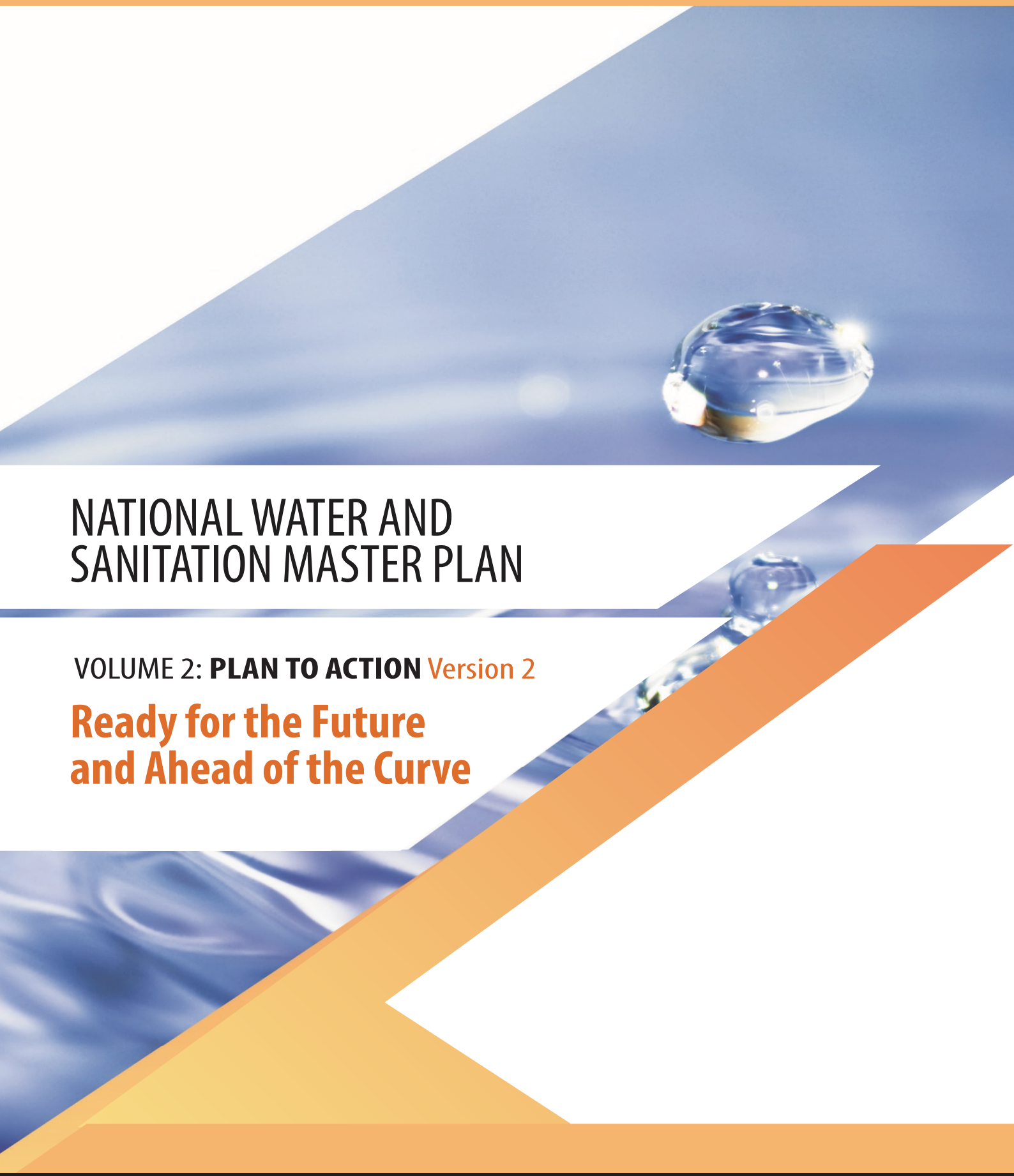

NATIONAL WATER AND SANITATION MASTER PLAN

VOLUME 2: **PLAN TO ACTION** Version 2

Ready for the Future and Ahead of the Curve

WATER IS LIFE - SANITATION IS DIGNITY

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

2030 NDP

DISCLAIMER:

This NW&SMP Volume 2: Plan to Action, is one of three volumes which together comprise the National Water and Sanitation Master Plan (NW&SMP). The draft Master Plan was noted by Cabinet on 27 June 2018 and will serve as the basis for further stakeholder engagement at a forthcoming sector-wide planning initiative, namely the Phakisa on Water and Sanitation scheduled for late 2018. The NW&SMP is a 'living' plan, and annual updates and reviews will be led the Department of Water and Sanitation in collaboration with sector partners.

