to ensure that there was holistic preparation of staff at all levels. These staff have a range of interests that function at differing strategic levels within the Government and as such have different capacity building requirements.*
- ***External to Government*** *- There are a range of stakeholders that are interested and affected by the IWQM Policy, Strategy and Implementation Plan. These include the private sector, research and academia, civil society including NGOs, umbrella organisations such as the South African Local Government Association (SALGA), the South African Cities Network (SACN), the Chemical and Allied Industries Association (CAIA), Business Unity South Africa (BUSA), AgriSA, the Chamber of Mines, amongst others. The purpose of targeting these stakeholders was to solicit their input, create awareness and guide external stakeholders on water quality management issues, strengthen the understanding of the policy, and strategy and their implications, and strengthen collaborative systems. Moreover, it is important for the successful implementation of the policy and strategy that external*

stakeholders become more engaged in both developing the policy and strategy as well as through the implementation of the policy and strategy.

Way Forward

A*s sector lead, the Department understands that the management of water resources requires a sector-wide approach and this is a central theme to the implementation of the National Water Resources Strategy. Similarly, the management of water quality requires a broader engagement that moves roles and relationships beyond that of user, stakeholder, Policy-maker and regulator, but towards one of cooperation, partnership and stewardship. This necessitates the development of robust and pragmatic management instruments, supported by effective communication and capacity building, both internally to the Department and externally to the larger sector.*

DOCUMENT INDEX

Reports developed as part of this project:

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Afred Nzo District Municipality
Afri Forum
African Rainbow Minerals
Agri Eastern Cape
Agri Kwa-Zulu Natal (Kwanalu Initiative)
Agri Northern Kaap
Agri SA
Agri Western Cape
Agricultural Research Council
Alliance for Water Stewardship
Amatola Water
Anglo American
AquaEco
ASA Metals
Association of Cementitious Material Producers
Award
Bloem Water
Bosch Capital
Breede-Gouritz Catchment Management Agency
Buffalo City Metropolitan Municipality
Centre for Environmental Rights
Chamber of Mines
Chemical and Allied Industries' Association
Chris Hani District Municipality
City of Cape Town Metropolitan Municipality
City of Johannesburg Metropolitan Municipality
City of uMhlathuze
Clean Stream Environmental Consulting
Council for Geoscience (CGS)
Council of Scientific and Industrial Research
Crocodile River Irrigation Board
De Beers
Department of Energy
Department of Environmental Affairs
Department of Health
Department of Higher Education and Training
Department of Human Settlement
Department of International Relations and Cooperation
Department of National Treasury
Department of Planning, Monitoring and Evaluation
Department of Public Enterprises
Department of Rural Development and Land Reform
Department of Science and Technology
Department of Tourism
Department of Trade and Industry
Department of Water and Sanitation
DH Environmental Consulting (Pty) Ltd
Digby Wells
East Rand Water Care Company
Eco Monitor
Eco- Owl Consulting
Emifula Riverine Consultants
Endangered Wildlife Trust
EOH Coastal and Environmental Services
Eskom
Ethekwini Metropolitan Municipality
Exova BM TRADA
Exxaro
Federation for a Sustainable Environment
Federation of Southern African Gem and Mineralogical Societies.
Fezile Dabi District Municipality
Frances Baard District Municipality
Free State Department of Agriculture and Rural Development
Free State Department of Health
Fresh Produce Exporters Forum
Freshwater Consulting cc
Galago Environmental
Gamtoos Irrigation Board
Gauteng Deptartment of Health
Geo Arc
Glencore
Goadex Engineering and Water Science Consultants
Golder Associates
Goldfields
Govan Mbeki Municipality
Green Cape Sector Development Agency

Department of Mineral Resources
Harmony Mines
Limpopo Department of Agriculture and Rural Development
Ikamva
Iliso Consulting
Impala Platinum
Inkomati Usuthu Catchment Management Agency
International Water Management Institute
iSAT
Isiqalo Cooperative
Jaco Consulting
Jantech
JCP Steel
JG Afrika
Joe Gqabi District Municipality
Johannesburg Water
Joint Water Forum
Jones & Wagener
Kaap River Irrigation Board
Kakamas Water User Association
Komati Basin Water Authority
Komati River Irrigation Board
Kumkani FM
KwaDukuza Local Municipality
Kwa-Zulu Natal Agricultural Union
La Brie Estate
Land bank
Lebalelo Water User Association
Lemogang womens health
Lepelle Northern Water
Lephalale Local Municipality
Letaba Water User Association
Letsemeng Local Municipality
Liberty NPO
LIM 368 (Mookgophong LM and Modimolle LM)
Limpopo Department of Economic Development, Environment and Tourism
Limpopo Proto-Catchment Management Agency
Living Lands
Lonmin
Madibeng Local Municipality
Magalies Water
Makane Local Municipality
Maluti Water
Mangaung Metropolitan Municipality
Manten Marina
Marico River Conservation Association
Masilonyana Municipality
MBB Consulting Services
Merafong City Local Municipality
Midvaal Water Company
Modikwa Platinum Mine
Mogalakwena Local Municipality
Mogalakwena Mine
Moses Kotane Local Municipality
Mpumalanga Water Caucas
Municipal Infrastructure Support Agent
Mzimvubu -Tsitsikamma proto CMA
Nala local municipality
Naledi Local Municipality
Naledzi Environmental Consulting
National African Farmers' Union
National Business Initiative
Nepad Business Foundation
New World Water Sanitation
North West Department of Rural, Environment and Agricultural Development
North West University
Northern Cape Department of Agriculture and Land Reform
Northern Cape Department of Environment and Nature Conservation
Northern Cape Provincial Government
Ntuzuma Enviro Cooperative
OR Tambo District Municipality
Orange Proto-Catchment Management Agency
Oranje-Riet Water User Association
Overstrand Municipality
Palabora Copper
Petra Diamonds
Phumelela Local Municipality
Pilanesberg Platinum Mines
Pioneer Foods
Platmines SA
Polokwane Local Municipality
Pongolo-Umzimkhulu Proto-Catchment Management Agency
PPC Cement
Prime Africa
Prop 5 Corporation
Randwater
RE-Solve
Rhodes University (Institute for Water Research)

Rhovan Operations
Rockwell Diamonds
Rowing SA
Royal Bofokeng Platinum
Royal Haskin
Samancor Chrome Limited
SANParks
Sasol
Save the Vaal
Scherman Colloty & Associates
Sedibeng Water
SeeSaw
SEMBCORP Silulumanzi
Sephaka Cement
Sibanye Gold
Sidebelo Platinum Mines
Softchem
Source Point
South African Logal Government Association
South African National Biodiversity Institute
South African Sugar Association
SRK Consulting
Stellenbosch Municipality
Stellenbosch University
Stellvine
Strategic Water Partners Network
Swartland Municipality
T Squared Corporate Solutions
Tlokwe Local Municipality
Tlou Consulting
ToxSolutions
Trans Caledon Tunnel Authority
Transnet
Tshegofents Facilities and Engineering
Tsogang Local Municipality
Tswane Local Municipality
TTM Water Quality Engineering
Umfula Wempilo Consulting
Umgeni water board
Umzinyathi District Municipality
University of Cape Town
University of Fort Hare
University of Johannesburg
University of KwaZulu-Natal
University of Pretoria
University of the Free State
University of Venda
University of Witwatersrand
Usapho Consulting
Vaal Catchment Management Agency
Vele Colliery
Vhembe Water User Associations
Vin Pro
Vunene Mining
Water Institute of South Africa
Water Research Commission
Western Cape Department of Agriculture
Western Cape Department of Environmental Affairs and Development Planning
Western Cape Government
White River Valley Conservation Board
Wildlands
Wildlife and Environment Society of South Africa
WineTech
World Wildlife Fund
Xylem Water Solutions

EXECUTIVE SUMMARY

South Africa is often lauded with having one of the most progressive Constitutions and Water Acts. However, this great framework alone cannot guarantee the sustainable and equitable use of the country's most precious resource. Rapid urbanisation, expansion of the mining industry, increasing use of chemicals in agriculture and destruction of our natural/green infrastructure has undermined the quality of the country's water resources. Poor water quality impacts negatively on human health, threatens downstream irrigation areas and food security, increases industrial costs and raw water treatment costs arising from removing pollutants, reduces income generated from recreation and ecotourism, destroys ecosystems and affects biodiversity. The deterioration of water quality is, therefore, an issue that can affect many national priorities and strategies including strategies for economic development, health management and biodiversity conservation. Sustainable development in South Africa is critically dependent on assurances of good-quality of the country's limited resources. Development must be balanced by an increased supply of water of an appropriate quality to satisfy the human needs. Water Quality Management (WQM) must be conducted within the realities as outlined above. Part of the project looks at reviewing the current WQM Policies and Strategies, the WQM Institutional Arrangements and the WQM Instruments. This report, the third of the series, aims to provide a baseline understanding of the instruments that govern and manage WQM in South Africa.

The management of water quality in the country falls under the broader umbrella of water resources management and can be categorised under legal instruments and regulatory instruments. South African's most powerful legal instrument is that of the South African Constitution. Chapter Two of the Constitution of South Africa contains the Bill of Rights which is the human rights charter that protects the civil, political and socio-economic rights of all people residing in South Africa. Importantly, the Bill of rights apply to all law and bind all branches of the government, including the national executive, Parliament, the judiciary, provincial governments and municipal councils. Stemming out from this are the guiding policies on water and sanitation, which provide the framework on which the three Acts, viz. the Water Services Act, the National Water Act and the National Environmental Act are based. These Acts, together with the National Water Resources Strategy and the Strategic Framework for Water Services are legally binding documents in South Africa to aid in the management of the country's water resources, and by default water quality.

The understanding of the nature of catchments has developed with time and in recent years there has been a realisation that there is a need to look beyond the bio-physical dimensions and the range of engineering interventions. Catchments are complex socio-ecological systems that require a more integrated and interactive discourse between stakeholders, which when supported by an adaptive management approach provides the basis for sustainable development and management of water resources. This recognises that through this discourse "social learning" processes develop a more dynamic approach that enables a

shared and co-created knowledge base. This is important when one notes the levels of complexity, interdependency, and uncertainty that exists.

This does not negate the importance of having a sound institutional basis for water resource management. In fact, it is imperative and provides the detailed framework within which these more engaged processes must exist. It is important to note that one does need to understand that the term 'institution' should not be used interchangeably with the term 'organisation' and in fact refers to the range of policies, laws, practices, processes, rules, regulations, and organisational dimensions such as leadership, customs, functions and teams. As such, institutions can be understood to comprise of instruments (that provide the architecture for the management approach), tools (that provide methods, procedures and processes) as well as organisation (that provides the leadership and functional structure) (Figure E-1).

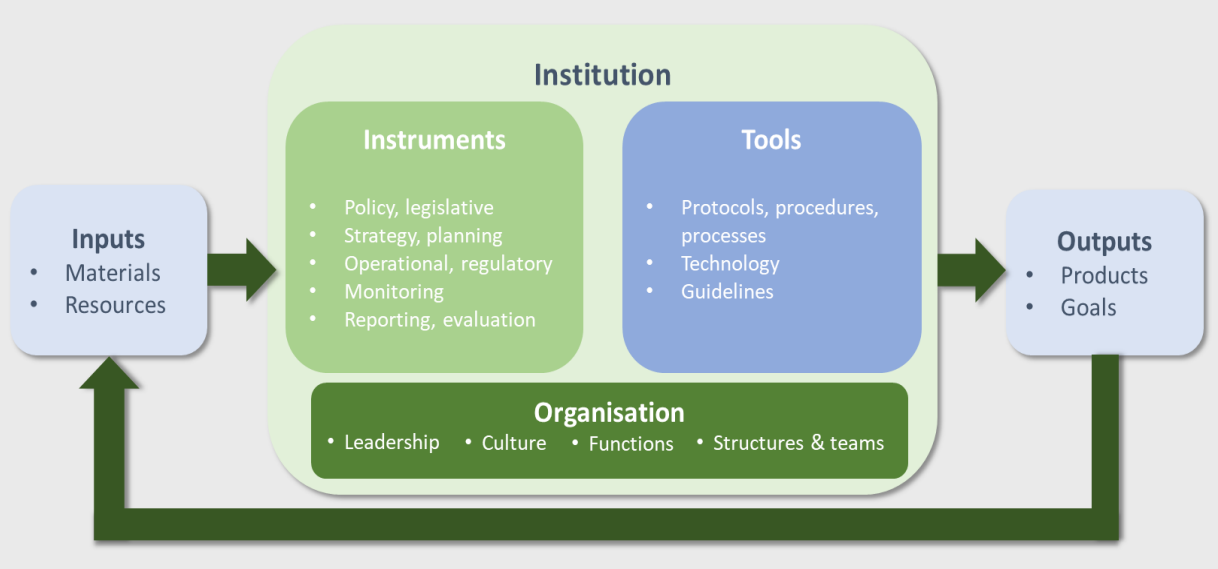

Figure E-1: System elements towards attaining programmatic objectives

The instruments that are available for WQM may be framed within the management approach that is utilised by the Department of Water and Sanitation and can be structured around this 4-step cycle:

- Step 1: **Plan** (Policy, legislative, strategy and planning);
- Step 2: **Do** (Operational and regulatory);
- Step 3: **Check** (Monitoring); and
- Step 4: **Act** (Reporting and evaluation).

This report has highlighted several instruments that the Department has at its disposal as it relates to the Plan-Do-Check-Act cycle. *While the list is not exhaustive, it provides a good framework for WQM in South Africa, and makes some references to the policy and legal instruments being used in other sectors.*

The project has shown that the current WQM instruments are sufficient to support good water quality management; however, the lack of an integrated and aligned approach has hampered the effectiveness of these instruments. In the most part the gaps that have been highlighted relate to the instruments that are required to link the various "steps" of WQM.

In particular, further work will need to be undertaken to develop instruments that link the activities undertaken during the "Plan" step with those that need to be implemented in the "Do" step, this includes, for example the development of technical instruments that will ensure the translation of instream or Resource Quality Objectives for water quality into water use authorisation conditions and catchment specific interventions. *In addition, whereas the requirements for the management of point-sources is widely understood, the management of non-point sources remains a challenge and further work on the development and implementation of Non-Point Source strategies will be required.*

Lastly the project has found that the implementation of the instruments that are available for WQM could be improved through improved and stable institutional and systems structures and well as increasing resources and capacity to implement and understand these instruments.

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LIST OF ACRONYMS

Abbreviation	Meaning
CMA	Catchment Management Agency
CMF	Catchment Management Forum
CMS	Catchment Management Strategy
COGTA	Department of Cooperative Governance and Traditional Affairs
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DPME	Department of Planning, Monitoring and Evaluation
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
HYDSTRA	Hydrological Information System
IWQM	Integrated Water Quality Management
IWRM	Integrated Water Resource Management
IWUL	Integrated Water Use Licence
MC	Management Class
M&E	Monitoring and Evaluation
MRPDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
MTEF	Medium-term Expenditure Framework
NDP	National Development Plan
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NGIS	National Groundwater Information System
NIWIS	National Integrated Water Informational System
NWA	National Water Act (Act No.36 of 1998)
NWRS	National Water Resource Strategy
RDM	Resource Directed Measures
RQO	Resource Quality Objectives
RWQO	Resource Water Quality Objectives
SDC	Source Directed Controls
WARMS	Water Authorisation and Registration Management System

WDCS	Waste Discharge Charge System
WMS	Water Management System
WQM	Water Quality Management
WRM	Water Resource Management
WSA	Water Services Act (Act No. 108 of 1997)
WUA	Water User Association
WWTW	Waste Water Treatment Works

1. INTRODUCTION

1.1 Background to the Project

Despite South Africa having a progressive Constitution (Act 108 of 1996) and National Water Act (Act 36 of 1998) the water resources of our country are under significant pressure. From a water quantity perspective, most water management areas are over allocated or are close to over allocation. Recent assessments have shown that from a water quality perspective 87% of our resources have some form of water quality challenge. Rapid urbanisation, expansion of the mining industry, increasing use of chemicals in agriculture and destruction of our natural/green infrastructure has undermined the quality of the country's water resources. This deterioration in water quality is **an economic and developmental issue**: -

- it reduces the amount of water available for use as more water must be retained in our river systems to assimilate to acceptable standards;
- it increases the costs of doing business as many enterprises are forced to treat water before being able to use it in their industrial processes and the cost of municipal water treatment increases;
- it reduces economic productivity as an increased number of work days are lost due to water-related illnesses and as poor water quality reduces productivity in certain sectors (e.g. poor water quality impacts on crop yields and makes crops vulnerable to import restrictions from countries with strict quality standards; and on recreation and tourism);
- it threatens human health and livelihoods where people are exposed to poor water quality for consumptive or domestic usage; and
- it has environmental implications where biological and chemical contamination of water can impact on important aquatic species and sustainable functioning of eco-systems.

The deterioration of water quality is therefore an issue that can affect many national priorities and strategies including strategies for economic development, health management and biodiversity conservation (DWS, 2015).

Sustainable development in South Africa is critically dependent upon an assured supply of good quality water. Demand for water will continue to grow as the country's population increases as well as social and economic conditions improve in South Africa. Consequently, this will place increasing pressure on the country's scarce water resources both in terms of water quantity and quality (DWAF, 2003). This is recognised in the National Development Plan (National Planning Commission, 2011).

Effective management of water quality in South Africa is thus a developmental issue, not simply an environmental issue, and must be addressed by government and its partners in civil society and the private sector as such. Without a radical improvement in water quality management, worsening water quality will continue to decrease the socio-economic benefits and increase the costs associated with use of the country's water resources.

The challenge has always been to clearly articulate water user requirements for specific circumstances and matching them with appropriate measures to ensure on-going beneficial water use. It is recognised that the existing Water Quality Management (WQM) policy is dated (Water Quality Management Policies and Strategies in the RSA in 1991 and the Resource Directed Management of Water Quality in 2006) and whilst innovative at the time of publication, is now in need of revision to align with current overarching policy and legislative frameworks. Key amongst these issues is the need to consider more carefully the role of various public and private actors.

It is recognised that there is a range of supporting operational policies, strategies, management instruments and methodologies that have been developed and implemented in recent years. These provide a significant platform for the development of new strategies and policies, based upon the pragmatic experience of implementing these instruments. It should be noted that the integration of the IWQM Policy and Strategy with wider national policies provides the opportunity to align the approaches toward managing water quality with other activities in the Department, and in Government. This will help entrench this project and secure its sustainability going forward.