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List of acronyms and abbreviations

ACIP	Accelerated Community Infrastructure Program
AIP	Alien Invasive Plants
AMCOW	African Ministers' Council on Water
AMD	Acid Mine Drainage
ARC	Agricultural Research Council
b/a	billion per annum
BBBEE	Broad-Based Black Economic Empowerment
bn	Billion = 1 000 000 000 = one thousand million
BRICS	Brazil, Russia, India, China and South Africa
CARA	Central Adoption Resource Authority
CHE	Council on Higher Education
CMAs	Catchment Management Agencies
CME	Compliance, Monitoring and Enforcement
CMF	Catchment Management Forum
CMS	Catchment Management Strategy
CoGTA	Department of Cooperative Governance and Traditional Affairs
COP 17	17th Conference of the Parties
CRDP	Comprehensive Rural Development Program
CRU	Central RIA Unit
CSI	Corporate Social Investment
CSIR	Council for Scientific and Industrial Research
CSO	Civil Society Organization
DAFF	Department of Agriculture, Forestry and Fisheries
DBE	Departments of Basic Education
DBSA	Development Bank of Southern Africa
DDT	Dichlorodiphenyltrichloroethane
DEA	Department of Environmental Affairs
DFI	Development Finance Institution
DHET	Department of Higher Education and Training
DM	District Municipality
DMR	Department of Mineral Resources
DOE	Department of Energy
DHS	Department of Human Settlements
DPE	Department of Public Enterprises
DPSA	Department of Public Service & Administration
DRD&LR	Department of Rural Development & Land Reform
DST	Department of Science and Technology

DTI	Department of Trade and Industry
DWA	Department of Water Affairs
DWAF	Department of Water Affairs & Forestry
DWM	Developmental Water Management
DWS	Department of Water and Sanitation
e.g.	for example
EU	European Union
ELU	Existing Lawful Use
etc.	etcetera; and so on
EWSETA	Energy and Water Sector Education and Training Authority
EXCO	Executive Committee
FAO	Food and Agriculture Organisation
FET	Further Education and Training
FETWater	Framework Programme for Research, Education and Training in Water, South Africa (UNESCO initiative)
G8	The Group of Eight (world's eight wealthiest western countries)
GA	General Authorisations
GCM	Global Circulation Models
GCIS	Government Communication Information System
GDP	Gross Domestic Product
GET	General Education and Training
GFETQSF	General and Further Education and Training Qualifications Sub-Framework
GG	Government Gazette
GGP	Gross Geographic Product
GIS	Geographical Information System
GLeWAP	Groot Letaba River Water Development Project
GN	Government Notice
GRIP	Groundwater Resource Information Project
HDI	Historically disadvantaged individuals
ha	Hectares (10 000 square metres)
HE	Higher Education
HEI	Higher Education Institutes
HEQSF	Higher Education Qualifications Sub-framework
HRDS	Human Resources Development Strategy
HLoS	Higher Level of Service
HYDSTRA	Integrated water resources management software
IB	Irrigation board
IBSA	The India-Brazil-South Africa Dialogue Forum

IDP	Integrated Development Plan
IDZ	Industrial Development Zone
i.e.	that is
IHP	International Hydrological Programme
IPAP3	Industrial Policy Action Plan 3
IPP	Independent Power Producers
IRP	Integrated Resource Plan
IRR	Institutional Reform and Realignment
IT	Information technology
i.t.o.	in terms of
IUA	Integrated Units of Analysis
IWA	International Water Association
IWRM	Integrated Water Resource Management
IWWMP	Integrated Water and Waste Management Plan
IWTTSA	Industry Water Task Team of South Africa
JPTC	Joint Permanent Technical Committee
JSE	Johannesburg Stock Exchange
JWC	Joint Water Commission
KNP	Kruger National Park
KPI	Key performance indicator
LEDP	Local Economic Development Plan
LGSETA	Local Government Sector Education & Training Authority
LHDA	Lesotho Highlands Development Authority
LHWP	Lesotho Highlands Water Project
LRAD	Land Reform for Agricultural Development
LTAS	Long Term Adaptation Scenarios
LWC	Limpopo Watercourse Commission
m^3/a	cubic meter per annum
mm/year	millimetres per year
mg/l	milligrams per litre
Ml/day	megalitres per day= 1 000 000 litres/day
MAR	mean annual runoff
MDG	Millennium Development Goals
MFMA	Municipal Finance Management Act
MIG	Municipal Infrastructure Grant
MISA	Municipal Infrastructure Support Agency
MMTS2	Mooi-Mgeni Transfer Scheme Phase 2
MoU	Memorandum of Understanding

MTEF	Medium Term Expenditure Framework
MWIG	Municipal Water Infrastructure Grant
MW	MegaWatts
NATED	National Technical Education
NCBF	National Capacity Building Framework for Local Government
NDP	National Development Plan
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NGA	National Groundwater Archive
NGP	New Growth Path
NGO	Non-government organisation
NGS	National Groundwater Strategy
NMBMM	Nelson Mandela Bay Metropolitan Municipality
NMIU	National Monitoring and Implementation Unit
NPC	National Planning Commission
NPS	Non-point source
NPSS	Non-Point Source Strategy
NQF	National Qualifications Framework
NRF	National Research Foundation
NRW	Non-Revenue Water
NSA	National Skills Accord
NSDP	National Spatial Development Perspective
NSDS	National Skills Development Strategy
NSI	National System of Innovation
NT	National Treasury
NWA	National Water Act (Act 36 of 1998)
NWAC	National Water Advisory Council
NWRI	National Water Resource Institute
NWRS	National Water Resource Strategy
NWRS1	National Water Resource Strategy (First edition, 2004)
NWRS2	National Water Resource Strategy (Second edition, 2013)
NWRSA	National Water Resources and Services Authority
NWRSR	National Water Resources and Services Regulator
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
ORASECOM	Orange-Senqu (River Basin) Commission
ORWRDP	Olifants River Water Resource Development Project
OQSF	Occupational Qualifications Sub-Framework