1.2 Context of the Report

This literature review contributes to the assessment phase of the initiative by the Department to develop an IWQM Policy and Strategy (**Figure 1**)

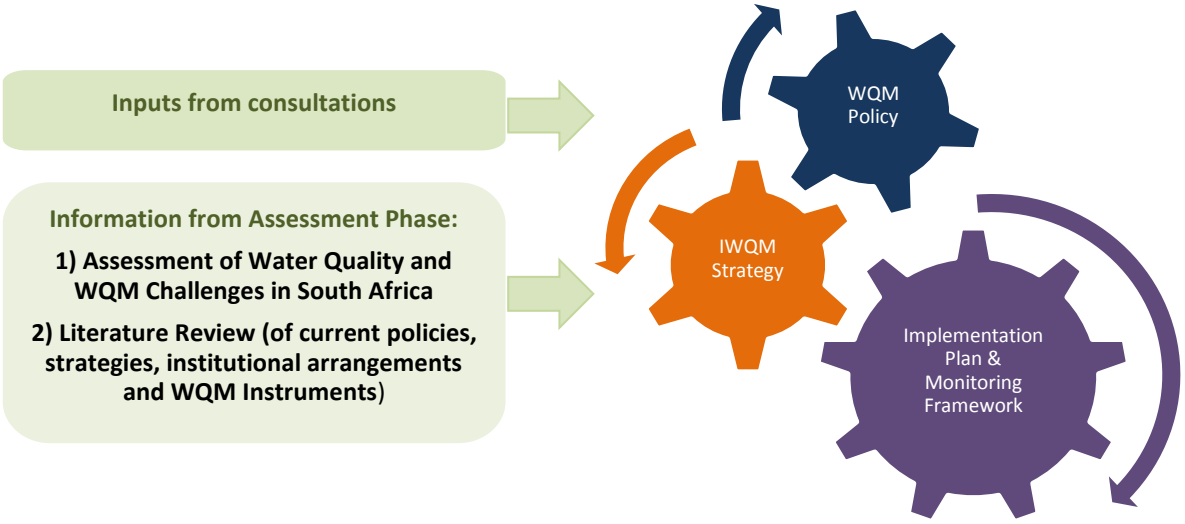

Figure 1. Context of the Report

The assessment phase aims to determine what South Africa currently has in place regarding its water quality management policies, strategies, institutional arrangements and management instruments. It also includes a review of international experiences and aims to identify the current and potential future gaps and challenges. The first task that was undertaken (Report 1.3) was to undertake a high-level situation assessment to understand the impacts, topography and root causes of the water quality challenges facing the country. To meet South Africa's development objectives, an approach to WQM should consider the importance of proactive planning in order to be prepared for the range of socio-economic and

developmental requirements of the country. This requires a more informed understanding of the range of impacts, and provides the opportunity to fully understand the management regimes required (DWS, 2015). Similarly, an understanding of the water quality challenges in the country provides a good starting point for research, planning and management interventions. These water quality challenges affect the country in different ways, and therefore have different characteristics such as:

- the geographical extent of their impacts;
- the integrated severity of their impacts on the fitness-for-use of the resource, on water users' health, on the local and regional economy, and on local and downstream ecosystems;
- the extent to which they have been / are being monitored; and
- levels of knowledge and understanding of the above impacts, their temporal patterns and geographic prevalence.

The range of water quality challenges, both existing and emergent, is varied and equally the response to these should also be varied. Analysis of these issues (see **Figure 2**) shows that there are five significant water quality priorities that should receive high priority management attention, based on the serevity of their impacts and the fact that a high level of knowledge and understanding is available regarding their locations and the science behind their management. These being Eutrophication, Salinisation, Sedimentation, Acidification and Urban Pollution. In addition to these, there are a range of issues that require improved levels of understanding, supported by data and information, for management actions to be affected. Some of these are emergent issues, but some, because of their nature (i.e. non-point sources), are difficult to monitor.

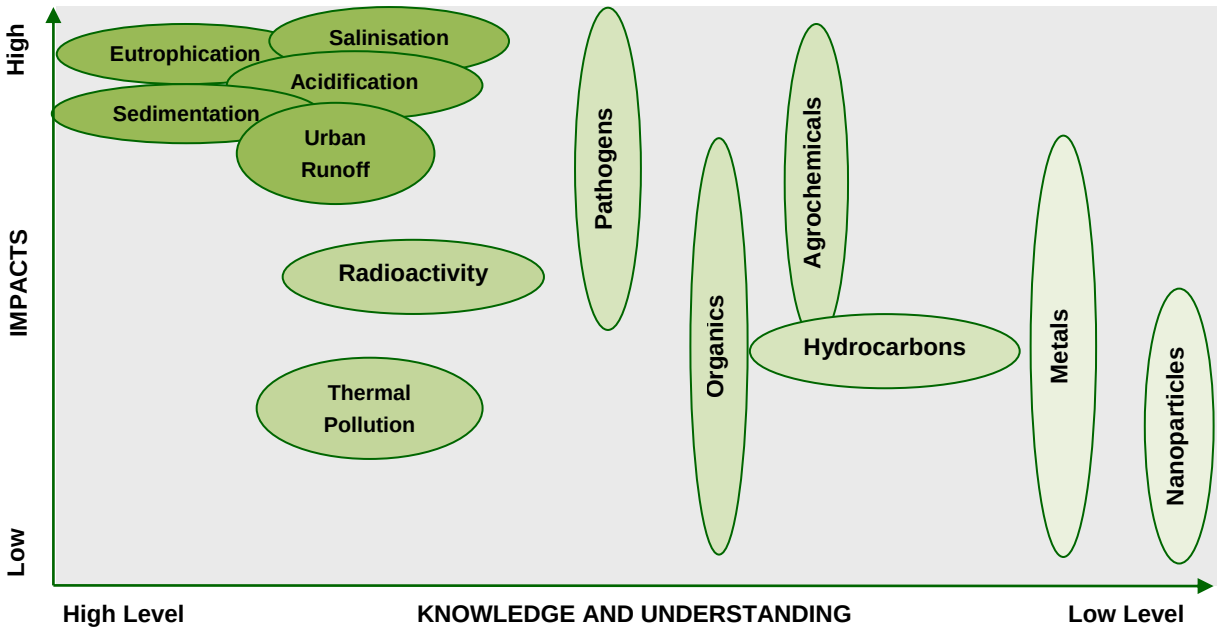

Figure 2: Mapping of water quality issues against Impacts and Knowledge/Understanding (Source: DWS, 2016)

Key Water Quality Challenges in South Africa

Water quality is the term used to describe the physical, chemical, biological and aesthetic properties of water that determines its fitness for a variety of uses and that is necessary to ensure the sustainable functioning of aquatic ecosystems (DWAF, 1996).

Physical water quality concerns refer to changes in the physical properties of the water such as the water temperature, water clarity, odour, taste, and pH. Concerns related to the physical properties of water bodies include:

- Artificial changes to the temperature of the water because of cold or heated discharges;
- Changes in water clarity due to increased suspended sediment loads;
- Changes in the dissolved oxygen content of the water due to warmer water temperatures or the discharge of oxygen-consuming compounds in the water;
- Unnatural odours due to chemical discharges or the decomposition of organic material in the water;
- The presence of urban litter (e.g. building rubble, plastic containers, and food wrappers) in urban streams; and
- Unnatural tastes due to chemical discharges or the breakdown of blue-green algae in the water.

Chemical water quality concerns refer to changes in the chemical properties of the water such as the amount of dissolved salts, the pH, dissolved nutrients, amongst others. These concerns include:

- An increase in salinity of the water due to irrigation return flows or the discharge of industrial effluents into water bodies;
- An increase in the nutrient content of the water due to the discharge of nutrient-rich treated and untreated domestic effluents to rivers;
- Acidification of streams and rivers due to the inflow of acid mine drainage into these water bodies and/or atmospheric deposition;
- The presence of agro-chemicals in water bodies from pesticides and herbicides used to control agricultural pests; and
- The presence of radioactive material in the water from upstream mining activities.

Biological water quality concerns refer to changes in the biological properties of the water such as the quantity of algae in the water, harmful bacteria and pathogens, health of biota such as fish, invertebrates, or aquatic reptiles and animals, etc. These concerns include:

- Blooms of harmful algae as a result of enrichment of the water with plant nutrients;
- Increase in water borne pathogens as a result of raw or partially treated domestic wastewater discharges or leaking sewers;

- Fish kills as a result of low oxygen, high suspended sediment or spills of toxic agro-chemicals into the water;
- Impairment of the endocrine systems of aquatic organisms due to the presence of endocrine disrupting chemicals in the water; and
- Death of crocodiles as a result of poor water quality and other wildlife due to high concentrations of toxic cyanobacteria.

Water quality problems are manifested at various scales and differently in different regions (**Figure 2**). Salinisation, sedimentation, nutrients enrichment and microbial pollution occur at a national scale (i.e. within all the Water Management Areas) while, acid mine drainage and agrochemicals occur at regional or site-specific scales. A number of reports have been published in recent years that provide an overview on the water quality situation in South Africa (this includes, reports by P. Ashton (2009), CSIR (2010), and DWA (2011*). Ideally the Department should strengthen this reporting through improving its water quality monitoring networks and reporting requirements.*

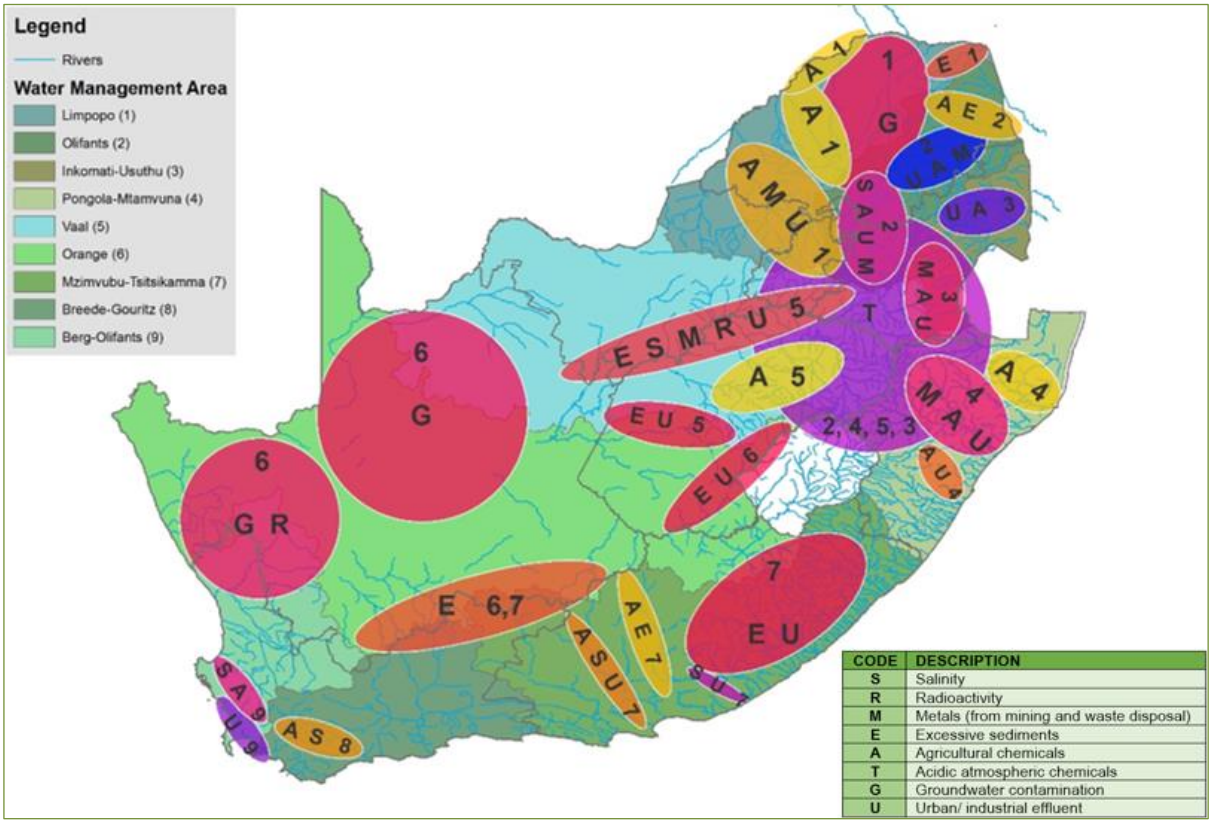

Figure 3: Map showing the different types of water quality problems and their location (after Ashton, 2009)

Understanding the root causes of these water quality challenges enables the implementation of effective WQM strategies and interventions. These challenges are exacerbated by climate change, incorporating a climate change lens enables the development of robust water quality management policy, strategy and implementation plans, which are adaptable and effective under changing environments. This, however, does not come easy, as the development of

new ideas and thinking requires considerable political and strategic support to see these ideas becoming part of policy and strategy (DWS, 2015).

Although South Africa's existing policies and strategies have an array of strengths and weaknesses, these need to be further explored in both the current and future context (particularly the climate, development, socio-economic context). Here-in lies the opportunities offered by innovative WQM interventions, as it enables countries to not only address water quality challenges, but to also meet other country objectives. Such opportunities can be described as:

- Aiming for **sustainable development** and promoting the **green economy**.
- Forming **stewardships efforts and partnerships** that promote collaboration to manage shared risks.
- Alternative and innovative **financing mechanisms** that provide opportunities to support improved WQM (DWS, 2015).
- The **restoration and rehabilitation** of natural systems (including water resources) to their natural state and thus ensuring equitable access to water resources for all water users (which include the ecosystems).

Consequently, deteriorating water quality is a socio-economic and development challenge and the management of the country's water resources must to be undertaken within the realities of increasing water resource pressures whilst aiming to sustainably support socio-economic development and specific water use requirements.

There is, therefore, an opportunity for South Africa to review, revise and refine WQM policies and strategies to address the above-listed opportunities offered by innovative solutions. This necessitates an evaluation of the current states of WQM in South Africa, and most importantly the challenges and gaps in the countries current WQM approach. This will enable the country to implement solutions that will resolve current water quality challenges by resolving the barriers to progress.

1.3 Purpose of the Report

The Literature Review consists of three parts: WQM Policies and Strategies, WQM Institutional Arrangements and WQM instruments for South Africa. *This report, the third of the series, aims to provide a baseline understanding of the instruments that govern and are used to manage WQM in South Africa.*

2. FRAMING THE WATER QUALITY MANAGEMENT INSTRUMENTS

The understanding of the nature of catchments has developed with time and in recent years there has been a realisation that there is a need to look beyond the bio-physical dimensions and the range of engineering interventions. Catchments are complex socio-ecological systems (Palmer, Munnik, du Toit, Slaughter, Retief and Sahula, 2015) that require a more integrated and interactive discourse between stakeholders, which when supported by an adaptive management approach, provides the basis for sustainable development and management of water resources. This recognises that through this discourse "social learning" processes develop a more dynamic approach that enables a shared and co-created knowledge base. This is important when one notes the levels of complexity, interdependency, and uncertainty that exists (Ison, Steyaert, Roggero, Hubert and Jiggins, 2004).

This does not negate the importance of having a sound institutional basis for water resource management. In fact, it is imperative and provides the detailed framework within which these more engaged processes must exist. It is important to note that one does need to understand that the term 'institution' should not be used interchangeably with the term 'organisation' which refers to the range of policies, laws, practices, processes, rules, regulations, and organisational dimensions such as leadership, customs, functions and teams (Ison *et al*., 2004). *As such, institutions can be understood to comprise of instruments (that provide the architecture for the management approach), tools (that provide methods, procedures and processes) as well as organisation (that provides the leadership and functional structure)* **(Figure** 44**)**.

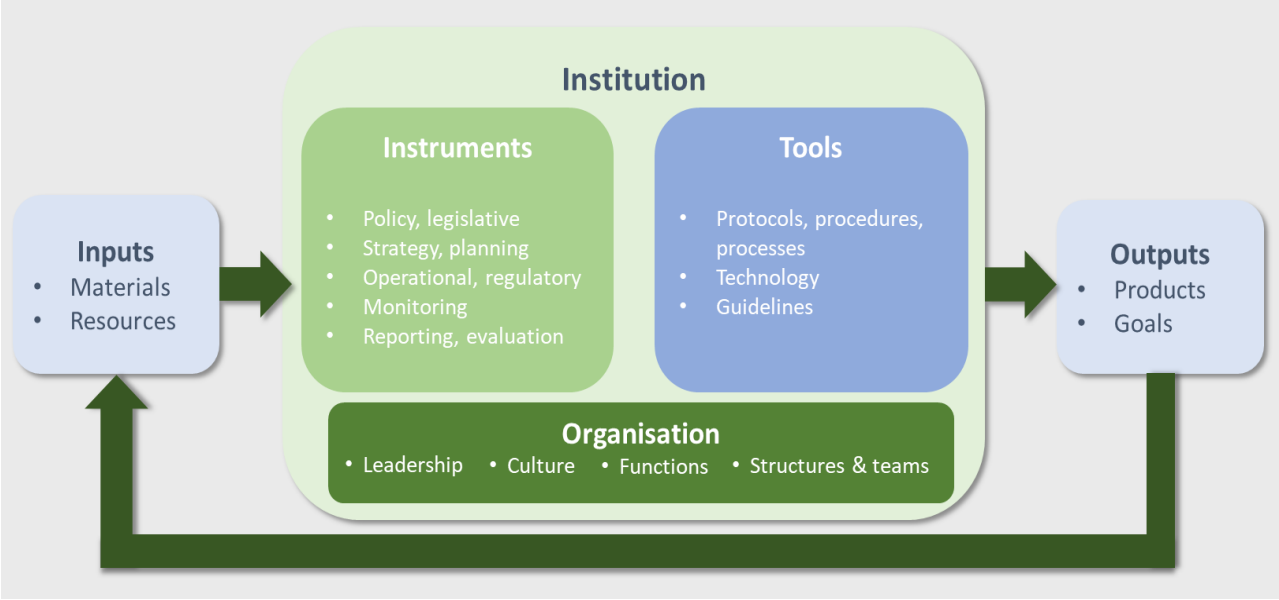

Figure 4: System elements towards attaining programmatic objectives

The instruments and tools that are available for WQM may be framed within the WQM management approach, consisting of 4 sequential and interactive steps (**Figure 5**).

- Stage 1: **Plan** (Policy, legislative, strategy and planning);
- Stage 2: **Do** (Operational and regulatory);
- Stage 3: **Check** (Monitoring); and
- Stage 4: **Act** (Reporting and evaluation).

2.1 Stage 1: Plan

These instruments provide for the broader water resource and water quality management frameworks through policy and legislation. This also includes the strategy and planning instruments that are aimed to give effect to the policy and law. Policies include the strategically important overarching policies as well as the more focused operational policies. Strategies and plans are typically more technically focused and include reconciliation, IWQM strategies, catchment management strategies (CMS) and thematic water quality plans (the plans are typically focussed on a water quality concern in a catchment such as pesticides, salinity or nutrients). This step includes the use of various tools that enable catchment assessments, the determination of catchment management and water quality objectives, modelling of catchment management scenarios and the development of recommendations for management that will enable the achievement of the objectives that have been agreed upon. Included in this process are the "softer" tools which assist planners to e.g. engage with stakeholders during the planning process.

2.2 Stage 2: Do

These instruments support the day-to-day operational aspects of water resource and water quality management and as such have an implementation focus that reflects both enabling water use as well as its regulation. This includes the water use authorisation process which involves application evaluation and the issuance of authorisations and incorporates the setting of appropriate license conditions. A wide range of regulatory instruments (including legal instruments) are available that support and encourage compliance with license conditions and ultimately support the achievement of objectives set out in the various strategies and plans (including meeting of Resource Quality Objectives) that have been defined in the "Plan" step of the WQM Cycle. The "Do" step typically contains different tools for the management of point vs. non-point sources and often a larger focus is placed on point sources as they are easier to detect and manage.

2.3 Stage 3: Check

This stage involves a range of monitoring instruments that enables the necessary assessment of the efficiency and effectiveness in attaining the goals and objectives, as set out in the planning stage. Monitoring needs to take place within water resources at national, water management area and catchment levels as well as at the source of the water quality

impact to support adaptive management. Monitoring may be undertaken by various entities and for various objectives and several tools exit, not only to guide how monitoring should be undertaken from a technical standpoint, but also from an organisational perspective. This includes tools on the involvement of local communities in monitoring and the integration of monitoring programmes across sectors. Water users also need to support this monitoring through the submission of local monitoring data to support the monitoring of compliance with license conditions as well as to enable improved local water resource management.

2.4 Stage 4: Act

In effect, this stage reflects upon the entire WQM cycle to assess the consistency, sustainability, efficiency and ultimately the effectiveness of the management paradigm. This stage utilises the data and information generated during Stage 3, as well as the reporting mechanisms that exist, to evaluate progress and process and as such to inform any needed adjustments in policy, legislation, strategy and plans. This then provides the key inflection point of the cycle that enables adaptation and improvement. Institutionally, this is an important and yet complex part of the WQM cycle.

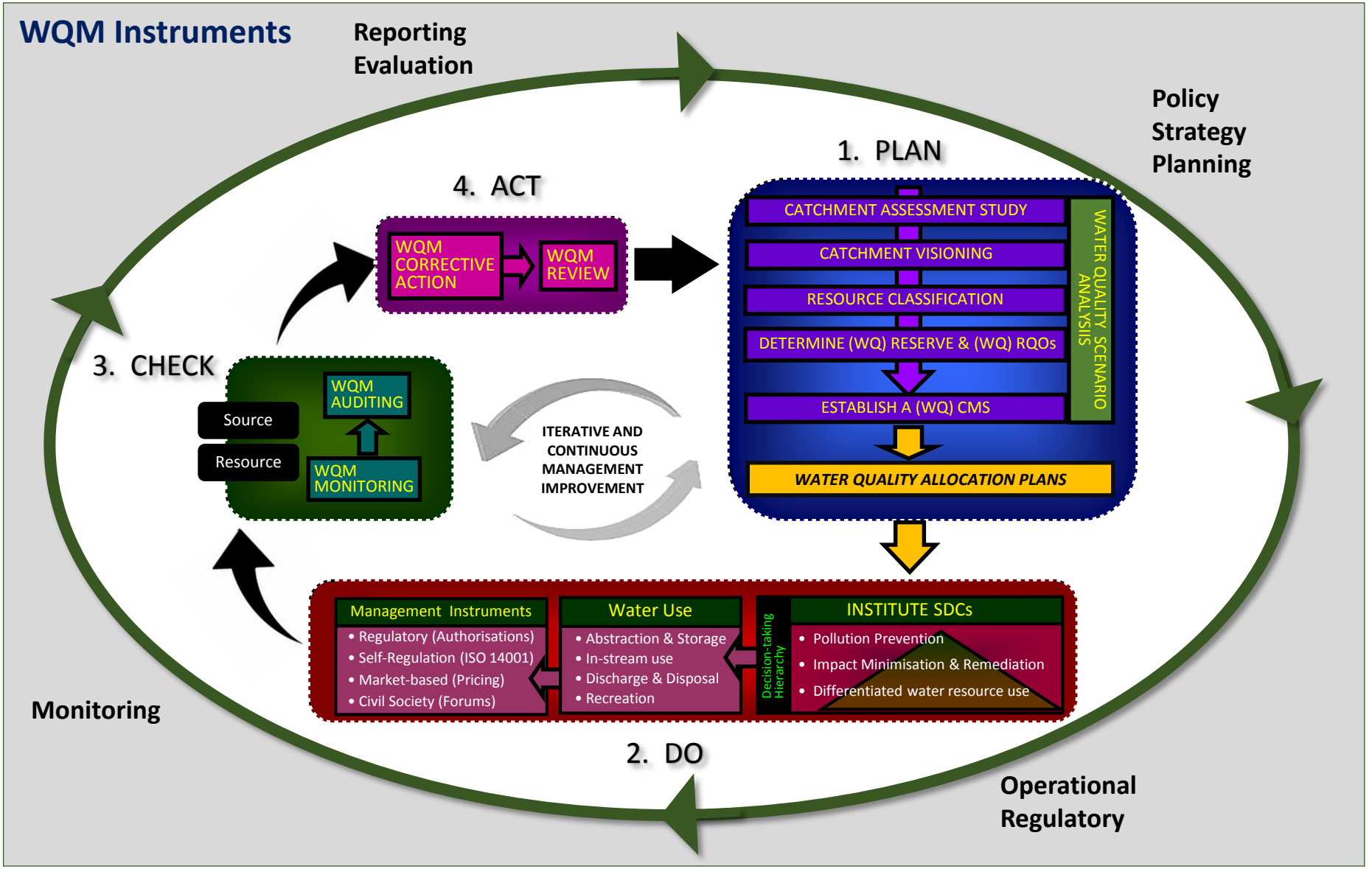

Figure 5: Instruments for water quality management (DWA, 2006c)

3. POLICY AND LEGISLATIVE INSTRUMENTS

South Africa has a strong institutional and regulatory landscape; however, alignment and consistency is an emerging challenge that requires cooperative governance and regulatory/strategic approaches that aim for alignment. In addition, regulatory and strategic approaches are increasingly focusing on minimising pollution by being stringent on major polluting sectors and enterprises.

South African's most powerful legal instrument is that of the South African Constitution (Act 108 of 1996). Chapter Two of the Constitution of South Africa contains the Bill of Rights which is the human rights charter that protects the civil, political and socio-economic rights of all people residing in South Africa. Importantly, the Bill of Rights apply to all law and bind all branches of the government, including the national executive, Parliament, the judiciary, provincial governments and municipal councils. Stemming out from this are the guiding policies on water and sanitation, which provide the framework on which the three Acts, viz. the Water Services Act, 1997 (Act 108 of 1997) (WSA), the National Water Act, 1998 (Act 36 of 1998) (NWA) and the National Environmental Act, 1998 (Act 107 of 1998) (NEMA) are based. These Acts, together with the National Water Resources Strategy and the Strategic Framework for Water Services are legally binding documents in South Africa to aid in the management of the country's water resources, and by default water quality.

3.1 Constitution of the Republic of South Africa, 1996

The Constitution caused a paradigm shift in South African environmental policy by providing a right to "***an environment that is not harmful to human health or well-being***", and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures. These measures relate to the prevention of pollution and ecological degradation, the promotion of conservation, securing ecologically sustainable development and the utilisation of natural resources while promoting justifiable economic and social development. The constitution also calls for effective, transparent, accountable and coherent government in a manner that does not encroach on the geographic, functional and institutional integrity of other spheres of government. ***The inclusion of an environmental right in the Bill of Rights sets the stage for the development of an array of policies, legislation, judicial pronouncements and development of these principles.***

Furthermore, "by elevating the environment to a fundamental justiciable human right, South Africa has irreversibly embarked on a road which will lead to the goal of attaining a protected environment by an integrated approach, which takes into consideration, inter alia, socio-economic concerns and principles."[1]

[1] BP Southern Africa (Pty) Ltd v MEC for Agriculture, Conservation and Land Affairs 2004 (5) SA 124 (W) at 144D

The socio-economic character of section 24(b) right is related to other socioeconomic rights, in particular the right to have access to food and water (section 27(1)(b)). Water quality impacts on the right to water because the water must be of an appropriate quality to consume. Equally, water must be of an appropriate quality to use for cooking food.

Table 1: The Bill of Rights in relation to WQM

Bill of Rights and WQM
CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA, 1996 **CHAPTER 2: BILL OF RIGHTS**
24. Environment. - Everyone has the right– (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of the present and future generations, through reasonable legislative and other measures that– (i) prevent pollution and degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.
27. Health care, food, water and social security - (1) Everyone has the right to have access to– (b) sufficient food and water
32. Access to information - (1) Everyone has the right of access to- (a) any information held by the state; and (b) any information that is held by another person and that is required for the exercise or protection of any rights.

3.2 Water Services Act, 1997

The WSA was promulgated to provide the legislative framework for the effective provision of water services, including for basic human needs. The Act is infused with the spirit of co-operative governance with the emphasis on building capacity at all levels of government. The Act places the responsibility on the different local authorities for service provision. The local authorities may make use of water services providers to ensure that the responsibility is fulfilled. The Act also regulates the use of water for industrial use in that water for industrial use may only be obtained from a source or the distribution system of a water services provider approved by the relevant local authority. The effluent produced by industrial use must also be disposed of as approved by the local authority.

If a local authority exercises any of the powers conferred on it in such a manner that it could result in the quality of the water in the water resources not being maintained fit for use, then

the Constitution, NWA and the WSA allow the Minister of Water and Sanitation to intervene by prescribing measures to be taken by the local authorities or water services providers or by taking measures themselves to ensure that the services are provided in such a way that the quality of the water remains fit for use. The intervention is not related to measures on the water service provision, but to ensure that the quality of the water stays fit for use.

The Draft National Sanitation Policy of 2016, published in 2016 for comment, is the first comprehensive policy for sanitation provision in South Africa. The 2016 draft policy includes positions on equity, institutions and sustainability, and commits the Minister to developing norms and standards for sanitation in informal settlements.

3.3 National Water Act, 1998

The White Paper on National Water Policy for South Africa of 1997 set out some of the principles that guide water quality management in the current context, including that: water quality should be managed jointly with quantity; economic considerations must be weighed together with social and environmental ones; groundwater and surface water should be managed in an integrated manner; and that the country must fulfil its international water obligations in shared river basins. It also recognises the inter-linkages between water management and other activities such as land use, human settlements, industrial activity and mining.

The NWA is the primary statute, providing the legal basis for realising South Africa's water quality management policy. The Act stipulates that the water resource of the country is a national asset for which the National Government must act as public trustee. The water resource must be managed to achieve sustainable water use for the benefit of all users. The use of the water resource in a manner that meets basic human needs and provides for ecologically sustainable development, is enshrined in the Reserve, which enjoys priority by right.

The Act also requires protection of the quality of the water resource as well as integrated management of all aspects of the water resource. Participation of everyone in the management of the water resource must be promoted by the delegation of management functions to regional and catchment levels. In the management of the water resource, cognisance must be taken of international requirements.

The Act also states specific considerations with the issue of licences. These include the need to redress the results of past racial and gender discrimination, efficient and beneficial use of water in the public interest as well as the socio-economic impact of water use.

The NWA also contains wide provisions particularly related to responsibility for the integrity of water resources.

The National Water Act of 1998 requires the establishment of a National Water Resources Strategy (NWRS) by the Minister of Water and Sanitation. At the same time, a decentralized approach to water resources management was introduced, with the Act enabling the establishment of CMAs, responsible for managing water resources at the catchment level.

Under the 1997 White Paper on a National Water Policy for South Africa, and the 1998 National Water Act, an integrated resource, remediation and source directed approach was adopted for water quality management, managing the water resource system as a whole. Currently, water quality is managed by DWS through the application of a number of policies and strategies, including: Water Quality Management Policy and Strategy for the RSA (DWAF, 1991); Resource Directed Management of Water Quality Policy and Strategy (DWAF, 2006a); Policy and Strategy for Ground Water Quality Management (DWAF, 2000),; National Water Resource Monitoring Strategy (DWAF, 2004); Regulation 810, which developed a system for the classification of water resources (DWA, 2010); Best Practice Guidelines for Water Resource Protection in the South African Mining Industry (DWAF, 2006b); and the Blue and Green Drop system (DWA 2009 and DWA 2010).

Municipalities have a regulatory role in relation to ensuring that ***by-laws*** regarding solid waste management and storm water management systems reduce water pollution from municipal areas, and in this regard, they carry part of government's responsibilities for preventing and reducing water pollution, and must ensure that management and control of such forms of diffuse water pollution are clearly addressed in their Water Services Development Plans. At the same time, local governments are responsible for sanitation provision and Waste Water Treatment Works (WWTWs), which are critical in the striving for improved water quality. In this regard, the DWS, working with the national and provincial departments of Cooperative Government, has a regulatory role to ensure that WWTWs are duly licensed under the NWA, that local governments ensure that their WWTWs meet discharge standards, and to act to ensure compliance by municipalities. In this regard, DWS will implement its internal protocol on engagement with municipalities, including taking legal action where necessary

The Department of Water and Sanitation, as the apex department in relation to water quality management, and should lead the co-ordination and alignment of Policy, legislation and implementation and put in place the necessary institutional arrangements under the Inter-*Governmental Relations Framework Act, 2005 (Act No. 13 of 2005)* to ensure a government-wide approach to integrated water quality management; DWS and Department of Environment Affairs (DEA)/Provincial Department of Environmental Affairs will develop a co-ordinated and joint water quality compliance monitoring and enforcement system to optimize the use of government resources and to achieve maximum impact.

3.3.1 Policies in Development

In addition to these policies, DWS has developed or is developing a range of more specific policy documents that are relevant to water quality management, which include:

The Climate Change Adaptation Policy which reaffirms the objectives of the National Climate Change Response White Paper and has as its primary objectives:

- To effectively manage inevitable climate change impacts on the country's water through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity.

- To make a fair contribution to the global and regional effort to promote the application of integrated water management as a priority tool to reduce climate vulnerability and to ensure that water management systems are well adapted to increased climate variability.

The Mine Water Management Policy, which aims to enhance the legislative and regulatory role of DWS in relation to mine water. The policy is one of the mechanisms to protect and ensure sustainable use of the country's water resources as provided for in the National Water Act. The policy will enable implementation of interventions and the enforcement of compliance in relation to mine water management including acid mine drainage.

The Sustainable Hydropower Development Policy which sets out the policy position in terms of the establishment and development of hydropower on existing DWS infrastructure as well as within the water resources of South Africa as part of long term interventions by DWS in supporting sustainable power supply in South Africa.

The Water for Development Policy: Sustainable Livelihoods policy which aims to enhance accessibility to financial support for water development (with priority given to rural communities) and to create an enabling environment for Historically Disadvantaged Individuals (HDIs) to develop sustainable livelihoods based on improved access to water.

The Water Stewardship Policy, which explores avenues for effective water stewardship involving the public and private sectors to safeguard against the depletion and degradation of water resources.

The Wetland Policy, which Acknowledges the importance of wetlands as water resources and the role they play as key components of South Africa's ecological infrastructure and aims to improve the way wetlands are managed by:

- Clarifying the role of the Department of Water and Sanitation and its position on wetland management;
- Ensuring consistent and informed decision making by the Department of Water and Sanitation and it's institutions on wetland use and protection;
- Ensuring co-operative and integrated governance of wetlands;
- Ensuring a sound scientific and technological basis is used for wetland management; and
- Encouraging the formation of partnerships and active citizenry in the management of wetlands.

In addition, DWS is in the process of developing polices for hydraulic fracturing, private sector investment in the water and sanitation sectors, and water and industrialisation. This Integrated Water Quality Management Policy forms an overarching policy that guides all these other policies being developed by DWS. The existing overarching water quality management policy (comprising the Water Quality Management Policies and Strategies in the RSA in 1991 and the Resource Directed Management of Water Quality in 2006) is dated, and whilst innovative at the time of publication, are now in need of revision to align with current realities.

3.4 Other Sector Instruments

Whilst the technical elements of water quality management have been sound for many years, it is realised that the shift in approach now must be one of managing water quality with a sector-wide approach. With this in mind, there are a range of policies and pieces of legislation administered by other government departments that are also relevant to the management of water quality in South Africa. In effect, these show the important connectivity of land based activities to water quality. These are described below.

3.4.1 The National Environmental Management Act, 1998

The *White Paper on Environmental Management* in South Africa of 1997 and the *National Environmental Management Act,1998 (Act No. 107 of 1998)* set out the overarching Policy and legislative framework for environmental management in South Africa. The White Paper outlines government's environmental vision, strategic goals and supporting objectives as well as the powers and responsibilities of different spheres of government and civil society. The NEMA gives legal effect to the internationally agreed principle of sustainable development. This aspect must be taken into consideration in all decisions that may affect the environment. In addition, the Act also provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote environmental governance and procedures for co-ordinating environmental management functions.

The Act also stipulates several principles providing the framework for environmental management. The principles of specific relevance to this framework policy can be summarised as follows:

- Environmental management must place people and their needs at the forefront of its concern
- Development must be socially, environmentally and economically sustainable
- Access to environmental resources, benefits and services to meet basic human needs and to ensure human well-being must be pursued
- Community well-being and empowerment must be promoted through environmental education and awareness
- Beneficial use of environmental resources must serve the public interest and the environment must be protected as the people’s common heritage.

The Act promotes sustainable development and sets national norms and standards for integrated environmental management (section 24) where all spheres of Government and all organs of State must co-operate, consult and support one another. Section 28 of the act also imposes a duty of care and remediation of environmental damage on any person who causes, has caused or may cause significant pollution or degradation of the environment. Furthermore, sections 32 and 33 of the act provide for legal standing to enforce environmental laws and private prosecution respectively (Swart, 2003).

The **primary instrument** to ensure that natural resources are managed sustainably as far as new projects are concerned is an **Environmental Impact Assessment** (EIA) (Brownlie, Coetzee, Morris, 2013). The National and Provincial Departments of Environmental Affairs are responsible for the implementation of the *National Environmental Management Act, 1998 (Act No. 107 of 1998)* (NEMA) and for conducting EIA's on development projects. The DEA must ensure, in consultation with DWS/CMAs, that water quality impacts are sufficiently dealt with in EIAs and through a co-ordinated approach with DWS to compliance monitoring and enforcement.

3.4.2 Conservation of Agricultural Resources Act, 1983

The White Paper on Agriculture of 1995 and the *Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)* principally aim to build the agricultural sector in South Africa to reduce unemployment and poverty. One of the Policy objectives is "to preserve agricultural natural resources and to develop supporting policies and institutions". With this in mind, the Department of Agriculture, Forestry and Fisheries (DAFF) has developed a number of legislative and other tools which provide and contribute to the prevention of water pollution by agricultural activities. They include: -

- An Irrigation Strategy of South Africa, 2015;
- National Policy on organic production;
- National Aquaculture Policy Framework;
- Pesticide Management Policy for South Africa, 2010; and
- Research studies in relation to water quality developed in collaboration with the Water Research Commission and the Agricultural Research Council.

In addition, there was the development of a discussion document on a Policy on Agriculture in Sustainable Development[2] by the DAFF, which deals extensively with water issues, including impacts on water quality arising from agricultural practices. However, the Agricultural Policy Action Plan (2015 – 2019) itself does not make any reference to issues relating to the water quality impacts of agriculture, or of the impacts of agriculture on declining water quality. This reality reiterates a recognition of the fragmented nature of IWQM and underscores the observation that the issue of water quality is not being appropriately addressed.

[2] http://www.daff.gov.za/daffweb3/Portals/0/Policy%20Documents/Policy%20on%20agriculture%20in%20sustainable%20development.pdf

The National and Provincial Departments of Agriculture are responsible for the implementation of the *Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)* (CARA) and for agricultural Policy; responsible for promoting agricultural practices that reduce water pollution. In reviewing the CARA, the **DAFF** will consider the need to reduce the water pollution arising from current agricultural practices. The Department will, in line with the approach outlined in the draft Policy on Sustainable Agriculture, **promote sustainable agricultural practices** that, amongst other things, will contribute to the reduction of water pollution arising from agricultural areas. The Department will also ensure improved enforcement.

3.4.3 Mineral and Petroleum Resources Development Act, 2002

From a mine water management perspective, there are additional challenges posed by current Policy and legislation under which the mining industry continues to benefit from a special regulatory regime implemented by the Department of Mineral Resources (DMR) unlike by the environmental authorities which is the case for other industries. **This results in a conflict of interest in the DMR's mandate, between the promotion of mining and the regulation of its environmental impacts; this fundamentally compromises effective regulation of the detrimental impacts of mining.** The authorisation of mining developments by DMR is not aligned with an assessment of sensitive, vulnerable, and important water resource areas, placing some of South Africa's strategic water source areas at risk. Despite the requirement by Cabinet of a one-stop authorisation process that involves DEA, DWS and DMR, too often mines are given authorisations to operate without due consideration of the long-term and often extremely significant water quality implications resulting from mining.