OSD	Occupation Specific Dispensation
PALAMA	Public Administration Leadership and Management Academy
PES	Present Ecological State
Ph	Phase
PFMA	Public Finance Management Act
PGDP	Provincial Growth and Development Plan
PGDS	Provincial Growth and Development Strategy
PMU	Project Management Unit
PPP	Public Private Partnerships
P/S	pump station
PWC	Permanent Water Commission
QCTO	Quality Council for Trades and Occupations
R&D	Research and Development
R&I	Research and Innovation
RBIG	Regional Bulk Infrastructure Grant
RBO	River Basin Organizations
RDM	Resource Directed Measures
RDP	Reconstruction and Development Programme
REGIS	Software system developed in the Netherlands, currently under investigation for its application in South Africa
RIA	Regulatory Impact Assessment
RIDMP	Regional Infrastructure Development Master Plan
RISDP	Regional Indicative Strategic Development Plan
Rio+20	United Nations Conference on Sustainable Development, 2012
RPL	Recognition of Prior Learning
RQO	Resource Quality Objectives
RSA	Republic of South Africa
RSAPIII	Regional Strategic Action Plan III
RWH	Rainwater harvesting
RWQO	Receiving Water Quality Objective
SA	South Africa
SAAWU	South African Association of Water Utilities
SADC	Southern African Development Community
SAICE	South African Institution of Civil Engineering
SALGA	South African Local Government Association
SAWS	South African Weather Service
SDC	Source Directed Controls
SETA	Sector Education & Training Authority

SIP	Strategic Integrated Project
SIV	System Input Volume
SIWI	Stockholm International Water Institute
SULP	Sustainable Utilization Plans
SWPN	Strategic Water Partnership Network
TAC	Technical Advisory Committee
TCTA	Trans Caledon Tunnel Authority
UDF	Urban Development Framework
UN	United Nations
UNCSD	United Nations Conference on Sustainable Development
UNEP	United Nations Environment Programme
GEMS	Global Environment Monitoring System
UNFCCC	United Nations Framework Convention on Climate Change
UNESCO	United Nations Educational, Scientific and Cultural Organization
VGG	Vaal Gamagara
WAR	Water Allocation Reform
WAS	Water Accounting System
WARMS	Water Registration Management System
WARS	Water Allocation Reform Strategy
WCWSS	Western Cape Water Supply System
WCWDM	Water Conservation and Water Demand Management
WDCS	Waste Discharge Charge System
WISA	Water Institute of Southern Africa
WMA	Water Management Area
WMP	Water Management Plan
WMS	Water Management System
WRA	Water Research Act
WRC	Water Research Commission
WRM	Water Resource Management
WRMI	Water Resource Management Institution
WRTC	Water Resources Technical Committee
WS	Water Services
WSA	Water Services Authority
WSAct	Water Services Act (Act 108 of 1997)
WSDP	Water Services Development Plans
WSLG	Water Sector Leadership Group
WSP	Water Services Provider
WMA	Water Management Area

WTW	water treatment works
WWC	World Water Council
WWTW	waste water treatment works
WUL	Water Use License

List of Units used in the Report

The following standard units have been used in this report

Description	Standard unit		Description	Standard unit
Elevation	m.a.s.l.		Velocity, speed	m/s, km/hr
Height	m		Discharge	m^3/s
Distance	m, km		Mass	kg, ton
Dimension	mm, m		Force, weight	N, kN, MN
Area	m^2, ha or km^2		Moment, torque	Nm, kNm, MNm
Volume (storage)	m^3, million m^3, Ml/day		Ampere	A, kA
Yield	million m^3/a		Volt	V, kV
Mean annual runoff	million m^3/a		Electric power	kVA, kW, MW
Pressure	Pa, kPa, MPa		Acceleration	m/s^2
Diameter	mm dia., m dia.		Density	kg/m^3
Power	kW, MW		Slope (H:V) or (V:H)	1:5 (H:V) or 5:1 (V:H)
Energy	kJ, MJ		Gradient (V:H)	%
Temperature	^oC		Frequency	Hz, kHz, MHz

"Ready for the future and ahead of the curve"

RATIONALE & CONTEXT

1 THE NATIONAL WATER AND SANITATION MASTER PLAN

ADDRESSING THE CRISIS AND CALLING SOUTH AFRICA TO ACTION TO BE READY FOR THE FUTURE AND AHEAD OF THE CURVE

1.1 BACKGROUND AND PURPOSE OF THE NATIONAL WATER AND SANITATION MASTER PLAN (NW&SMP)

Water security, defined by UN-Water as "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability"[1] is a critical challenge confronting South Africa in the 21st century. Water security presents a profound challenge to South Africa's social well-being and economic growth.

South Africa is a water scarce country, receiving around half of the global average annual rainfall, with this rainfall distributed unevenly across the country, and across seasons and years. This water scarcity is being exacerbated by escalating demand due to economic and population growth, urbanization and rising standards of living, unsustainable use and high levels of wastage and loss, and increasing pollution which renders water not fit for use. In addition, the degradation of wetlands, changes in rainfall patterns due to climate change and

We must act now

South Africa CAN avoid a projected 17% water deficit by 2030 by taking bold action today!

5.3 million households (35%) do not have access to safe and reliable drinking water

Only 65 % of households have access to a safe and reliable water supply

14.1 million people do not have access to safe sanitation

56% of waste water treatment works (WWTW)

44% of water treatment works (WTW) are in a poor or critical condition causing health risks

11% of WTW are dysfunctional creating a critical health risk

41% of municipal water does not generate revenue. 35% is lost through leakage

48% of the remaining wetlands are critically endangered

Only 5% of agricultural water used is by black farmers

Municipalities are losing about 1660 million m³ per year through Non-Revenue Water. At a unit cost of R6/m³ this amounts to R9.9 billion each year

R33 billion more is needed each year over the next 10 years to achieve water security

[1] UN Water. 2013.Water is Water Security?

increasing temperatures also driven by climate change, are contributing to reduced security of supply.

Based on current demand projections and without effective interventions[2], the water deficit confronting the country could be between 2.7 and 3.8 billion cubic meters, a gap of approximately 17% of available water sources, by 2030. The South African water sector must take bold steps to adopt a `new normal' to head off the projected water gap.

In addition, in April 2017[3], 14,1 million people still used sanitation facilities below the Reconstruction and development Programme (RDP) standard and only 10,3 million households (65%) had access to reliable water supply – lower than the percentage of the population that had access to a reliable water supply in 1994. Approximately 56% of the over 1 150 municipal wastewater treatment works (WWTWs) and approximately 44% of the 962 water treatment works (WTWs) in the country are in a poor or critical condition and in need of urgent rehabilitation and skilled operators[4]. Some 11% of this infrastructure is completely dysfunctional. This crisis in water supply and sanitation threatens the health and well-being of poor South Africans in particular, while also impacting negatively on economic growth and environmental sustainability.

The National Water and Sanitation Master Plan (NW&SMP) forms part of a suite of initiatives announced by the newly appointed Minister of Water and Sanitation in May 2018, which will provide key focus to the work of the water sector leader at this time. The Department will therefore coalesce its efforts around these five strategic pillars in the coming period:

- National Water Resources and Services Water Authority (NWRSA);
- National Water Resources and Services Regulator (NWRSR);
- Water Resources and Services Value Chain;
- **Water Resources and Services Master Plan**; and
- Institutional Rationalisation and Organisational Alignment.

The Department of Water and Sanitation (DWS) will work in conjunction with other government departments and agencies, the private sector and civil society to ensure that the crisis in the water and sanitation sector is addressed with the aim of attaining a water secure future with reliable and safe water and sanitation services for all, and that these contribute towards meeting national development objectives.

[2]McKinsey. 2010. Confronting South Africa's Water Challenge.

[3] Statistics South Africa. 2011. Census 2011 Statistical release P0301.4.
Statistics South Africa. 2016. Community Survey 2016 Statistical release P0301.

[4] Benchmarking of Water Loss, Water Use Efficiency and Non-Revenue Water in South African Municipalities, July 2017

While the development of the Master Plan has been led by DWS in conjunction with key sector partners including the TCTA and WRC, it is a country-wide plan as the critical challenges confronting water and sanitation service delivery in the country requires concerted effort by all water institutions and users to resolve. This first-of-its-kind NW&SMP introduces a new paradigm that will guide the South African water sector, led by DWS and implemented and supported by local government and other sector partners, towards the urgent execution of tangible actions. This action will make a real impact on the management of South Africa's water resources and the supply and use of water and sanitation in the country.

The NW&SMP:

- Sets out a schedule of **prioritised actions** for the period to 2030 that will create a water and sanitation sector that can meet national objectives as set out in the *National Development Plan* (NDP) and the internationally agreed Sustainable Development Goals (SDGs)
- Sets out the roles and responsibilities in government, the private sector and civil society for the implementation of the plan

Volume One of the NW&SMP is the ***Call to Action***, which is divided into two sections, Water and Sanitation Management, and Enabling Environment, each having six sub-sections. Each section includes critical actions that, when implemented, will have a significant impact on addressing the crisis. These actions are collated at the back of the document for ease of reference.

This **Volume 2: *Plan to Action*** provides a more detailed analysis of and rationale for, the key issues raised in the Call to Action. References to further related bodies of knowledge are contained in this Volume.