However, an agreement between the Ministers of Water and Sanitation, Environmental Affairs and Mineral Resources concluded through the *Water Amendment Act of 2014* has set the basis for improved integration and alignment between the three departments. This agreement, titled One Environmental System, entails that all environment related aspects will be regulated through NEMA and that all environmental provisions will be repealed from the *Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)*; that the Minister responsible for environmental affairs sets the regulatory framework and norms and standards, and that the Minister responsible for mineral resources will implement the provisions of NEMA and the subordinate legislation as far as it relates to prospecting, exploration, mining or operations; that the Minister responsible for mineral resources will issue environmental authorisations in terms of NEMA for prospecting, exploration, mining or operations, and that the Minister responsible for environmental affairs will be the appeal authority for these authorisations; and that the three Ministers agreed to align the time frames and processes for authorisation processes.

The Mining Charter provides that mines are expected to design and plan all operations so that adequate resources are available to meet the closure requirements of all operations. Section 28(2) (c) of the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA) requires mines to report on their compliance to the *Mining Charter on an annual basis. However, in instances where a mine is declared insolvent and subsequently closes, the responsibility is inherited by the State who then must ensure the continuous rehabilitation of derelict and ownerless mines.* The rehabilitation fund provided prior by the mine is often not sufficient for continuous management and rehabilitation and the financial burden falls on the state. The challenge of providing sufficient funding for the on-going management of water pollution from closed mines has not yet been satisfactorily addressed. What becomes clear in looking at the relevant policies across government is that there is a lack of Policy and implementation alignment between the relevant government departments, and a lack of a common Policy imperative which balances the need for economic development with the protection of natural resources, including water. The DWS has developed a Mine Water Management Policy, that seeks to address the issues outlined above, particularly when it comes to issues around liability, funding and attribution.

The Department of Mineral Resources is responsible for approving Environmental Management Plans and for the regulation and control of mining waste. In exercising this responsibility, DMR is required to ensure that DWS/CMAs are involved throughout the process of mine authorisation, and that no authorisation for mining is given without a water use authorisation from DWS, which will include stringent water quality management conditions. In addition, DWS, DMR and DEA will develop a joint process for mine closure which effectively addresses the potential long-term water quality impacts of the mine. Work has already begun in this regard through the Inter-departmental Project Implementation Committee on integrating licencing for the mining sector.

3.4.4 Spatial Planning and Land Use Management Act, 2013

The *White Paper on South African Land Policy (1997)* stipulates that "environmental issues" should inform the Policy and stipulates that one challenge of land reform is to relieve land pressure without extending environmental degradation. The *Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013)* , administered by the Department of Rural Development and Land Reform, provides a framework for spatial planning and land use management and specifies the relationship between spatial planning, the land use management system and other kinds of planning; provides for development principles and norms and standards; provides for the sustainable and efficient use of land; and provides for cooperative government and inter-departmental relations between national, provincial and local spheres of government[3]. The *Spatial Planning and Land Use Management Act, 2013*

[3] http://www.lexology.com/library/detail.aspx?g=dc21b3d0-c543-42f9-b93c-ec389b52e976

(Act No. 16 of 2013) applies to the whole of South Africa (urban and rural areas) and governs informal and traditional land use development processes. However, there has been insufficient consideration of water quality impacts from land use and this aspect is not sufficiently considered in spatial planning and land use management initiatives.

The Department of Rural Development and Land Reform is responsible for the administration of the SPLUMA which aims, amongst other things, to (i) provide a framework for spatial planning and land use management in South Africa; (ii) to specify the relationship between the spatial planning and the land use management system and other kinds of planning; and (iii) to provide for inclusive, developmental, equitable and efficient spatial planning at the different spheres of government. DWS and CMAs are responsible for the development of Catchment Management Strategies which are a critical planning tool in managing water quality. It is important that this function of DWS/CMAs is taken into account in the implementation of the SPLUMA, and that there is sound co-ordination between DWS/CMAs and the DRDLR in order to ensure effective alignment of land-use planning and water resources planning in the country.

In meeting the requirements for IWQM, coordination and alignment with other sector Departments, such as Mineral Resources, Agriculture, Health, Environmental Affairs, Cooperative Governance is required. Initial engagements were held as part of this project, which provide a platform on which to build or strengthen ties with these sector partners. Future work will need to unlock approaches to these.

4. STRATEGY AND PLANNING INSTRUMENTS

Strategies are higher order plans that set the strategic action to be followed to achieve medium to long term goals. They should complement a policy and be given effect through detailed plans (such as business plans and implementation plans)

(DWAF, 2006a)

South Africa has a number of levels of water planning as indicated in **Figure 6** to ensure that water is managed in this context. Vertically, planning is aligned and consistent as per legal requirements. It also indicates the delegation of responsibilities from the national level down to the local and sub-catchment levels. Horizontally, there is cooperation between the three broad water sector areas.

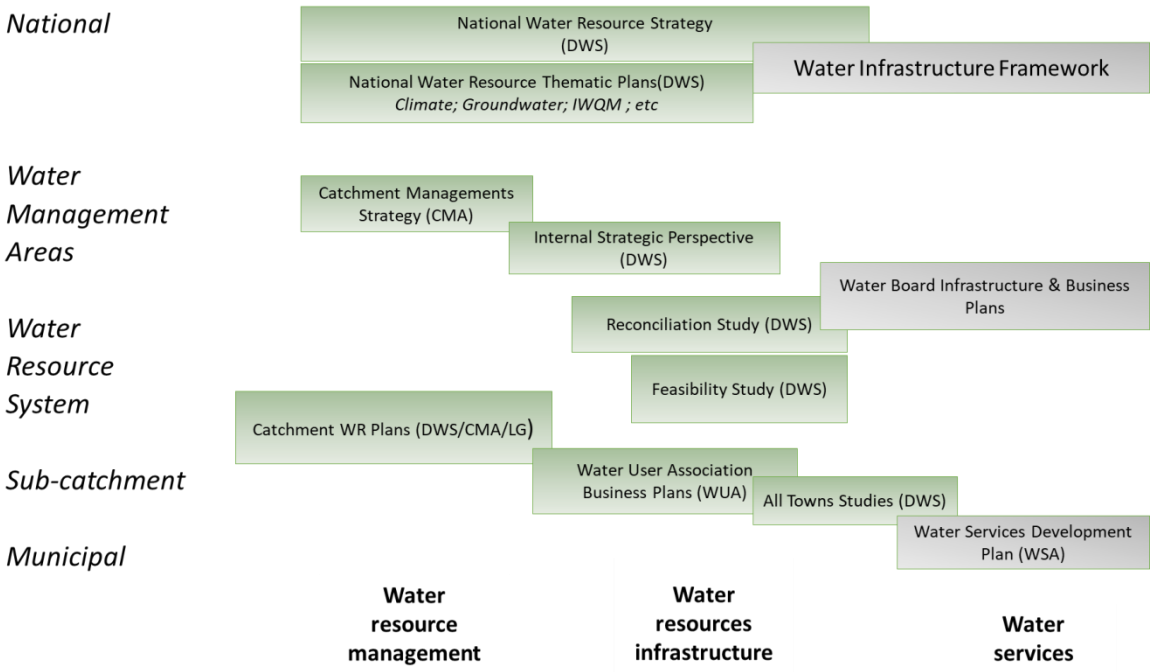

Figure 6: South African Water Planning Landscape

The key strategy and planning instruments that relate to water quality management are presented below.

4.1 National Planning

National planning provides the strategic framework for local planning. The overarching plan is the National Development Plan which is operationalised in part by the National Water Resource Strategy (NWRS). This strategy is required by the National Water Act, 1998 (Act 36 of 1998) and defines the strategic direction for water management in South Africa over the next 20 years, but also the focus on water priorities for the next five years. Under the

NWRS there are a number of national thematic plans including the National Climate Change Strategy for Water Resources, the ground water strategy, etc.

National water services planning is more focused on financing and monitoring, and providing a framework with norms and standards for the local government sphere to provide water services in terms of its Constitutional Mandate.

4.1.1 National Development Plan, 2012

The National Development Plan (NDP), supported by the NWRS will be the key drivers for the IWQM Strategy over the next 5 to10 years at least. The primary aim of the NDP – 2030 (NPC, 2012) is to eliminate poverty and reduce inequality by "*growing an inclusive economy, building capabilities, enhancing the capacity of the state and promoting partnerships throughout society*." This will be undertaken within the international context of the sustainable development agenda as well as Agenda 2063, which are both aimed at ensuring inclusive growth and sustainable development.

Nine primary challenges were identified in the Commissioner's Diagnostic Report in 2011, and four of these have direct relation to the quality of the country's resources, either impacting on the resource, or being impacting by the resource (NPC, 2011):

- The public health system cannot meet demand or sustain quality - illuminates the additional burden that poor water quality puts on the human health.
- The economy is unsustainably resource intensive - links to the competing demands of the economic sectors (mining, agriculture, industries, amongst others and the water resource)
- Infrastructure is poorly located, inadequate and under maintained - supports the challenges experiences by municipalities and WWTWs.
- Public services are uneven and often of poor quality – links to the capacity to manage water quality in Government.

The NDP recognises of the importance of shifts in the global economy, rural-to-urban economic migration; increased urbanisation, gender equality, climate change and the continent's economic growth, in order to try and understand the resources and capabilities required to address these shifts.

The key departure point being that **all sectors need to jointly contribute to the vision and objectives of the plan**. This is an important centrality that takes South Africa away from a more programmatic approach towards one of recognising that integrated action is essential.

The NDP is looking to prioritise and address the challenges in rural agricultural development, the requirements for economic infrastructure build, the need for increasing partnerships with the private sector, obligation to address the crisis in healthcare management, commitment to increasing vigilance in the protection of the environment, the duty to professionalise the public sector, and the responsibility to strengthen accountability and improve coordination.

In order to manage these challenges, the NDP's approach to change (**Figure 7**) **identifies active citizenry, together with effective government and strong leadership as key drivers** of the country's development and support towards social cohesion. Concerns around the state's capacity and capability to implement identified actions are also concerns experience in managing the country's water quality.

Figure 7: The National Development Plan's approach to change

The one critique of the NDP is that even though it addresses water as an economic infrastructure, it mainly alludes to ensuring that the country's water supply issues are a top priority, while making little to no reference to the debilitating effect of poor water quality on the country's resources**.** The alignment of the NDP to the Sustainable Development Goals is also important in taking the country forward.

The shorter-term vision for the country is generally set by the President. An **outcomes approach** is adopted, which sets the goalposts for the residing ministers for the period 2014 to 2019. The way in which water quality is managed in the country will affect five of those proposed outcomes:

Outcome 2: A long and healthy life for all South Africans.

Outcome 6: An efficient, competitive and responsive economic infrastructure network.

Outcome 7: Vibrant, equitable and sustainable rural communities with food security for all.

Outcome 8: Sustainable human settlements and improved quality of household life.

Outcome 10: Environmental assets and natural resources that are well protected and continually enhanced.

The NDP has a number of strategic objectives and enabling factors that serve to shape the priorities of government. Of these, several have direct relevance for this strategy.

Table 2: IWQM Strategy in support of the NDP

NDP Strategic Targets	IWQMS Alignment and Support
By 2030 Eliminate income poverty	Improved raw water quality will contribute to a reduction in the cost of doing business, a reduction in the cost of treating water, and a reduction in the illness burden on poor households. All of these will contribute to economic growth and the potential to eliminate poverty.
Increase employment from 13 million in 2010 to 24 million in 2030	Increased employment opportunities arise from the need to improve the management of water quality. This includes infrastructure development and maintenance through to those jobs related to managing and monitoring the water resource. These would range from more artisanal work through to more highly skilled jobs, both directly in the water sector and indirectly in the private sector.
Establish a competitive base of infrastructure, human resources and regulatory frameworks	Investments in infrastructure development and maintenance is a key element of the IWQM Strategy and is a fundamental part of the country's continued growth. Regulatory frameworks become critical when managing scarce natural resources. The development of human capacity is equally critical to support the development and maintenance of infrastructure and to give effect to regulatory systems.
Ensure that all South Africans have access to clean running water in their homes	Improvements in raw water quality will reduce the costs and challenges of providing potable water to all residents of South Africa.
Realise a food trade surplus, with one-third produced by small-scale farmers or households	Increasingly poor water quality will impact upon the ability of agriculture to maintain crop yields and in some instances, may render agriculture non-viable. Current requirements for dilution of salts uses water that could be used for social and economic purposes.
Ensure household food and nutrition security	Improved water quality, particularly in relation to microbial pollution, will contribute to improving the nutritional status of poor households in South Africa, especially in more rural settings where communities are dependent upon raw water resources.
Realise a developmental, capable and ethical state that treats citizens with dignity	Effective management of water quality is a critical part of recognising and protecting the rights of all people living in South Africa to an environment that is not harmful to their health or well-being.

4.1.2 The National Water Resources Strategy, 2013

The NWA required the establishment of a NWRS by the Minister of Water. At the same time, a decentralized approach to water resources management was introduced, with the Act requiring the establishment of CMAs that have the responsibility to develop and implement a CMS that is consistent with the framework provided by the NWRS. The South African water resources planning framework is based on the international principles of IWRM. However, the complexity of integrated planning and the capacity needed to implement the results have outstripped the ability of the country to deliver.

Whilst the first NWRS (DWAF, 2004) set out the policies, strategies, guidelines and procedures for the management of water in the country, as required by the National Water Act, 1998 (No. 36 of 1998). The updated strategy (DWA, 2013) aims to "ensure that national water resources are managed towards achieving South Africa's growth, development and socio-economic priorities in an equitable and sustainable manner over the next five to 10 years."

The strategy also responds to the priorities set by government in the NDP and NWA imperatives that support sustainable development. Under the NWRS are a number of national thematic plans, including the National Climate Change Strategy for Water Resources. The NWRS has been described by the National Climate Change Response White Paper as setting out the short-term response to climate change, with the Water for Growth and Development Framework (WfGD) 2030 seen as the medium to long-term responses. It recognises that climate change will increase the pressure on already stressed water resources, further impacting on water quality, and there is thus a crucial requirement for the effective management, use, allocation and re-allocation of available water resources. The **revised NWRS** has incorporated aspects of the WfGD that pertain to water resource management as key core strategies and further **looks to adopt a sectoral approach in its implementation.** Whilst the water quality issues are illuminated in the NWRS, it lacks the appropriate strategy to deals with both the water quality issues, as well as issues around WQM. It is this very lack of approach to WQM, that initiated the development of this current project to support the future revisions of the NWRS.

The IWQMS is an integral part of the NWRS and as such underpins the intent of that strategy to support the National Development Goals as laid out in Vision 2030 of the NDP. The NWRS provides an overarching framework and vision for the water sector to support these national development objectives noting the centrality of water in our country's development. This is laid out in the vision, goal, objectives and strategic themes of the NWRS (**Figure 8**). Water quality is a critical element across all objectives and strategic themes.

Equally, the five foundational elements that are important to ensure execution are critical to ensuring effective WQM. As such, the objectives and actions outlined in this strategy support these objectives of the NDP and the NWRS, through a practical and achievable approach.

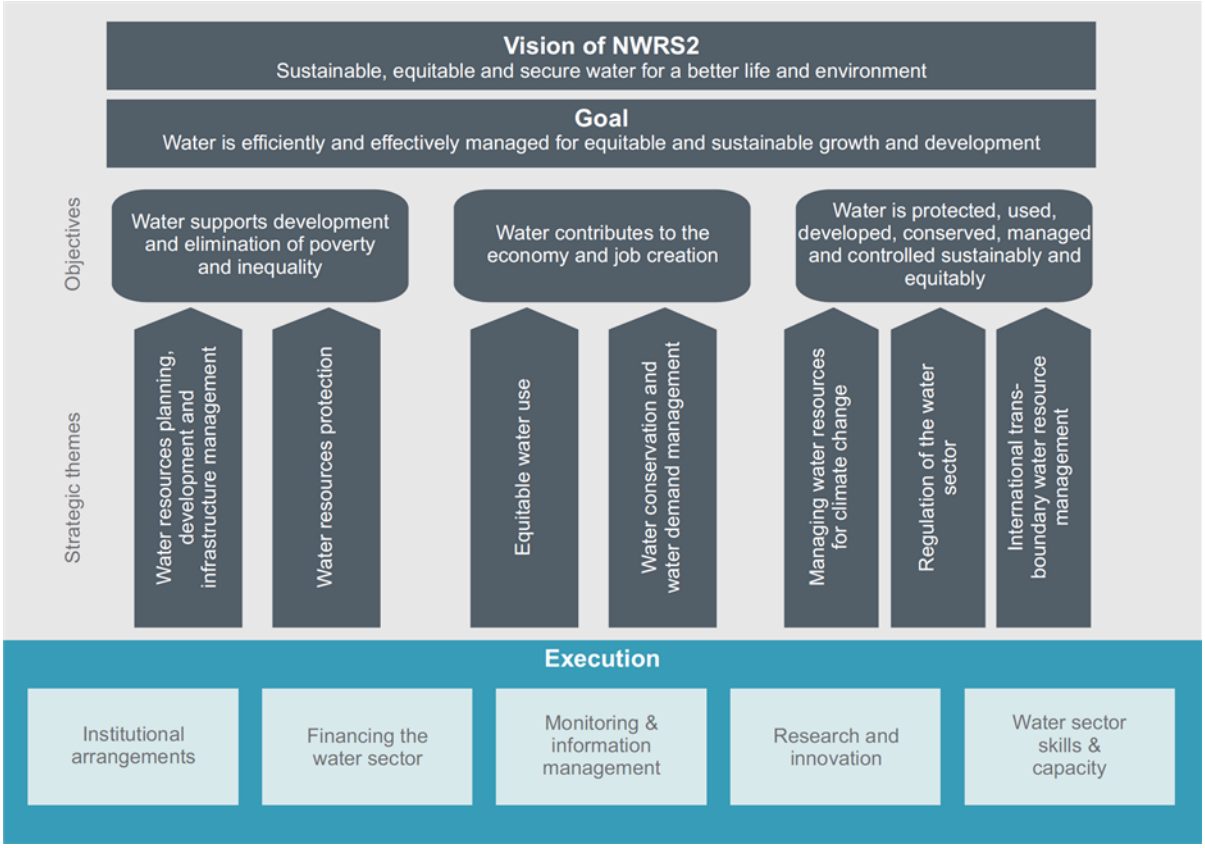

Figure 8: Overview of the NWRS (second edition) (DWA, 2013)

4.1.3 The Strategic Framework for Water Services, 2003

This framework provides the approach for the provisioning of water services in South Africa, which ranges from compliance with water authorities to ensure appropriate drinking standards for potable water. All water services providers must develop a water services provider business plan. This plan is an annual operational plan which shows how the activities of the water services provider will support the achievement of the desired outcomes of the water services development plan by planning for water quality.

It should be noted that at the time of compiling this document, The Department has undertaken to amalgamate the NWA and the WSA. Furthermore, the NEMA and MPRDA have been amended to include mine water management.

4.1.4 Integrated Water Quality Management Strategy, 2017

The IWQMS provides a coherent and consolidated to approach to manage the water quality of the country's resources. The IWQM Strategy calls for an inclusive, adaptive, coordinated and aligned approach and outlines the Vision, Goals and Strategic Actions to take the country forward in improving WQM.

The NWA dictates that water resources management practices and strategies must give effect to the Reserve, the RQOs, and to the Water Resource Classification system. In the

absence of the RQO's, certain catchments have implemented the agreed Resource Water Quality Objectives (RWQO's).

The key components to effective water quality management include the effective co-ordination between the various planning, information management, monitoring and source directed control activities (such as water use licensing and compliance monitoring and enforcement) and well as engagement with stakeholders (DWS, 2015). Given that water quality management considers the collective impact of land use and water use processes, coordinated planning and action is required not only within the Department but at all levels, from national government through provincial and local authorities to individual landowners and affected stakeholders, such as civil society. The provision and implementation of clear policies, strategies and plans, which provide the necessary direction to the Department as well as the larger water sector, for the effective, equitable, sustainable and integrated management of South Africa's surface and ground water quality is paramount for the management of the resources.