Volume 3: *Schedule of Actions* provides a detailed implementation plan with costs covering all the actions required across the sector to achieve the objectives of the plan. The purpose of Volume 3 is to order and define all actions and interventions identified within Volume 1 and Volume 2 of the NW&SMP into annual measurable outcomes inclusive of roles and responsibilities, time frames and associated estimated costs. DWS has worked with key sector partners to develop the first draft of Volume 3, and in keeping with the 'living' nature of the Master Plan, will continue to work with sector partners to refine this action schedule. A key milestone for this engagement will be at the Phakisa on Water and Sanitation planning `laboratory' supported by Cabinet and scheduled for late 2018.

Implementation of the NW&SMP will be reviewed and reported on annually, and the NW&SMP will be updated accordingly in an adaptive management approach. The soon to be established DWS Project Management Unit (Delivery Unit) will be the custodian of these sector-wide processes and responsible to drive implementation on the NW&SMP Programme of Action in collaboration with sector partners.

The following actions necessary to give effect to these priorities, are recorded in Volume 3:

Action [5]	Responsibility	Completion date
Phakisa on water and sanitation to be held (Volume 3, Action 2.7.1)	DWS, DPME	First quarter 2019/20
Determine cost required to implement NW&SMP and identify where reprioritisation or cost savings can be used to address the NW&SMP priorities (2.7.2)	DWS, WSAs	2019
Appoint skilled Management, Technical and Programme Manager staff for Delivery Unit (2.7.3)	DWS	2019
Monitor, review, evaluate, report on and update NW&SMP (2.7.4)	DWS	Annual report to Parliament

[5] Where actions apply to more than one chapter, they have been duplicated in the action tables at the end of the relevant chapters. All actions are summarised in a table at the end of the Call to Action, *without this duplication.*

1.2 KEY CHALLENGES AND NW&SMP STRATEGIC FOCUS

Water resource management and water and sanitation service delivery challenges have escalated over the past few years in the country and the water sector in South Africa cannot afford to ignore these challenges and continue with business as usual. There is a need to act decisively in addressing the deterioration of standards and to restore the integrity and effectiveness of governance, delivery, management and monitoring systems. The NW&SMP sets out a strategic focus and seeks to mobilise support and resources to address critical challenges and make a measurable impact and ensure alignment of views, goals and actions.

The most important challenges and the key focus areas are outlined briefly below, and elaborated in greater detail in relevant chapters:

- Water security is one of the biggest issues/challenges facing South Africa and the world in the 21st century (see Chapter 3 of this document). Based on projections by McKinsey[6], if no substantive action is taken the water deficit by 2030 could be between 2,7 and 3,8 billion m^3/a - a gap of about 17% of available surface and ground water. The growing requirements of neighbouring states for water from our shared river basins could further impact on water availability for South Africa. A "Business Unusual" approach is required to close the gap.
- At the same time, water resources must benefit all citizens equitably. Water is an important catalyst and driver of socio-economic development. The water allocation to agriculture is approximately 61%, but little has been achieved in reallocating water to historically disadvantaged individuals in this sector. The NW&SMP aligns with government's transformative agenda as outlined in the National Development Plan (NDP) and identifies actions to redress past inequities through the re-allocation and use of water.

- South Africa must balance supply and demand
- South Africa must ensure equitable access to water
- South Africa must protect and restore ecological infrastructure
- South Africa must reduce demand in all sectors and halve physical water losses
- South Africa must diversify its water mix
- South Africa must create a financially sustainable water sector
- South Africa must build effective water sector institutions

[6] McKinsey. 2010. Confronting South Africa's Water Challenge.

- Water security will be further threatened as supply decreases due to the negative impacts on yield arising from climate change, degradation of wetlands and water resources, siltation of dams, whilst water losses and demand escalates due to population and economic growth, urbanization, inefficient use, and changing lifestyles. South Africans currently consume more water per capita at approximately 237 l/c/d than the world average of approximately 173 l/c/d[7]. The country's water losses are also exceptionally high with non-revenue water (NRW) currently standing at about 41%. Studies indicate that actual physical losses in municipal systems are at 35%[8]. Interventions will be made to reduce demand by improving efficiency, adopting new technologies and reducing losses (especially in the agricultural and municipal sectors).
- Desalinated sea water (in coastal areas) and treated waste water will increasingly be brought into the water mix, as well as increased use of groundwater.
- Institutional arrangements will be optimised to improve governance and ensure that key sector objectives are achieved. New institutional arrangements are under consideration which include nine water boards, catchment agencies and local water resource management institutions. A National Water Resources and Services Authority will be established to finance, develop, manage and operate national water resource infrastructure and sanitation. A National Water Resources and Services Regulator will be established which will be responsible for ensuring the development, implementation, monitoring and review of regulations across the water and sanitation value chain in accordance with the provisions of the National Water Act (1998), the Water Services Act (1997) and related water and sanitation policies.
- The capacity of water services authorities (WSAs) to operate, maintain and manage existing infrastructure will receive urgent attention. According to the *Stats SA General Household Survey* (GHS)[9]:
    - 89% households have access to operational services, but reliability is only at 64%. Current access to sanitation services is 80% on average (50% in some LM's). This will be increased to 90% by 2019 and 100% by 2030 as per National Development Plan (NDP) and Sustainable Development Goal (SDG) targets.
    - 56% of the over 1 150 waste water treatment works (WWTW) are in poor and critical state and will be rehabilitated urgently and properly maintained thereafter.