Currently, water quality is managed and controlled by the Department through the application of a number of management instruments. The hierarchy of decision-making, is one such instrument which informs the level of regulatory response.

4.1.5 Climate Change Strategy for Water Resources, 2015

The Climate Change Strategy for South Africa's water resources examines the status quo of water resources in South Africa and the additional dimension climate change adds to various aspects of managing water resources.

The starting point of looking at the water impacts of climate change and therefore the strategic responses, is that we are already facing a highly developed, highly stressed and damaged water system in South Africa. High water demand and high levels of pollution from a variety of sources have added to the complexities of a fundamentally high-risk hydrology. Thus, climate change adds a layer of increased stress onto an already stressed system. The message from this is that there are urgent actions to be taken immediately in terms of managing water better, regardless of the longer-term impacts of climate change.

Broadly, South Africa could face two possible extreme climate futures:

- A slightly more water abundant future, which supports and maintains our current demands as well as our agricultural sector. This future tends to move the country to food sufficiency, which is what the NDP is proposing (50% increases in agriculture).
- A less abundant water future that provides further constraints in an environment that is already under water constraints, especially in the Highveld, Lowveld, Orange Systems and the Western Cape.

The less abundant future requires economic decisions on allocation and a trade-off between different sectors including:

- Shifts in agriculture and its implications on food security
- Shifts in energy production

- Reconsidering a rural economy based on agriculture
- WCDM that affects every sector including catchment rehabilitation

The shift away from the agricultural sector becomes an important decision as South Africa will become more reliant on the region for food security (e.g. Mozambique, Zambia etc.). This would require South Africa to become more proactive as a regional integrator. Further, there needs to be a greater understanding of the role of water in energy, food and trade and how South Africa improves its current account. The non-negotiable in a less abundant future is the domestic and environmental allocation, however, how do we recalculate the environmental demand and ensure the environmental reserve is preserved under increased temperature and evaporation and ensure improved catchment management.

This Strategy can play a leading role in understanding water as an opportunity and constraint linked to other sectors and how this feeds back to economic planning in South Africa and can provide a guide as to the importance of cross sectoral planning and coordination for future development.

4.1.6 National Ground Water Strategy, 2016

There are serious warning signals that groundwater use is presently on an unsustainable path. Water services to communities, a national priority, are under threat. Many municipal schemes from groundwater have failed or are close to failing. Municipal managers have expressed themselves against the use of groundwater and virtually no management of the resource takes place at local level. Just based on national monitoring networks, it is clear that Karst aquifers and coastal aquifers, the major aquifers the country has, are under pressure in many locations through over- abstraction, declining water levels and water quality degradation. Even hard-rock aquifers in Limpopo show local declining trends in groundwater levels as a result of over-abstraction. Equally concerning is the wide-spread trend of increasing nitrate levels (parts of Limpopo, Northwest and Free State Provinces), most probably as result of human activity. Water quality impacts by mining on groundwater must be present, but cannot be readily detected from the present national scale monitoring (DWS, 2016).

From the beginning, it was recognized that the National Water Act, 1998 was a framework act, which had to be underpinned with regulations to make it functional. This was particularly important for groundwater, which had not received regulatory attention in the past. In 2010 the Department responded to this change with an internal Groundwater Strategy, and already took the decision to work towards a national strategy together with the wider sectors. The national strategy is required to:

- Let the full role/potential of groundwater towards water security in SA unfold.
- Establish a framework within which stakeholders at all levels can become an essential part of good groundwater governance in SA.
- Initiate a long-term process of rolling out sustainable groundwater utilization within WRM (DWS, 2016).

4.2 Catchment Planning

While the management of water quality happens through all levels of planning, it can be facilitated directly at the catchment level, as it is at this scale that the effects of climate variability and change play out on a micro-level. However, Catchment Management Agencies (CMA) are still being developed, with only 2 CMAs being functional. There are capacity constraints and this local level to provide the necessary implementation and management of strategies. Furthermore, the CMAs have been amalgamated from 19 in number down to 9, and once functional will require that the catchment management strategies be updated to accommodate this change. The CMA is however a huge opportunity in supporting adaptation, with support from catchment forums and WUA at a more localised level that can help implement the risk and disaster management plans for the catchment.

4.2.1 Internal Strategic Perspectives

Internal Strategic Perspectives were completed by DWS in order to document their understanding of the water resources management and relevant water management issues within each Water Management Area in South Africa. These reports, completed by DWS in 2004, are considered to be the forerunners of the Catchment Management Strategies and provided a framework for water management.

These strategies focussed on the current water situation and described the following:

- Water availability,
- Water requirements and use,
- Water reconciliation (which includes WCDM)
- Water quality management
- Infrastructure system management
- Institutional aspects

4.2.2 Catchment Management Strategies

In accordance the NWA, the Catchment Management Agencies, or CMAs, are responsible for the protection, conservation, development and management the water resources at the water management area (WMA) level. One of the first delegated functions of water resource management to the CMA will be the development of a Catchment Management Strategies in the South African context (DWAF, 2006d).

A CMS, developed by a Catchment Management Agency (CMA), is **statutory document** which provides the vision, and the strategic actions to address integrated water resources management. It is based on the best available information. The framework for the CMS is given by the NWRS (DWA, 2013).

Part 2 of the NWA requires every CMA to progressively develop a CMS for the water resources within its water management area. In the process of developing this strategy, a CMA must seek co-operation and agreement on water-related matters from the various stakeholders and interested persons. The CMS must:

- Be in harmony with the NWRS.
- Be reviewed from time to time.
- Include a water allocation plan. In this respect, a **CMS must set principles** for allocating water to existing and prospective users, considering all matters relevant to the **protection, use, development, conservation, management** and, control of water resources (DWAF, 2006d).

4.2.3 Integrated Water Quality Management Strategies and Plans

The Department of Water and Sanitation (DWS) has identified the need to develop overarching Integrated Water Quality Management Strategies and supporting thematic plans (e.g. on the management of eutrophication or salinity) that can be implemented by water resource managers and users in a Water Management Area (WMA). These strategies need to be developed within the context of the National Water Resource Strategy, be aligned with the studies and initiatives that have been completed to date and provide sufficient details regarding the strategies, plans, protocols and implementation programmes to give effect to the Catchment Management Strategy Framework Component.

4.3 System Planning

System planning is where the detailed planning and operational considerations reside. The main instruments are the classification process, which guide water resource planning and the reconciliation studies, which in turn guide water infrastructure planning. An overview of these processes and its focus areas are described in the chapters that follow.

There are a number of thematic plans at the system planning level, which are commissioned on an “as-needed” basis and tend to be specific to a single system. An example would be the Acid Mine Drainage (AMD) plans which affect particular water systems in South Africa. These tools could be further developed to support IWQM.

4.3.1 National Water Resource Classification System

The Department’s Integrated Water Resource Planning (IWRP) function provides the required Resource Planning and Management cohesion that links Resource Objectives with Water Use Management (**Figure 9**) and hence, it functionally fulfils the coordination role from a water quality perspective.

Resource Directed Measures (RDM), together with Source Directed Controls (SDC) are the key strategic approaches designed under the NWA to achieve equity, sustainability and efficiency in Integrated Water Resources Management in South Africa. These measures comprise the classification system, the Reserve and Resource Quality Objectives. Together they are intended to ensure comprehensive protection of all water resources.

The Water Resource Classification System, which is required by the NWA, is a set of guidelines and procedures for determining the desired characteristics of a water resource, and is represented by a Management Class (MC). The Management Class outlines those

attributes that the custodian (DWS) and society require of different water resources. The above is a consultative process to classify water resources (Classification Process) to help facilitate a balance between protection and use of the nation's water resources. The outcome of the Classification Process will be the Minister or her delegated authority setting the MC and RQOs for every significant water resource (river, estuary, wetland and aquifer) which will be binding on all authorities or institutions when exercising any power or performing any duty under the NWA.

Only three management classes are acceptable, Class I: Minimally Used, or Class II: Moderately Used, or Class III: Heavily Used.

The management classes essentially describe the desired condition of the resource, and conversely, the degree to which it can be utilised. In other words, the MC of a resource sets the boundaries for the volume, distribution and quality of the Reserve and RQOs, and thus the potential allocable portion of a water resource for off-stream use. The Classification Process is not carried out in isolation, but is integrated within the overall planning for water resource protection, development and use. A key component of classification is therefore the on-going process of evaluating options with stakeholders in which the economic, social and ecological trade-offs will be clarified and decided upon (DWAF 2011). To date a suite of instruments have been developed to support this. The challenge that is now to be faced is the implementation of these instruments.

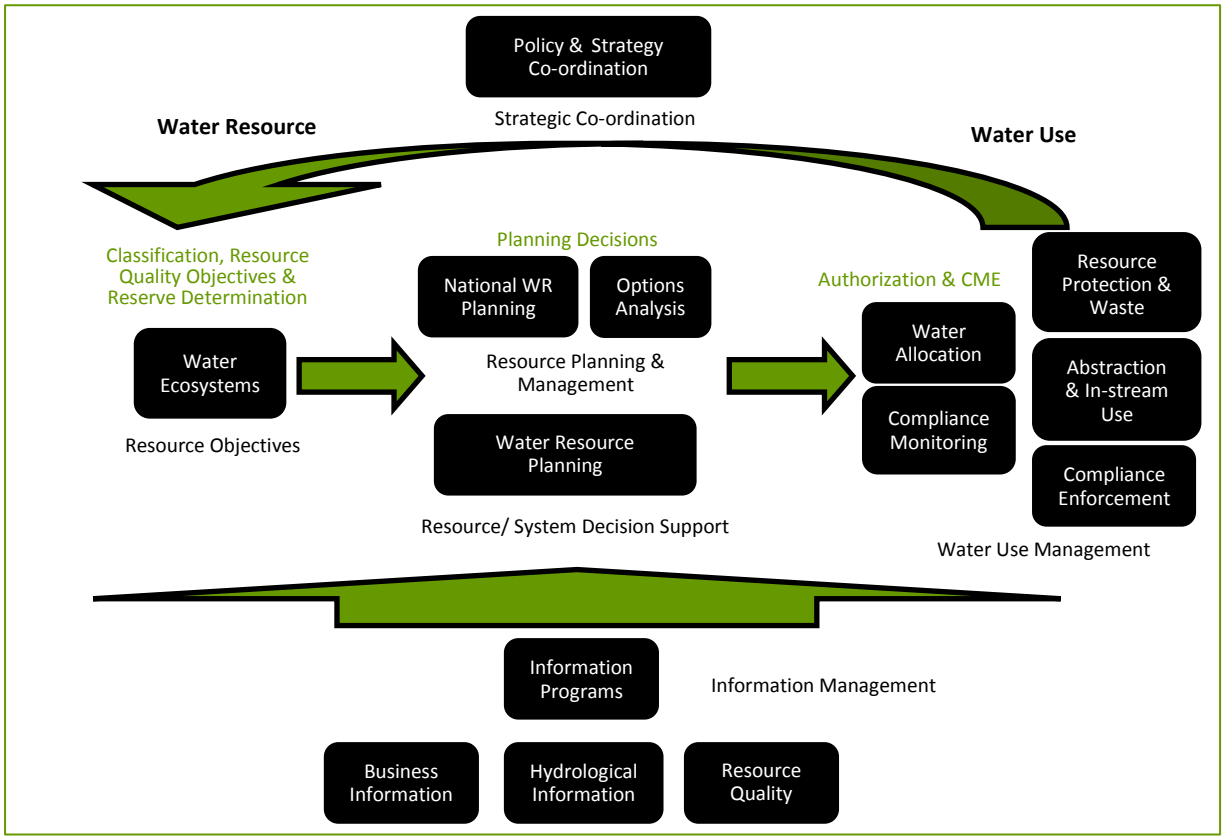

Figure 9: Water Quality Planning in DWS (DWAF, 2006c)

4.3.2 Water Resource Reconciliation Studies

Water resource reconciliation studies involve an assessment of the use, and future requirements for water and how these can be 'reconciled' with the available sources through various strategies for the next two to three decades. The main aim is to determine when the next water infrastructure system would be required and when should it be built. It has an inherent adaptation in its planning **approach but does not take a long-term strategic perspective**. These studies do address the following:

- Future water requirement scenarios for and with the metropolitan area,
- Water resources and other interventions that could add to water availability,
- Possible methods for reconciling the requirements for water with the available resources,
- Development and implementation of interventions and actions required by providing recommendations,
- Monitoring and updating of the strategies into the future.

Water resource planning also requires an understanding of the key drivers of water demand and how different development futures will impact on water resource availability and use. The most common approach to incorporating different development futures in water resource planning is to firstly understand the trends in current water use and to quantify the available resources, and then account for future demand under different scenarios.

The key drivers of water use are to a large extent linked to population growth rates, and water use in specific sectors such as industry, domestic use and irrigation. The general trend has been to construct different scenarios that can be summed up into two main types, a low water demand scenario and high demand scenario, that is based either on population growth rates, or water demand in key sectors of the economy that are expected to grow with significant water requirements.

There are eleven reconciliation studies for South Africa, excluding the All Towns Strategy. Currently 7 of the bulk water studies have been completed with some town strategies being developed. Generally, the assessments of water availability are based on current infrastructure, current levels of development and accurate accounting for surface water, groundwater, return flows and inter-basin transfers. Implementation of the reserve and availability of water from desalination are also considered.

5. OPERATIONAL AND REGULATORY INSTRUMENTS

The operational and regulatory instruments enable the use of water resources and provide the bounds for this use to ensure that that use is sustainable. As such, the instruments used should give effect to the policy, strategy and implementation plans, with the later instruments being used to assess the efficacy of how the policy, strategy and implementation plans were effected. As such, these instruments become the hub of water quality management.

Whereas the operational instruments really enable the use of water resources, regulatory instruments influence environmental outcomes by regulating processes or products, limiting the discharge of specified pollutants, and by restricting certain polluting activities to specific times or areas. In effect, these two suites of instruments work together although within current organisational structures these are often split functions, which can result in disjointed approaches in some instances.

Currently, the Department's approach to the protection of the resources is two-pronged, utilising both RDM and SDC. RDM set the goals for resource protection and are informed by the Water Resource Classification system, which allows for different levels of protection for different water resources. This is then given effect through the RQOs that provide a numerical or descriptive statement of the conditions which should be met within the receiving water resource. Coherent and integrated approaches to balancing the protection and use of water resources will therefore require the collective application of RDM and SDC in respect of water quantity and quality, as well as the biological and physical dimensions of the resource.

The NWA stipulates that water resources management practices and strategies must give effect to the Reserve, the RQOs, and to the Water Resource Classification system. In the absence of the RQO's, certain catchments have implemented the agreed Resource Water Quality Objectives (RWQO's). These become stipulated within the CMS and as such it is the focus of the operational and regulatory instruments to ensure that these objectives are met.

These instruments fall within the remit of SDCs as the measures that contribute to defining the limits and constraints that must be imposed on the use of water resources to achieve the desired level of protection (DWAF, 2004). As such, **SDCs are primarily designed to control water use activities at the source of impact**, through tools such as standards (Special Standards exist for waste water/effluent arising in a catchment draining to a Schedule I river; Special Standard for phosphate draining to a Schedule II river and General Standard to be applied for non-Schedule I or II areas)[4]. and the situation-specific conditions that are included in water use authorisations.

Currently staff are using the General and the Special standards gazetted in 1984 in terms of 1956 Water Act. However, section 163(4) of NWA states the following:

[4] DWS (1984) General and Special Standards - Procedures to Assess Effluent Discharge Impacts, First Edition

(4) Any regulation made under a law repealed by this Act remains in force and is considered to have been made under this Act -

(a) to the extent that it is not inconsistent with this Act; and

(b) until it is repealed by the Minister under this Act

It is, therefore, appropriate to still be making use of these standards, despite the fact that they are set nationally and are not designed to give effect to the RQOs. In the absence of RQOs, it is appropriate to use the General and Special Effluent Standards in water use licenses.

Importantly, SDCs are the key link between the protection of water resources and the regulation of their use. The use of SDCs can be both proactive and reactive by firstly preventing or minimising future water quality problems and secondly, by managing existing water quality problems to achieve the management class, the Reserve and the RQOs.

It is therefore important to understand the approach towards managing a given resource is determined through the hierarchy of decision-making. This approach then dictates the way that water use is authorised and the nature of the management and regulatory instruments to be utilised (**10**).

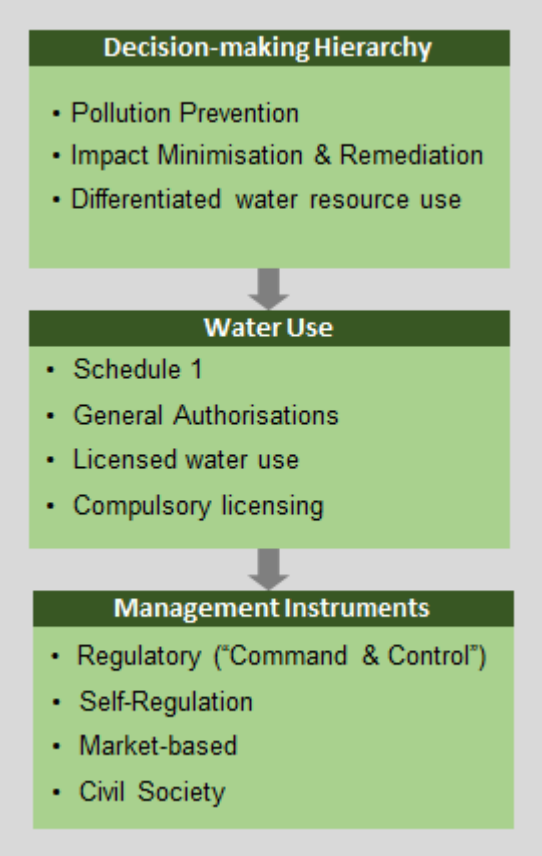

Figure 10: Utilisation of source directed controls

5.1 Hierarchy of decision-making

The exact nature of regulatory approach that will be applied to a catchment will depend on the management objectives that are set for local water resources. Overall, the DWS applies an approach that ensures conservative decision making so as to minimise the risk of unacceptable ecological impacts that may influence sustainability. The DWS balances the ecological necessities with that of supporting socio-economic development, and of current and proposed water use. A hierarchy of sequential steps of both water pollution management decision-making and water use management decision-making is applied (**Figure 11**).

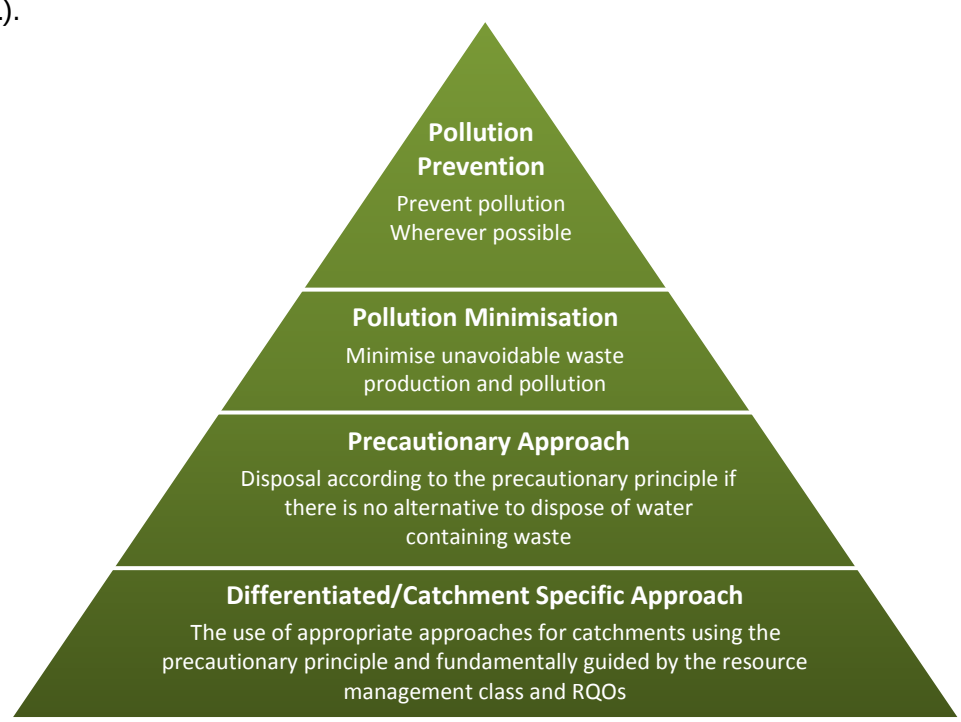

Figure 11: Hierarchy of decision-making

5.1.1 Step 1: Pollution Prevention

The first step in decision-making on water quality is to prevent pollution where possible, while recognising the need for equitable socio-economic development to take place. This is based on the premise that it is better to prevent harm than to manage it after the fact. Thus, irrespective of the amount of allocable water quality, are encouraged to prevent pollution where possible.

Prevention is specifically important for controlling the handling, discharge and disposal of hazardous substances, or substances that could present a major threat to the water resource quality. This is particularly important in the field of emerging contaminants, where understanding cumulative impacts is particularly complex, for pollutants of high toxicity, hazard or bio-accumulation, or in the context of uncertainty arising, for example, from climate change.

5.1.2 Step 2: Pollution Minimisation

Where prevention of pollution is not altogether possible, and is in the interests of promoting ecologically sustainable and justifiable economic and social development, the discharge of water containing waste (point source or diffuse source) is minimised. Some of the tools for the minimisation of pollution include detoxification, neutralisation, application of best practices, recycling and re-use of water that would otherwise be discharged, and the capture for re-use of products in the water that would otherwise be discharged into water resources.

Since many land uses have a significant impact on water pollution, the regulation of land use, including the prohibition of polluting activities, is where appropriate, used as an instrument to minimise pollution.

5.1.3 Step 3: Precautionary Approach

Where there is no alternative but to discharge water containing waste or to dispose of waste, water uses with a pollution potential are regulated under minimum standards, general authorisations or licences with specific discharge conditions, or through prohibition of particular discharges or activities.

5.1.4 Step 4: Differentiated / Catchment Specific Approach

Catchments differ in their hydrological and ecological functioning. Additionally, there are differences in the ways and extent to which they are used, and this requires a differentiated and adaptive management response. This is guided by the extent of water quality stress that is experienced with the catchment.

The DWS is be guided by the level of protection determined by the resource class and associated RQOs (including the Reserve). In practical terms, for a river, for instance, this implies that collectively all SDCs (including licence conditions) applied upstream of each classified reach and each RQO site, must ensure that the water quality RQOs at all downstream sites are achieved and maintained.

The resource class and RQOs vary between catchments and water resources, and decisions are informed by the specific catchment or water resource related conditions. In catchments with no water quality stress, minimum standards and/ or requirements for waste discharge, as determined by DWS or the CMA are applied. These may be relaxed in special circumstances, but the resource class should be maintained.

In stressed water catchments or water catchments where application of the minimum standards and/ or requirements is not sufficient to maintain water quality objectives, standards stricter than the minimum effluent standards can be applied. These standards can be site-specific and are based on the results of a waste allocation load investigation according to the Receiving Water Quality Objectives approach. In addition, and differentially, consideration is given to the need to rehabilitate specific resources or in some instances reclassify resources.

5.1.5 Rehabilitation

In considering, specific responses to catchments there may be the need to rehabilitate or remediate the impacts of heavily polluted water resources to improve water quality. The DWS does drive programmes to rehabilitate and remediate these impacts in identified, critical catchments.

In general, this applies where a water resource has already been degraded to below the determined resource class. In this regard, a catchment-wide approach is adopted to ensure that the most cost-effective solutions for addressing the rehabilitation at the catchment scale are identified and implemented.

Remediation or rehabilitation may include direct intervention on degraded land to minimise contamination risk to a water resource. This either requires action and funding by government, or actions to be taken by those responsible for the pollution, depending on the nature of the polluting activity and the rehabilitation actions required. The rehabilitation of sources of pollution is also addressed, such as rehabilitation of mine dumps and other contaminated sites. The implementation of the WDCS will increase the funding available for waste minimisation and rehabilitation activities.

The protection and restoration of wetlands and similar green infrastructure is an important part of IWQM, and is being highlighted through the development of a specific policy on wetlands by DWS.

5.1.6 Reclassification

As a last resort, if the receiving water body does not have enough allocable water quality to absorb the waste without exceeding the RQOs, and if there are major socio-economic drivers behind a proposed new waste discharge, there may be a case to be made for reclassification of a resource. In this case, it needs to be investigated whether a lower Resource Class, that might allow for socio-economic development opportunities to be implemented, may be more appropriate. In such a case, the full procedures required under the legislation for the determination of Resource Class, RQOs and Reserve, including stakeholder consultation, will be applied. The converse is also true, that is, if the Resource Class is found to be inadequate for any reason, a higher Class might be applied, after appropriate investigation and consultation. Currently, however, the legislation does not allow for the classification of a resource to be changed, and a legislative amendment to the NWA is required for this purpose.

5.2 Water use authorisation

Water Use Authorisations are instruments that are used to support social and economic development. Government will continue to use these authorisations as the primary mechanism for the authorisation of the following water quality related water uses:

- Section 21(c) Altering the bed, banks, course or characteristics of a water course. “Characteristics” is defined as the resource quality of a watercourse within the extent

of a watercourse, where water quality, including the physical, biological and chemical characteristics of water, is a key component of resource quality;

- Section 21(e) Engaging in a controlled activity: irrigation of any land with waste or water containing waste generated through any industrial activity or by a waterwork.
- Section 21(f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.
- Section 21(g) Disposing of waste in a manner which may detrimentally impact on a water resource.
- Section 21(h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation.

Other command and control mechanisms include the regulation of land use activities and the control of development activities through regulations, Environmental Impact Assessments (EIAs), prohibitions on certain activities, setting of product or technical production standards, and setting of performance standards (such as ISO 14001). While the mandate of different departments influences the instruments that can be used, the relevant regulatory instruments can be implemented in support of IWQM.

Water use can be authorised via:

- **Schedule 1**: small volumes of water or wastewater used at a household level with little potential for negative impacts on the water resource, and for which no application or formal authorisation needs to be made.
- **General Authorisations**: Larger volumes of water or wastewater with some potential for negative impacts on the water resource which may be generally authorised for a specific water resource, specific group of users or type of water use.
- **Existing lawful use**: Is water use that lawfully took place in the period two years before the promulgation of the NWA.
- **Licensed water use**: Larger volumes of water, waste or other water use authorised in terms of a license issued under the NWA, and upon approval of an application by the delegated authority.
- **Compulsory licensing**: Although not a type of authorisation, this instrument can be utilised to ensure that there are transformative shifts in water use authorisations to be representative of the racial and gender make-up of the country, as well as to promote efficiency and environmental sustainability.

Water use may also be regulated through regulations such as:

- **GN 704:** Regulations on use of water for mining and related activities aimed at the protection of water resources (Government Gazette No. 20119 of 1999).

In some cases, new water uses may need to be declared as such, before regulations may be gazetted, as has been the case with activities associated with unconventional gas

exploration and./or production, which were declared as a controlled activity (Section 21(e)) in 2015 (GN 999 of 2015, GG No. 39299).

Unauthorised water use is illegal and constitutes an offence in terms of section 151(1) of the NWA. A person may be authorised to use water:

- If the water use is permissible in terms of Schedule 1 of the NWA, or
- As a continuation of an existing lawful use, or
- If authorised by a General Authorisation, or
- If licensed to do so in terms of the NWA.

With the limited water resources in the country, it becomes crucial to understand know how much water is used, by whom, and where, and as such this is important in understanding how much water quality is allocable. The NWA gives the Department of Water and Sanitation the tools to gather the information that we need for the optimal management of our water resources. The registration of water use is one of these tools and the Department utilises the Water Authorisation and Registration Management System (WARMS) for such purposes. The registration aids the Department:

- To manage water resources;
- To ensure fair share allocation;
- To protect the environment; and
- To enable the Department to charge for water.

Registration of water use is compulsory to all the authorization types, viz. general authorizations, licenses, and existing lawful water use.

5.3 Integrated Water Use Licence

The responsibility for environmental protection currently lies with both the DWS and the DEA, with both the NWA and the NEMA being used to protect resources. Thus, the NWA and the NEMA set out the parameters for regulation, including the institutional arrangements and regulatory instruments.

The primary instrument to ensure that environmental (biodiversity) resources are taken into account as far as new projects/developments in South Africa are concerned is through Environmental Impact Assessments (EIAs) (Brownlie et al, 2013). On the other hand, the primary instrument to ensure the sustainable use of water and water resources are through water use authorisations. Challenges with both of these processes exist, particularly as far as they align with each other.

According to Brownlie *et al* (2013), although project-level EIAs do contribute to some extent to providing assurance of sustainable development, the challenges that are faced included the fact that:

- there is a low level of coordination and collaboration by key authorities regarding environmental management at a strategic level;
- many projects are authorised although they do not ensure sustainable development, that is, EIA practice is largely dictated by procedural and reporting requirements in the NEMA EIA Regulations and do not really engage with key sustainability issues;
- integrated decision-making and cooperative governance is not occurring;
- by moving environmental regulation from DEA to the key impacting sectors, conflicts of interest particularly in the mining sector, may be problematic (Brownlie, Coetzee, Morris, 2013).

Given the need to align the various environmental authorisation processes, a "one environmental system" was announced in December 2014, which aims to streamline licensing processes for mining, environmental authorisations and water use.

Under the One Environmental System, the Minister of Mineral Resources will issue environmental authorisations and waste management licences in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), and the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), respectively, for mining and related activities. The Minister of Environmental Affairs will be the appeal authority for these authorisations. The Ministers of Environmental Affairs, Mineral Resources as well as Water and Sanitation furthermore agreed to synchronise the process for the issuing of permits, licences and authorisations within a 300-day period. To give effect to this agreement, in March 2017 **regulations regarding the procedural requirements for water use licence applications and appeals was published** (GN 267, No. 40713 of 2017) for the

To ensure the continuous improvement in the alignment of the various authorisation processes and by extension in the management of natural resources, platforms such as the Interdepartmental Project Implementation Committee (IPIC) on integrating licencing have been established. Future processes may also involve the amendment and alignment of all four of the acts that deal with the management of natural resources in South Africa (NWA, NEMA, CARA and MPRDA).

The real opportunity exists to look at improved cooperative governance arrangements between sectors that could strengthen regulatory powers across the sectors.

5.4 Management Instruments

Regulation can be defined as "*the means by which any activity, person, organism or institution is guided to behave in a regular fashion, or according to rule*." (Picciotto and Campbell, 2002). Whilst there are a range of operational procedures, management tools and institutional mechanism that are utilised to manage water quality, regulation remains as the central instrument that guide processes. Under this definition, the regulatory framework for water resources consists of a great number of players and processes, some falling within the formal regulatory process, i.e. regulation as practiced by the state, and some falling within a

more informal regulatory process, for example through the media, community pressure groups, consumer behaviour and so on.

Regulatory instruments influence environmental outcomes by regulating processes or products, limiting the discharge of specified pollutants, and by restricting certain polluting activities to specific times or areas. In understanding organisational issues for water resources regulation, it is useful to understand the current regulatory chain and the roles of the various players active in water resources regulation in South Africa. The complexity of the regulatory chain provides numerous challenges in ensuring that regulation is effective. Clarity with regards to institutional frameworks and the finalisation of key institutional development processes does create additional challenges over and above the typical challenges that exist between different spheres of government and different sector departments (Figure 12).

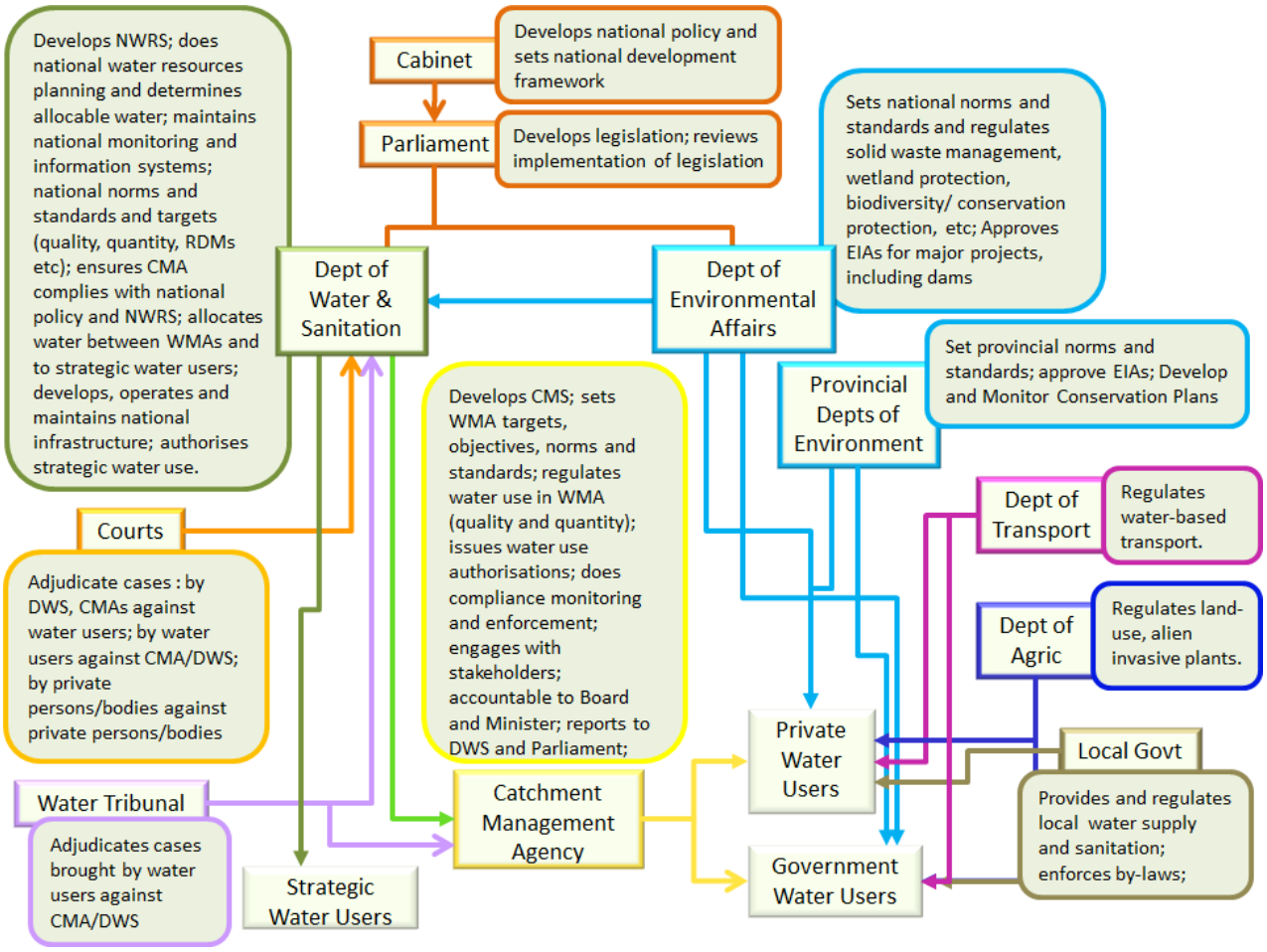

Figure 12: The South African Water Resources Regulatory Chain (Schreiner, 2011)

Water resources regulation is a form of social regulation, aimed at the protection and equitable use of a common pool resource. Within water resources regulation, however, there three different types of regulation (Schreiner, 2011):

- **Technical regulation:** This includes water quality or abstraction control, is related to, but distinct from the governance or economic regulation of water management and water services institutions. Technical water resources regulation refers to the control of activities that impact on a water resource.
- **Governance regulation:** This refers to the regulation of the governance of subsidiary water institutions, such as CMAs and WUAs. This includes regulation of such matters as whether Governing Boards are operating according to statutory and best practice requirements, whether adequate financial management systems and controls are in place, and that statutory requirements relating to business plans, audited financial statements, and annual reports are met.
- **Economic regulation:** Refers to interventions in what are considered to be market decisions, such as pricing, competition, the entry to or exit from the market, and promoting economic efficiency.

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

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

Direct intervention occurs when the Department intervenes, commands certain behaviour or performance from the target community. These instruments put the Department in a position to pre-empt the need for reactive measures. The instruments at the Department's disposal include those authorisations described in the section. The above and other control instruments are implemented within the context of procedural and technical guidelines.

The four categories of regulatory instruments for WQM are shown in **Figure 13** and are further described below.

5.4.1 Command and Control

The other main approach to WQM is regulatory, often referred to as "Command and Control". Under the command and control approach to regulation, government prescribes specific guidelines or standards that regulated parties must comply with. There are various forms that such guidelines or standards can take, such as prohibitions on certain activities, licensing of regulated activities, setting of product or technical production standards, setting of performance standards and water use authorisations (General Authorisations and Licences). The regulations for the use of water for mining and related activities aimed at the protection of water resources (in terms of section 26(1) (b), (g) and (i) of the NWA), set out in Government Notice 704, are an example of this type of regulatory guidance.

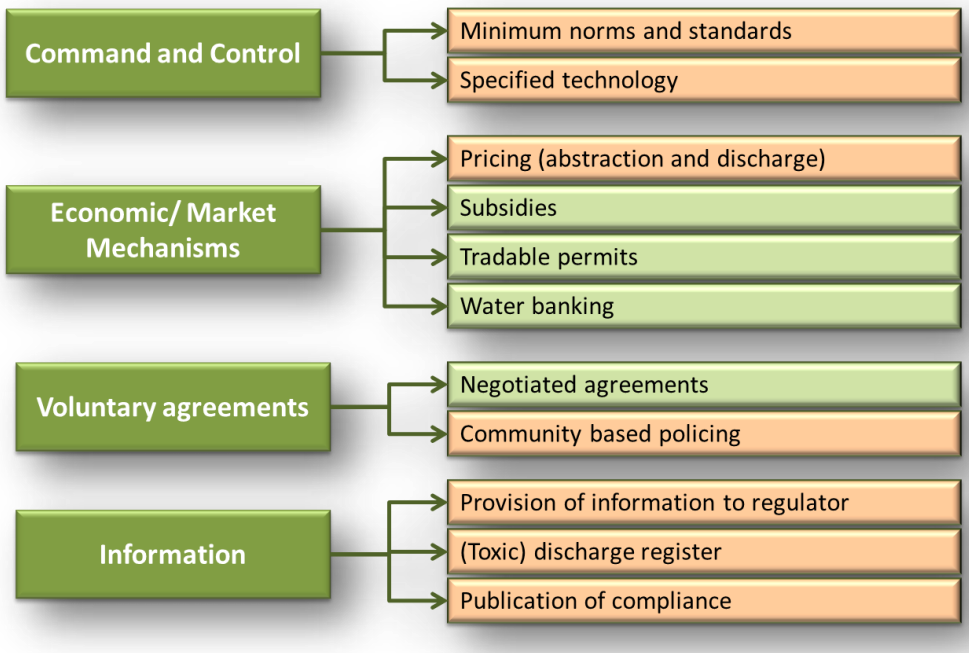

Figure 13: Categories of Regulatory Instruments (Schreiner, 2011)

The DWS also provides a Record of Recommendation to DEA related to Waste Management sites. Thus, command and control regulation generally requires government to formulate standards, schedules for meeting the standards, permitting and enforcement procedures, and the development of penalties for non-compliance. It has the benefit of being predictable in terms of the results that can be expected (UNEP, 1997).