[7] The world average per capita per day usage (173 l/c/d) does not appear in any report but is based on expert opinion
[8] Benchmarking of Water Loss, Water Use Efficiency and Non-Revenue Water in South African Municipalities, July 2017"
[9] Stats SA, 2018. Stats SA GHS General Household Survey 2016

- 44% of 962 domestic Local Government water treatment works (WTWs) are in a poor condition and require urgent rehabilitation. This is essential to ensure safe drinking water to the population.

- Deteriorating water quality is a major constraint to economic and social development, reduces the sustainably of the available resource, and impacts significantly on the cost of treating water. Urgent measures must be taken to protect and restore South Africa's water quality.
- A lack of data and information resulting from weak monitoring systems poses high risks to decision making and planning and will urgently be addressed by repairing and maintaining measuring infrastructure, adopting new monitoring technologies, and improving data management and distribution.
- Application of the latest research, innovation and development in water-less/alternative water and sanitation systems will be implemented urgently to address excess demand.

2 BUILDING A WATER SECURE FUTURE

2.1 THE POLICY AND LEGISLATIVE FRAMEWORK

This NW&SMP gives effect to the mandate given to the water sector through the Constitution of the Republic of South Africa, the White Paper on a National Water Policy for South Africa (1997), the Strategic Framework for Water Services (2002), the National Sanitation Policy (2017), the National Water Act (1998) and the Water Services Act (1997). In addition, it takes into account other relevant policy and legislation such as the Industrial Policy Action Plan (IPAP), the Irrigation Strategy developed by the Department of Agriculture, Forestry and Fisheries (DAFF), the National Climate Change Response White Paper, the National Environmental Management Act, the Public Finance Management Act, the Municipal Finance Management Act, and the Municipal Structures and Systems Acts.

The National Water Act and the Water Services Act are currently under revision to ensure that they effectively support the delivery of a water secure future. A future in which there is adequate water and sanitation for all.

The *National Water Resources Strategy* (NWRS), required under the National Water Act, is also currently under revision with the third iteration of this strategy due for gazetting in 2018. There is a possibility under consideration in the revision of the legislation that a future strategy will include water resources, water services and sanitation into an integrated National Water and Sanitation Resources and Services Strategy.

#1: The values of the Constitution include those of human dignity, the achievement of equality and the advancement of human rights and freedoms.

#2: The Constitution states that everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that

- *prevent pollution and ecological degradation*
- *promote conservation; and*
- *secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*

#3 The Constitution states that everyone has the right to have access to sufficient food and water.

#4 The Constitution states that the property clause may not impede the state from taking measures to achieve land, water and related reform, to redress the results of past racial discrimination.

These constitutional imperatives, combined with the national water and sanitation policy papers, the National Water Act and the Water Services Act, give the mandate to the water sector to:

- *Provide universal and equitable access to reliable water supply and sanitation services*
- *Protect, manage and develop the nation's water resources in a manner that supports justifiable and ecologically sustainable economic and social development*
- *Transform access to water to redress the racial imbalances created by apartheid.*

This NW&SMP is the implementation mechanism for the NWRS2 (and any future iterations of the NWRS) while also including actions relating to water services and sanitation. It defines the

actions that are critical to achieve the outcomes outlined in the strategy and to ensure water security and safe sanitation for all.

A water security framework is also being developed by the National Planning Commission, and this plan will, iteratively, be aligned with that framework.

2.2 LINKAGES BETWEEN THE NW&SMP WITH THE SDGS, AU AGENDA 2063, NDP AND MTSF

The NW&SMP sets out the framework for how South Africa will manage its water resources and implement water and sanitation programmes to achieve targets set in Government's *National Development Plan*, Medium Term Strategic Framework (MTSF) and Medium-Term Expenditure Framework (MTEF). The NW&SMP also addresses the global and African agendas outlined in the Sustainable Development Goals (SDGs and the African Union's (AU) *Agenda 2063*. The diagram below illustrates how the NW&SMP fits within the timelines of the national and the global planning framework.