However, criticisms of controls which take the form of standards and guidelines are that they can be inflexible and stifle innovation, are vulnerable to evasion, costly to implement and result in enforcement difficulties (Schreiner, 2011).

5.4.2 Economic Mechanisms

While there are variations in the definition of economic instruments in the literature, UNEP (1997) offers the following definition: *"a policy, tool or action which has the purpose of affecting the behaviour of economic agents by changing their financial incentives in order to improve the cost-effectiveness of environmental and natural resource management".*

Since the inception of environmental policy in most industrial countries, governments have tended to use these instruments as their main strategy for controlling pollution. Many countries, however, are becoming aware that regulatory instruments are inefficient for achieving most pollution control objectives, and that the level of expenditure required to comply with increasingly stringent environmental laws and regulation is becoming a major cost of production (WHO, 1997). Economic instruments have been described as promising tools for advancing sustainable development and therefore, WQM.

In terms of water quality, economic instruments hold potential to speed adjustment towards optimal outcomes and stretch available resources. However, there are complexities to be considered. To be effective these instruments must be well designed and, in particular, there

must be adequate investment in science and in the administrative arrangements necessary to make them practical and pragmatic.

Often these instruments need also to be supported by the development of standards, regulation and other instruments. Economic instruments are rarely a substitute for regulatory and other approaches. They just make it possible to achieve desired environmental outcomes at less cost.

The Waste Discharge Charge System (WDCS) that was developed by the Department to promote waste reduction and water conservation was one such economic instrument. It forms part of the Pricing Strategy, which is being established under the NWA. The WDCS is based on the polluter-pays principle and aims to:

- promote the sustainable development and efficient use of water resources;
- promote the internalisation of environmental costs by impactors; and
- create financial incentives for dischargers to reduce waste and use water resources in a more optimal way.

The WDCS was premised on RQOs as the measure of acceptable risk, and seeks to achieve RQOs at lowest total cost to the catchment. Where RQOs are exceeded or are threatened, impact on the resource is unacceptable and the WDCS may be deployed to achieve RQOs. The system will be applied at a catchment scale where the catchment is defined as those areas that have a significant impact on water quality, or are impacted by the specific water quality problem.

One key finding was that the difficulty in measuring actual outcomes of interest for diffuse source water quality issues has made application of economic instruments particularly challenging.

5.4.3 Voluntary Agreements

Voluntary regulation is an important addition to the suite of instruments that can be used to achieve regulatory objectives. There are four main types of voluntary regulation:

i) environmental agreements negotiated between regulators and industry;
ii) public programs (administered by regulators or third parties) that individual firms are invited to join;
iii) public disclosure initiatives that collect and disseminate information on participants' environmental performance; and
iv) unilateral commitments made by firms (Khanna, 2001).

While voluntary regulation is used in both developed and developing countries, there is disagreement on how effective it has been in developing countries. One view is that voluntary regulation sidesteps the challenges of weak institutions, weak legal frameworks and limited political will and relies partly on the pressure place on polluters by consumers, markets, non-governmental organisations, and community groups and the potential for an improved profile from environmental improvements (Schreiner, 2011). However, a second

school of thought is less convinced that voluntary regulation is effective in developing countries, partly because of weak regulatory and non-regulatory pressure on companies. Research suggests that the threat of mandatory regulation often pushes firms to take part in voluntary regulatory initiatives (Khanna, 2001), so that the incentive to take part is lower with weaker mandatory regulation.

Whatever the case may be, without a culture of self-regulation for WQM in South Africa, the onus simply lies upon the DWS, instead of being a shared responsibility with multi-sectoral participation. Most of the large water users, be they mines, industry or water treatment works, have sets of standards that they have to comply with in their processes, as well as their discharge standards (DWAF, 2011).

The shared responsibility of the water resources also extends to other governmental departments, specifically because the nature of water quality management across South Africa is both variable and complex. It requires strong institutional capacity (well-trained resources, active, effective systems and appropriate finances) at a national and regional level as well as cooperative governance with the various Departments that both impact on and are impacted by water Quality (**Figure 14**).

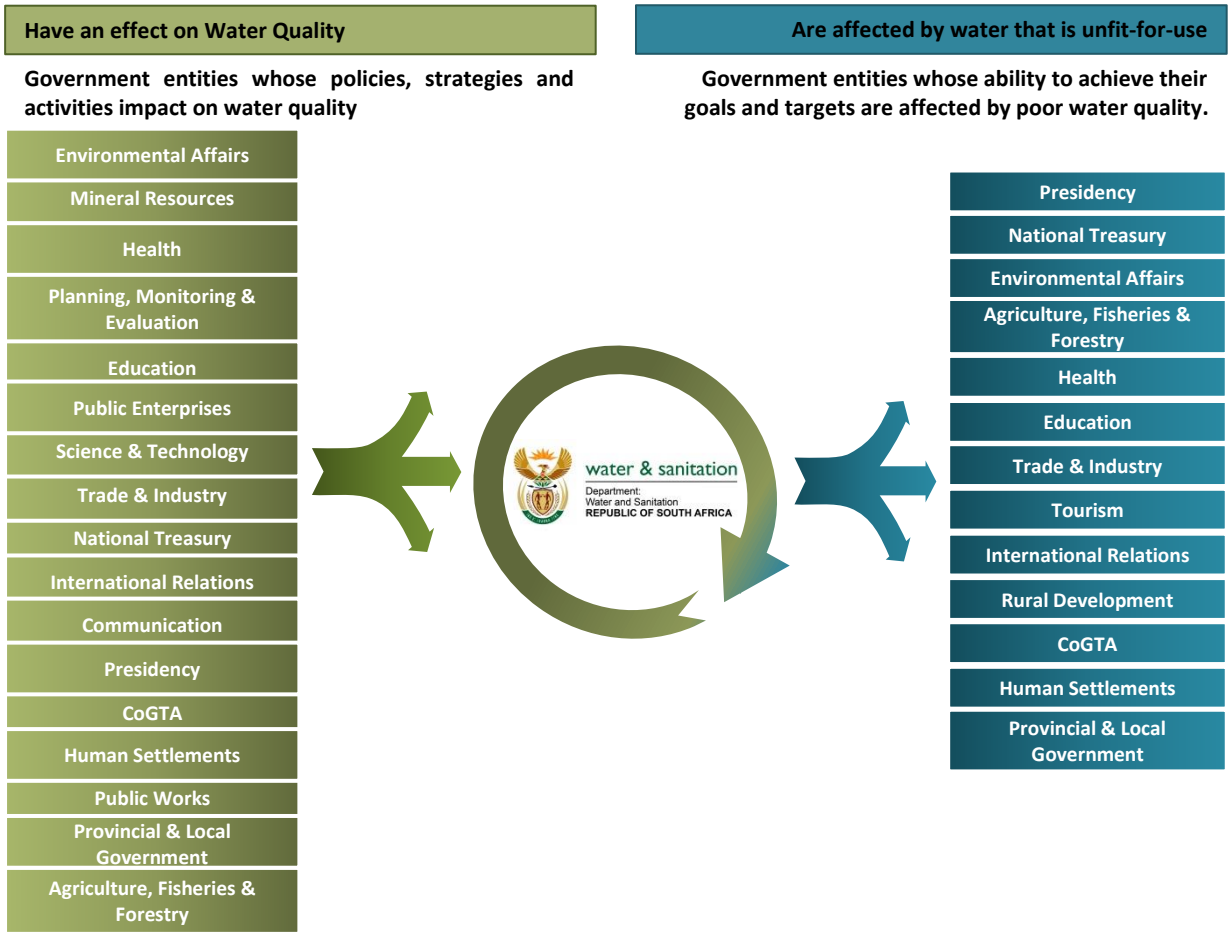

Figure 14: Departments which are impacted by, and impact upon, water quality

5.4.4 Information

While adequate information is a prerequisite for all forms of regulation, and the exercise of all regulatory instruments, it can also be used as a regulatory tool in its own right (Lopez, Sterner and Afsah, 2004). Requiring water users to disclose information can provide a useful way for authorities to collect information. Equally, if the information is made public, such disclosure can also give the public access to the information and provide for monitoring and control both by the authorities and by public pressure. The collection of information also signals to water users that the authorities are taking their regulatory role seriously.

Information disclosure can take several forms such as certification of products, firms, processes, or management procedures, usually by independent agencies; self-certification, without independent review; or the provision of raw data to the authorities. In the South African context, the Blue Drop/Green Drop certification system for municipalities has proved the regulatory value of the reporting and disclosure of information, with specific regards to water quality monitoring.

❖ **Green Drop System**

Green Drop System (GDS) process measures and compares the results of the performance of Water Service Authorities and their Providers, and subsequently rewards (or penalises) the municipality upon evidence of their excellence (or failures) according to the minimum standards or requirements that has been defined. Awareness of this performance is obtained by pressure through the customers, the media, political classes and NGOs. The strategy revolves around the identification of mediocre performing municipalities who consequently correct the identified shortcomings, as well as the introduction of competitiveness amongst the municipalities and using benchmarking in a market where competition is difficult to implement.

❖ **Blue Drop System**

Blue Drop System provides information on the performance of Water Services Authorities (WSAs) with respect to drinking water management from January to December 2013. 1036 drinking water supply systems were audited. The Report not only provides audit details on drinking water quality compliance with respect to the South African National Standard for drinking water (SANS 241) but also includes:

- Assessment of water safety planning which is a risk-based approach in drinking water quality management dealing with associated risks and mitigation thereof;
- Asset management (operation & maintenance, design capacity, budgeting);
- Technical skills availability for operation of the plants; and
- Management support.

It should be noted that the DWS is planning to implement the Integrated Regulatory Information System focused on Drinking Water Quality early in June 2017.

5.4.5 Offsetting

The use of water quality offsets has been recognised in a number of countries for some time now, with the key to its successful implementation lying in strong planning and regulatory capacities of the responsible government departments. In South Africa, the DEA is busy with the development of policy guidance with regards to the use of environmental offsetting as an instrument to effect improved levels of protection in identified priority environments and landscapes. This concept, at least in terms of its application as a tool in WQM, is relatively new in South Africa and further research into its potential in the South African legislative and management context is required. From a water quality perspective offsetting would entail the authorisation of actions that have the potential to degrade environmental quality (e.g. wastewater discharges) in exchange for actions which enhance environmental quality (e.g. actions that reduce non-point sources). This may involve offsets between point and non-point sources, offsets between one point source and another and offsets between water quality parameters. In most cases, countries have developed guidelines around what may and may not be considered for water quality offsets.

Such an approach could be more actively utilised in an adaptive management regime, and in support of the classification and meeting the Resource Quality Objectives (RQOs) and should be further researched for potential future use as an .

6. MONITORING INSTRUMENTS

Monitoring involves the on-going observation of a range of criteria that provides data and information regarding progress in terms of policy and strategy implementation. The information gathered during monitoring may be qualitative and quantitative in nature, generated from formal or informal collection processes. Examples of formal processes include specifically designed water resource monitoring programmes or designed survey questionnaires. Informal processes include general observations about process, interactions or information gathered through informal project team discussions or discussion with stakeholders. Information gathered from informal processes needs to be tested to determine if it is suitable as evaluation evidence. Monitoring is, therefore, a continuing function that uses systematic collection of data on specified indicators to provide management and key stakeholders, of an ongoing development intervention, with indications of the extent of progress and achievement of objectives and progress (DCEC, 2009).

The National Water Act requires the establishment of national monitoring systems for water resources to collect appropriate data and information that is necessary to assess -

- the quantity, quality and use of water in water resources;
- the rehabilitation of water resources;
- compliance with resource quality objectives;
- the health of aquatic ecosystems;
- atmospheric conditions that may influence water resources; and
- other data and information that may be necessary.

In addition, the Act requires the Minister to establish national information systems, including

- A hydrological information system.
- A water resource quality information system.
- A groundwater information system.
- A register of water use authorisations

These systems are summarised in the sections below.

6.1 WARMS

The Water Use Authorisation Registration Management System (WARMS) application solution supports 'WARMS' business environment with the management and administration of water use related activities. Its objectives are to establish a National Register of Authorised Water Use as required in terms of the National Water Act of 1998; serve as the source data in respect of the customer contracts and water use sales for the revenue management system; and provide volumes of water use registered and licenses for the planning of water resources protection and utilisation.

Its functionality includes:

- **Reporting:** On various aspects of registered water use to support water resources management activities as well as to inform the process of tariff determination.
- **Billing related parameters:** The Accounts Receivable System could process the required billing on relevant water use volumes accurately and timeously.
- **Transfers of Water & Properties:** Allows for the status /ownership of Registers to be managed and maintained when property is sold/subdivided and when water rights are transferred from one property/User to another.
- **Tariff Management System:** To allow for the application of relevant tariffs for the water use related activities managed in WARMS

6.2 WMS

Water Management System (WMS) is a DWS system designed to support the water resource management function of the department with emphasis on water quality. It provides a central database for the storage, management and analysis of water quality sample results and is used to assist in interpreting and determining the quality and the status of the water resource.

The vision for WMS is to provide:

"*A working integrated computer system where different directorates and provinces, with different mandates and functions, can support each other, sharing information and the workload, and in this way, help the Department of Water and Sanitation to be consistent in all its decisions and actions in the management of water resources*."

WMS consists of four main sub-systems. These are the:

- *Water Quality Database* – central database with test results used by other systems as listed below;
- *Monitoring Management Subsystem*, - used to manage resource quality operational monitoring on a national scale;
- *Water Resource Management Subsystem*, - used to achieve the sustainable use of water and the protection of the quality of the water resource, apply source control and exporting of *water quality data from WMS to other systems; and*
- *GIS subsystem, - used to assist in interpreting and determining the quality and the status of the water resource.*

6.3 HYDSTRA

A commercial, off-the-shelf Hydrological Information System (HYDSTRA) for the storage, editing, retrieval, manipulation and analysis of surface water, water quality and groundwater time series data and related hydrological information in support. The objective is to support

effective planning, management and protection of water resources by ensuring a safe archive for hydrological records while it provides fast and easy access to all data for internal and outside registered users.

Hydstra can import data from a variety of sources and has facilities to automate data imports. If populated with surface water, water quality and groundwater data. It allows users to combine flow, water quality and groundwater-borehole information and geographical information. The system provides powerful functionality to edit and review data. HYDSTRA also includes facilities to perform routine data audits and will highlight potential problems in the archive. It provides a wide range of outputs. The system consists of the following modules:

HYDSTRA/TS: The central module with the time series database and associated programmes.

HYDSTRA/WQ: The water quality utility programmes.

HYDSTRA/GW: The groundwater utility programmes.

HYDSTRA/MP: The mapping module.

HYDSTRA/RT: The real-time utilities for telemetry.

These systems could be structured along the lines of the DWA or CMA quarterly reporting. There is the need to also monitor the socio-economic impacts that are incurred through the implementation of the WDCS. At this juncture, there does not appear to be an in-house system that can be used to monitor and evaluate these impacts, and this does need to be in place to support the implementation of the system. The economic model that will be developed for each catchment, to look at possible environmental and socio-economic impacts will provide the basis for the monitoring system.

6.4 NGIS

The National Groundwater Information System (NGIS) is a groundwater based portfolio of applications and projects which include:

- The **National Groundwater Archive** provides data storage, web-enabled capturing and data dissemination capabilities for groundwater related data.
- **CHART** which is a monitoring management and representation tool for chemical geo-hydrological data (macro, micro and isotope data)
- **Geoinfobase** which is a GIS geo-database where quality controlled spatial groundwater related data are stored and used in dissemination.
- **Geohydrological** reports, a web based capturing and search tool for groundwater reports.

The aim of the NGIS is to provide the groundwater community with reliable and timely data on groundwater resources and tools to analyse, monitor and compile groundwater information products. Some of its functionalities includes:

- National co-ordination and support of groundwater data management, verification and validation and information products;
- Registration of Geosites;
- Maintenance of data;
- Registration of groundwater levels;
- Registration of chemistry data; and
- Archiving of groundwater related reports.

6.5 NIWIS

The National Integrated Water Information System (NIWIS) is a recent development at the Department which gives real time status updates of various aspects related to water resource management. Importantly, the NIWIS website also provides key information related to Water supply, Water quality monitoring network, drought status amongst others.

The NIWIS System consists of a set of dashboards to enable managers to make a quick assessment of the water situation in South Africa. NIWIS aims to serve water information through a number of easy to understand dashboards, without getting into too many technical details. The dashboards are designed to give an overview at National level, Provincial or WMA level, and where possible at the level of individual items (e.g. dams, weirs etc.). NIWIS will be a living system, not only is it plausible, but also encourages that new ideas emerge to improve the dashboards over time. The system is a living system, and will undoubtedly improve as more information, monitoring networks and links to other existing DWS platforms become available.

In terms of water quality, the system aims to answer the following questions:

- What problematic water quality constituents pose the greatest risk to human health in areas
- Where they are routinely measured?
- Where do we know that drinking untreated water may be risky? (The dashboard includes a map of communities to give an idea of where people are likely to be exposed to risk.)
- What are the trends of the problem constituents at sites where routine measurements are available?

7. REPORTING AND EVALUATION INSTRUMENTS

Once data is obtained from the monitoring process, analysis and conversation of that data into information that is reported on is crucial. This reporting allows for the evaluation and re-direction of plans/strategies in order to achieve the objective set-out. Reporting and Evaluation are defined below:

Reporting involves the regular communication, within defined intervals, of results and findings, and the facilitation of their use. Reporting often follows pre-determined and structured formats to ensure that information gathered is more easily collated and synthesised. Whilst reporting is essential for informing adaptive management that improves implementation methods and the achievement of outcomes, it is equally important in demonstrating commitment and accountability. DPME (2012) note that monitoring data should arise from normal business processes and be captured in administrative data systems, such that both monitoring and reporting is based on the extraction of key information points from these systems.

Evaluation is a periodic, systematic, and objective analysis to assess matters of relevance or appropriateness, performance in terms of efficiency or effectiveness, as well as value for money. Evaluations typically provide recommendations as to the way forward to address specific challenges and strengthen programme delivery. Hence, evaluation requires a questioning attitude for it to lead to continual improvement. Moreover, the complexity and stage of the programme or activity will determine the type of evaluation. For example, an evaluation that considers whether a programme's outcomes have been achieved will occur towards the end of a programme as well as at the mid-term if it is a long programme (DWS, 2017b).

The main instruments that can be used for Evaluation and Reporting are the Delivery Agreements to report and evaluation the Outcomes Approach and the Annual Performance Reports which reports on the Annual Performance Plans. These are elaborated on below.

7.1 Delivery Agreements

The delivery agreement is a negotiated charter which reflects the commitment of the key partners involved in the direct delivery process to working together to undertake activities effectively and on time to produce the mutually agreed-upon outputs for the Government Outcomes Approach.

Government has agreed on 12 outcomes as a key focus of work and each outcome has a limited number of measurable outputs with targets. Each of the 12 outcomes has a delivery agreement which in most cases involve all spheres of government and a range of partners outside government.

The way in which water quality is managed in the country will affect five of those proposed outcomes:

Outcome 2: A long and healthy life for all South Africans.

Outcome 6: An efficient, competitive and responsive economic infrastructure network.

Outcome 7: Vibrant, equitable and sustainable rural communities with food security for all.

Outcome 8: Sustainable human settlements and improved quality of household life.

Outcome 10: Environmental assets and natural resources that are well protected and continually enhanced.

The delivery agreement, as a reporting and evaluation instrument, provides detail to the outputs, targets, indicators and key activities to achieve outcome 9, identifies required inputs and clarifies the roles and responsibilities of the various delivery partners. It spells out who will do what, by when and with what resources. The outcomes apply to the whole of government and are long term. While the delivery agreement may contain longer term outputs and targets, it also includes outputs and associated targets that are realisable in the next 4 years. The Delivery Agreement is reviewed annually in the light of learning by doing and M&E findings. Accordingly, it is refined over time and become more inclusive of the relevant delivery partners.

7.2 Annual Performance Plan Reports

The Annual Performance Plan details the specific performance targets that the institutions will aim to achieve in the budget year and the next two years of the MTEF in pursuit of strategic outcomes oriented goals and objectives set out in its Strategic Plan. It presents the institution's programme performance indicators together with targets.

In 2007, Cabinet mandated the Governance and Administration Cluster of the Forum of South Africa's Directors-General to construct an overarching Government-wide Monitoring and Evaluation System (Presidency, 2007). This was consolidated over time via the "Policy Framework on Performance Monitoring and Evaluation - Our Approach" document and the "Revised Green Paper: National Planning Commission", which were tabled in Parliament (DWS, 2017b).

Whilst all Government Departments have a clear responsibility to monitor and report on their progress in delivering upon their mandate, there is equally a need for an oversight function that monitors and evaluates the overall performance of Government. The Department of Planning, Monitoring and Evaluation (DPME) has the following key mandates:

- Facilitate the development of plans or delivery agreements for the strategic cross cutting priorities or outcomes of government
- Monitor the implementation of these plans
- Assess departmental strategic plans and Annual Performance Plans to ensure alignment with long term and short-term plans

- Monitor the performance of individual national and provincial government departments and municipalities
- Monitor frontline service delivery
- Carry out evaluations
- Promote good planning and M&E practices in government.

Moreover, National Treasury has delegated the PFMA function of regulating strategic and annual performance planning to DPME (DPME, 2015). During the current planning cycle, the department will embark on a review of the current Framework for Strategic and Annual Performance Plans (**Figure 15**), as utilised by all Government Departments, and issued by National Treasury in terms of the Treasury Regulations under the Public Finance Management Act (Act 1 of 1999) (PFMA). This process has started with the commissioning of an evaluation that will determine the effectiveness of the current frameworks and recommendations for changes that could be made. Noting that the IWQM Policy and Strategy call for an inter-sectoral approach to the management of water quality, these revised approaches will provide an opportunity for improved M&E approaches in support of IWQM, over time.

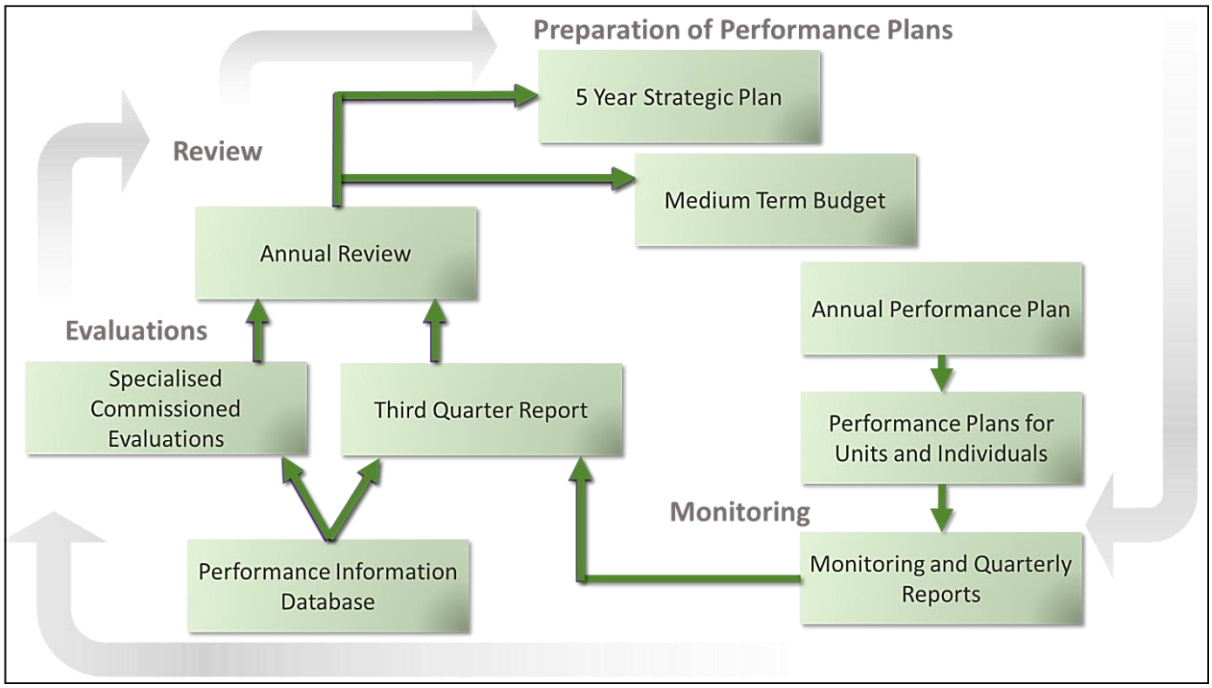

Figure 15: Governmental Planning and Review Cycle (Adapted from Public Service Commission, 2008)

The reporting for the Annual Performance Plans is elaborated in the **Table 3** below.

Table 3: Annual Performance Reporting for Government Departments

THE ANNUAL PERFORMANCE REPORTING FRAMEWORK
Purpose An Annual Performance Plan sets out what the institutions intends doing in the upcoming financial year and during the MTEF to implement its Strategic Plan. **Focus** The document sets out performance indicators and targets for budget programmes, and sub-programmes where relevant, to facilitate the institutions realising its goals and objectives set out in the Strategic Plan. Where appropriate, the plan should include a quarterly breakdown of performance targets for the upcoming financial year. **Timeframe** The Annual Performance Plan covers the upcoming financial year and the MTEF period. It should be noted that in years four and five of the Strategic Plan the Annual Performance Plan's outer years will fall outside the period covered by the Strategic Plan. Forward projections should nonetheless be provided. Departments should aim to table their Annual Performance Plan within a month after the tabling of the budget in respect of the year to which it relates. Public entities must submit the plan to their executive authorities and responsible departments by the end of January prior to the start of the first financial year covered in the plan. **Updating** To simplify performance tracking, in-year changes to the plan should not be made. Where an institution's performance exceeds, or misses targets due to in-year budget changes or for another reason, this should be noted in its annual report. **Linked to** An Annual Performance Plan should be linked to the Strategic Plan, the budget and the MTEF, and should be informed by any updates to government's long-term plans, the MTSF, Government Implementation Action, provincial growth and development strategies and local government Integrated Development Plans, Performance Agreements between the President and Ministers, Service Delivery Agreements and any other relevant long-term government plans. In-year monitoring of the Annual Performance Plan is conducted through the quarterly performance reports; end-year reporting is made in the programme performance section of the institution's annual report. **[Source: National Treasury (2012) Framework for Strategic Plans and Annual Performance Plans]**

8. CONCLUSION

This report has highlighted a number of instruments that the Department, and the water sector, has at its disposal as it relates to the Plan-Do-Check-Act cycle. While the list is not exhaustive, it provides a good framework for categorising and understanding the WQM Instruments that are available in South Africa, and makes some references to the policy and legal instruments being used in other sectors.

The project has shown that the current WQM instruments are sufficient to support good water quality management, however, the lack of an integrated and aligned approach and of sufficient training and mentoring on the use of these instruments has hampered their effectiveness.

In the most part the gaps that have been highlighted relate to the instruments that are required to link the various "steps" of WQM. In particular, further work will need to be undertaken to develop instruments that link the activities undertaken during the planning step with those that need to be implemented in the "Do" step, this includes, for example the development of technical instruments that will ensure the translation of instream or Resource Quality Objectives for water quality into water use authorisation conditions and catchment specific interventions. In addition, whereas the requirements for the management of point-sources is widely understood, the management of non-point sources remains a challenge and further work on the development and implementation of Non-Point Source strategies will be required. Instruments and tools for reporting on compliance and for ensuring that the "Act" step of the WQM cycle is undertaken and informs the "Plan" step are also potential gaps that should be addressed in the future.

Lastly, this project has shown that the implementation of the instruments that are available for WQM could be improved through improved and stable institutional and systems structures and well as increasing resources and capacity to implement and understand these instruments.

The IWQM Policy calls for the harmonisation of these instruments, and further engagements are required to understand the full array of instruments being used in other sectors and to find synergies and alignment. Ways in which to achieve this have been highlighted in the IWQM Policy and Strategy.

If our limited water resources are to provide a foundation for the development of a prosperous nation into the future, ***it is critical that there be coherent and aligned water quality management instruments for all government departments, and that strong inter-departmental arrangements enable the implementation of the IWQM policy in line with the imperatives of the Bill of Rights.***

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Mduduzi Nkuna	IUCMA
Busi Mahlangu	IUCMA Control Environmental Officer
Thabo Cecil Rasiuba	IUCMA Control Environmental Officer
Adolph Mbetse	IUCMA WQM
Rofhiwa Ramunenyiwa	IUCMA WQM
Stephan Kitching	Jaco K Consulting
Ronel Oelofse	Kaap River Irrigation Board
Nokwanda Mhlanga	KOBWA
Sakhiwe Nkomo	KOBWA
Martin Slabbert	Komati River Irrigation Board (KRIB) & LRIB
Robert Davel	Mpumalanga Agri

Betty Mnguni	Olifants Proto-CMA
Hloniphekile Ayanda Madonsela	Olifants Proto-CMA
Mmadi Moloto	Olifants Proto-CMA
Mokgadi Maloba	Olifants Proto-CMA
Musa Lubambo	Olifants Proto-CMA
Isaac Tlagadi	Olifants Proto-CMA Environmental Officer
Linda Desmet	Palabora Copper
Thabang Mokgatle	Quality Engineering
Eddie Riddell	SANParks
Robin Pietersen	SANParks
Guiseppe Sappa	Sapienza University, Rome
Mouritri Bezbieri	Sapienza University, Rome
Yolanda Oosthuizen	SEMBCORP Silulumanzi

Regional Workshop
Limpopo

Robert Bologo	
Faith Mugivhi	ASA Metals
Kai Petty	AvDE Consulting
MP Lekoane	COGHSTA
Thembinkosi Ndou	De Beers
Ramaano Masibigiri	DWS CAO
Marencia Mashilo	DWS CME EOSP
NS Mello	DWS IGR
Motlogonang Maeosele	DWS IOM
Adolph Maredi	DWS Limpopo
Joseph Phasha	DWS Limpopo
Ben Sengani	DWS LPNW Proto-CMA
Damaries Thotse	DWS P&I
Moses Malete	DWS P&I
Regina Kganyago	DWS Regional Office
Kenneth Makhubele	DWS Strategy
Margaret Matide	DWS SWSS
Molly Maluleke	DWS Water Sector Regulation
Mpho Sinthumule	Eskom
Tshiphiwa Matamela	Eskom
Anthony Dikgale	Exxaro Coal Mine
Baloyi Khanamola	IVA Plats
Ansia de Jager	Joint Water Forum
Jakes Louw	Joint Water Forum
Solomon Monyepao	LDARD
A Letsoalo	LEDET
MC Mphahlele	LEDET
PD Mathole	LEDET
Lebo Sebola	Lepelle Northern Water
Lekwato Marakalala	Lephalale Municipality
Ngoako William Moremi	Lephalale Sub-catchment
Nkele Lodgina Ditsela	Lephalale Sub-catchment
Andre Venter	Letaba Water User Association
Manamela Lehabo	LIM 368
Mokgadi Thobejane	LIM 368
Sandra Ramaphala	LIM 368
Matshamaite Gilbert	Lower Mogalakwena Sub-catchment
ER Kutama	Luvhuvhu CMF
MIR Bohego	Luvhuvhu CMF
Nebonde Dominick	Makhado Catchment
Thema Maishibe	Mogalakwena
Hlengwane Joseph Nkhona	Mogalakwena CMA
Calvin Shiburi	Mogalakwena Mine

Richard Nemaungani	Mutale CMA
Patrick Muthelo	Mutale CMF
Modikwa Motibane	NAFU
Doyoyo Farani	Naledzi Environmental Consulting
Matsenene Thendo	Naledzi Environmental Consulting
Nembahe Aluweni	Naledzi Environmental Consulting
Ramathieledza Ronald	Naledzi Environmental Consulting
Shitlhangu Aaron	Naledzi Environmental Consulting
Sithabusiwe Ncube	Naledzi Environmental Consulting
Ndou Africa	Naledzi Water Works
Sepadi Motau	North West Proto-CMA
CJ Emmerich	Nzheleke/Nwandi CMF
Moses Mudau	Nzheleke/Nwandi CMF
Alidzulwi Mudau	Office of the Premier
Salome Sathekge	Polokwane Municipality
Letsatsi Chuene	Sand Catchment Management Forum
Joseph Sara	University of Limpopo
Kris Bal	University of Limpopo
Freeman Chauke	Vele Colliery
Jacques Willemse	Vhembe WUA/ Werpe Farmers Union

Regional Workshop
Western Cape

Carolyn Howell	ARC
Reckson Mulidzi	ARC
Nico Rossouw	Aurecon
Patrick van Coller	BGCMA
Phumla Ngqumshe	Bitou Local Municipality
Richard Nell	City of Cape Town
Linda Rossouw	Consultant
Jonas Mphepya	DEA
Annabel Marian Horn	DEA&DP (BRIP)
Juan Hugo	DEA&DP (BRIP)
Marlé Kunneke	DEA&DP (BRIP)
Wilna Kloppers	DEA&DP (PCM)
Izak Toerien	Department Local Government
Sibusiso Maseko	DWS Institutional Oversight HO
Felicia Nemathaga	DWS RPW Mines
Michiel Meets	Eco-Owl Consulting
Bridget Fundikwa	Green Cape
Gareth McConkey	Jantech CC
Irene Waller	La Bri
Jiahnah Göbel	Living Lands
Elizabeth Were	See Saw (probably)
Adriaan Kurtz	Stellenbosch Municipality
Esmari Steenkamp	Swartland Municipality
Johan de Jager	Vin Pro
Rudolph Rescher	Western Cape Department of Agriculture
Lydia van Rooyen	Wildlands
Adriaan Oelofse	Winetech
Anel Andrag	Winetech
Derick Kellerman	Xylem

Regional Workshop
North West

Anna Malemela	DWS
Jenny Evans	DWS
Kevin Khoze	DWS
Lillian Siwelane	DWS

Mahadi Mofokeng	DWS
Phillip Tjale	DWS
Sebenzile Ntshangase	DWS
Sharlotte Tema	DWS
Tshepo Mathebe	DWS
Kentse Mathiba	DWS Head Office
Ndivho Mphuma	DWS Limpopo North West Proto-CMA
Lucky Motsoeneng	Glencore BHK
Lelanie du Preez	Glencore Rhovan Operations
Lynette Tungwane	Glencore Western Mine
Keneilwe Makwela	Glencore Western Mines
Tania Rademeyer	Impala Platinum
Abram Semata	Land Bank
Beatrice van der Merwe	Marico River Conservation Association
Irene van der Merwe	Marico River Conservation Association
Shalene Janse van Rensburg	Midvaal Water Co
Mothusi Mafatshe	Pilanesberg Platinum Mines
Peter Lentsoane	Platmin SA
Tshepo Dire	RB Plats
Stenly Makuwa	Tlokwe City Council
Thuli Letseka	Tlokwe City Council
Hlulani Chauke	Union Mine Anglo American
Mmalenyalo Moeng	Union Mine Anglo American

IWQM National Symposium

Tswelopele Pida	African Rainbow Minerals
Hannes De Wet	Agri MP
Janse Rabie	Agri SA
Janse Rabin	Agri SA
Mark Dent	AWS
Misaveni Ngobeni	BNT
Melissa Fourie	CER
Amanda Mkhonza	CER
Johan Kapp	CRM
Sibonginkosi Maposa	CSIR
Matome Mathetha	CSIR
Edwin Mametja	DAFF
Nomvuzo Mjadu	DAFF
Takalani Sithi	Department of Tourism
Joan Arrikum	DPE
Andretta Tsebe	DPE
Phawen Maluleke	DRDLR
Magamase Mange	DST
Tsakane Baloi	DWS
Wilna Bezuidenhout	DWS
Eustathia Bofilatos	DWS
Marie Brisley	DWS
Laura Dotse	DWS
Fanus Fourie	DWS
Nwabisa Fundzo	DWS
Johan Greyling	DWS
Rachalet Grobbelaar	DWS
Geert Grobler	DWS
Jackie Jay	DWS
Millicent Kabwe	DWS
Marius Keet	DWS
Kwaila Lamola	DWS
Knowledge Langa	DWS
Musa Lubambo	DWS
Maduvha Maseda	DWS

Patrick Mlilo	DWS
Zama Mncwabe	DWS
Ndileka Mohapi	DWS
Lerato Mokoena	DWS
Lebo Mosoa	DWS
Thobile Mthiyane	DWS
Anet Muir	DWS
Mxolisi Mukhawana	DWS
Moses Mukota	DWS
Namisha Muthraparsad	DWS
Beason Mwaka	DWS
Noxolo Ncapayi	DWS
Tovhowani Nyamande	DWS
Bongizenzo Nyawo	DWS
Rivashi Panday	DWS
Sputnik Ratau	DWS
Isa Thompson	DWS
Nnzumbeni Tshikalange	DWS
Itan Tshohale	DWS
Jurgo Van Wyk	DWS
Niel Van Wyk	DWS
Fred Van Zyl	DWS
Pieter Viljoen	DWS
Barbara Weston	DWS
Luvuyo Zigana	DWS
Anne Kilian	Engineering News
Ian Midgley	Eskom
Lutho Totsa	Eskom
Mariette Liefferink	FSE
Gabi Khumalo	GCIS
Annah Ngope	Glencore
Lynette Tungwane	Glencore
Joanna Goeller	Gold Fields
Zeveli Masuku	Govan Mbeki Municipality
Victor Munnik	Independent
Marcus Selepe	IUCMA
Stenly Makuwa	Johannesburg Water
Bertus Bierman	Lebalelo WUA
Shalene Janse van Rensburg	Midvaal Water
Marina Krüger	Midvaal Water
Robert Davel	Mpumalanga Agri
Iqbal Mohamed Ali	National Treasury
Sara Bopape	NTD
Amanda Nyingwa	Pegasys
Guy Pegram	Pegasys
Traci Reddy	Pegasys
Barbara Schreiner	Pegasys
Derek Weston	Pegasys
Francois Van Wyk	Rand Water
Morakane Madiba	Rhodes University
Tally Palmer	Rhodes University
Heather Booysen	Samancor
Shane Laubscher	Samancor
Bongani Mtsweni	Samancor
David Schaub-Jones	SeeSaw
Marilyn Govender	South African Sugar Association
Vukosi Tinghitsi	South Deep Gold Mine
Michelle Proude	SWPN
Nick Tandi	SWPN
Tinashe Mukuta	University of Pretoria
Willem Hazewindus	WESSA & ARMOUR

Nonhlanhla Kalebaila	WRC
Robyn Arnold	Write Connection
Samir Randera-Rees	WWF
Klaudia Schachtschneider	WWF