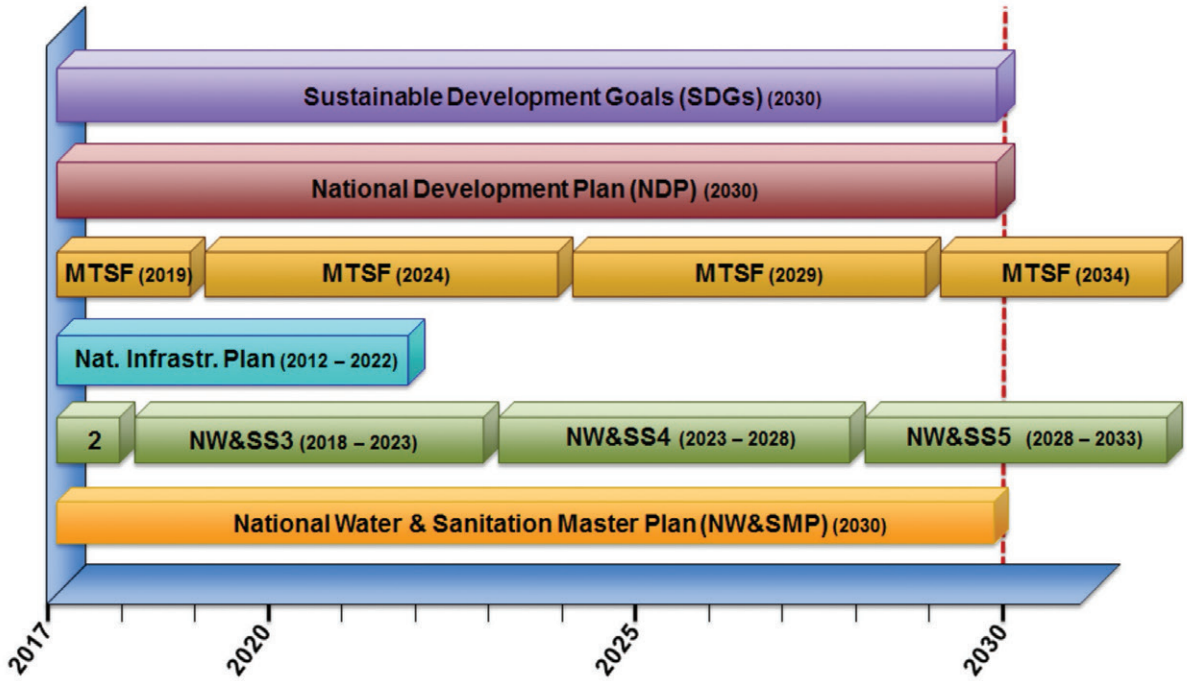


Figure 2-1: NW&SMP timelines relative to other planning instruments

2.2.1 Sustainable Development Goals

The Sustainable Development Goals (SDGs), approved by the United Nations in 2015, provide a unique opportunity to map a pathway to a better future for all. Goal 6, which stipulates, "*to ensure the availability and sustainable management of water and sanitation for all,*" is central to realising the vision of a better future for all and the NW&SMP is aligned with achieving this goal. The targets and indicators for Goal 6 are set out below:

Target 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all

- Indicator: Proportion of population using safely managed drinking water services

Target 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

- Indicator: Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water

Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

- Indicator: Proportion of wastewater safely treated; Proportion of bodies of water with good ambient water quality

Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

- Indicator: Change in water-use efficiency over time; Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

Target 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

- Indicator: Degree of integrated water resources management implementation (0-100); Proportion of transboundary basin area with an operational arrangement for water cooperation

Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

- Indicator: Change in the extent of water-related ecosystems over time

Target 6.A: By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

- Indicator: Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan

Target 6.B: Support and strengthen the participation of local communities in improving water and sanitation management

- Indicator: Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management

2.2.2 African Union's (AU) Agenda 2063[10]

There are seven aspirations in the African Union's Agenda 2063, which reflect the desire for shared prosperity and well-being, for unity and integration, and for a continent of free citizens. The most relevant aspiration for the NW&SMP is the first, which includes:

- Eradicating poverty and achieving high standards of living for all
- Ensuring well-educated citizens and a skills revolution underpinned by science, technology and innovation
- Modernising infrastructure and agriculture
- Structurally transforming economies to create growth, decent jobs and economic opportunities for all *and*
- Preserving the environment and ecosystems.

2.2.3 National Development Plan

The National Development Plan (NDP), finalised in 2012, articulates the vision of development for the country and identifies key milestones and targets to will be achieved in the various sectors. It sets out a detailed blueprint for how the country can eliminate poverty and reduce inequality by the year 2030. It was endorsed by Cabinet as a strategic framework to form the basis of future government detailed planning. The NDP envisions a South Africa where everyone feels free yet bounded to others; where everyone embraces their full potential, a country where opportunity is determined not by birth, but by ability, education and hard work.

Realising such a society will require transformation of the economy and focused efforts to build the country's capabilities. To eliminate poverty and reduce inequality, the economy must grow faster and in ways that benefit all South Africans. In particular, young people deserve better educational and economic opportunities, and focused efforts are needed to eliminate gender inequality. Promoting gender equality and greater opportunities for young people are integrated themes that run throughout the NDP.

There is a burning need for faster progress, more action and better implementation. The future belongs to all of us. The NDP is a vision for every South African, requiring action, change and sacrifice from all sectors of society. The NDP emphasises the need to address poverty by broadening access to employment, strengthening the social wage, improving public transport

[10] African Union (AU). 2015. Agenda 2063: The Africa We Want.

and raising rural incomes. It outlines the steps that need to be taken to professionalise the public service, strengthen accountability, improve coordination and prosecute corruption. The NDP suggests that public infrastructure investment be set at 10 percent of the country's gross domestic product (GDP).

The NDP recognises the role of water in contributing to poverty eradication and social development. The most relevant programmes and targets articulated by the NDP in this regard include:

- Ensure people have access to clean, potable water and that there is sufficient water for agriculture and industry, recognizing trade-offs in the use of water
- Reduce water demand in urban areas to 15% below business-as-usual scenario by 2030
- Complete Lesotho Highlands Water Project Phase 2 by 2020
- Implement a comprehensive management strategy including an investment programme for water resource development, bulk supply and wastewater management for major centres by 2012, with review every five years
- Develop regional market for food, energy and water and put in place water management agreement with neighbouring countries *and*
- Develop regional utilities to deliver some local government services on an agency basis where local or district municipalities lack capacity.

2.2.4 Medium Term Strategic Framework

The Medium Term Strategic Framework (MTSF) 2014 – 2019 confirms government's commitment to the goals of the NDP through resource allocation and budget prioritisation and sets out the strategic plan of government for the 2014 – 2019 electoral term. The MTSF outcomes related directly to the water sector include:

- MTSF Outcome 6: An efficient, competitive and responsive economic infrastructure
- MTSF Outcome 7: Vibrant, equitable, sustainable rural communities contributing towards food security for all
- MTSF Outcome 9: Responsive, accountable, effective and efficient developmental local government system
- MTSF Outcome 10: Protect and enhance our environmental assets and natural resources *and*
- MTSF Outcome 11: Related to international relations and co-operation.

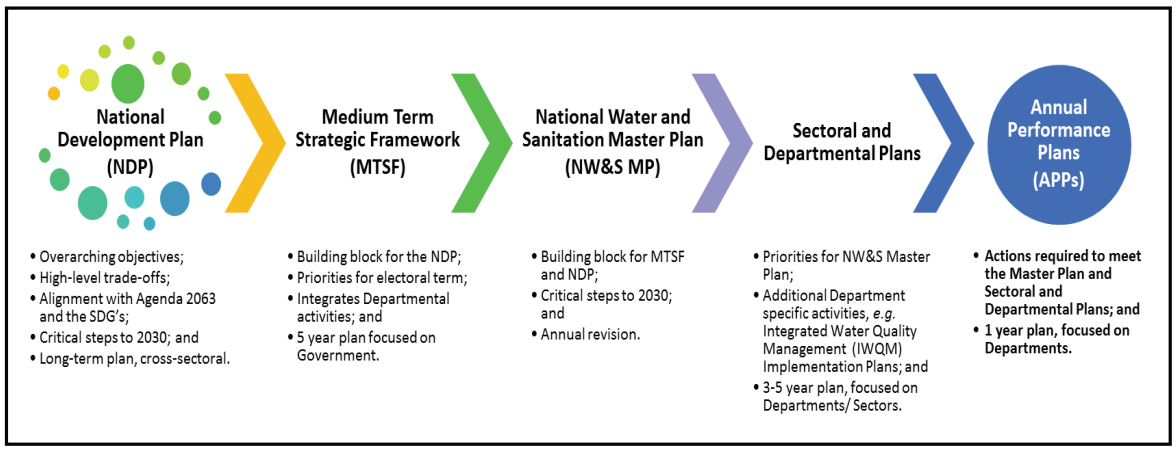


Figure 2-2: Alignment of National Planning Process with Sectoral & Departmental Planning Process

2.3 NW&SMP FRAMEWORK

The aim of the NW&SMP is to achieve a water secure future and reliable and affordable access to adequate and safe water and sanitation to improve social and economic well-being with due regard to the environment. As introduced in Volume 1: Call to Action of the NW&SMP, the key objectives of the Master Plan that define a 'new normal' for water and sanitation management in South Africa speak to the main challenges within the water sector, including:

- Resilient and fit-for-use water supply
- Universal water and sanitation provision
- Equitable sharing and allocation of water resources
- Effective infrastructure management, operation and maintenance *and*
- Reduction in future water demand.

The Master Plan recognises that achieving water security in South Africa requires a new normal: a significant paradigm shift that

- *recognises the limitations of water availability*
- *addresses the real value of water*
- *ensures equitable access to limited water resources*
- *delivers reliable water and sanitation services to all*
- *focuses on demand management and alternative sources of water*
- *considers the impacts of climate change and addresses declining raw water quality.*

The new reality:

- *Water will become more expensive*
- *Everyone (except those without access to piped water) MUST use less water for the same activities*
- *Everyone - except the indigent - MUST pay for water and sanitation services*

In order to facilitate and accelerate progress towards the attainment of a water secure future for South Africa, the NW&SMP deliberately maintains a tight focus that is based on twelve elements which reflect the key programmes that have been identified as necessary to operationalise a new water and sanitation sector paradigm in the country. These elements are clustered under two key themes: **water and sanitation management** and **enabling environment,** each with clearly defined sub-themes.

Section1: Water and sanitation management

- Reducing demand and increasing supply
- Redistribution for transformation
- Managing effective water and sanitation services
- Regulating water and sanitation
- Improving raw water quality and
- Protecting and restoring ecological infrastructure

Section 2: Enabling environment

- Creating effective institutions
- Managing data and information
- Building capacity for action
- Ensuring financial sustainability
- Amending the legislation and
- Enhancing research, development and innovation

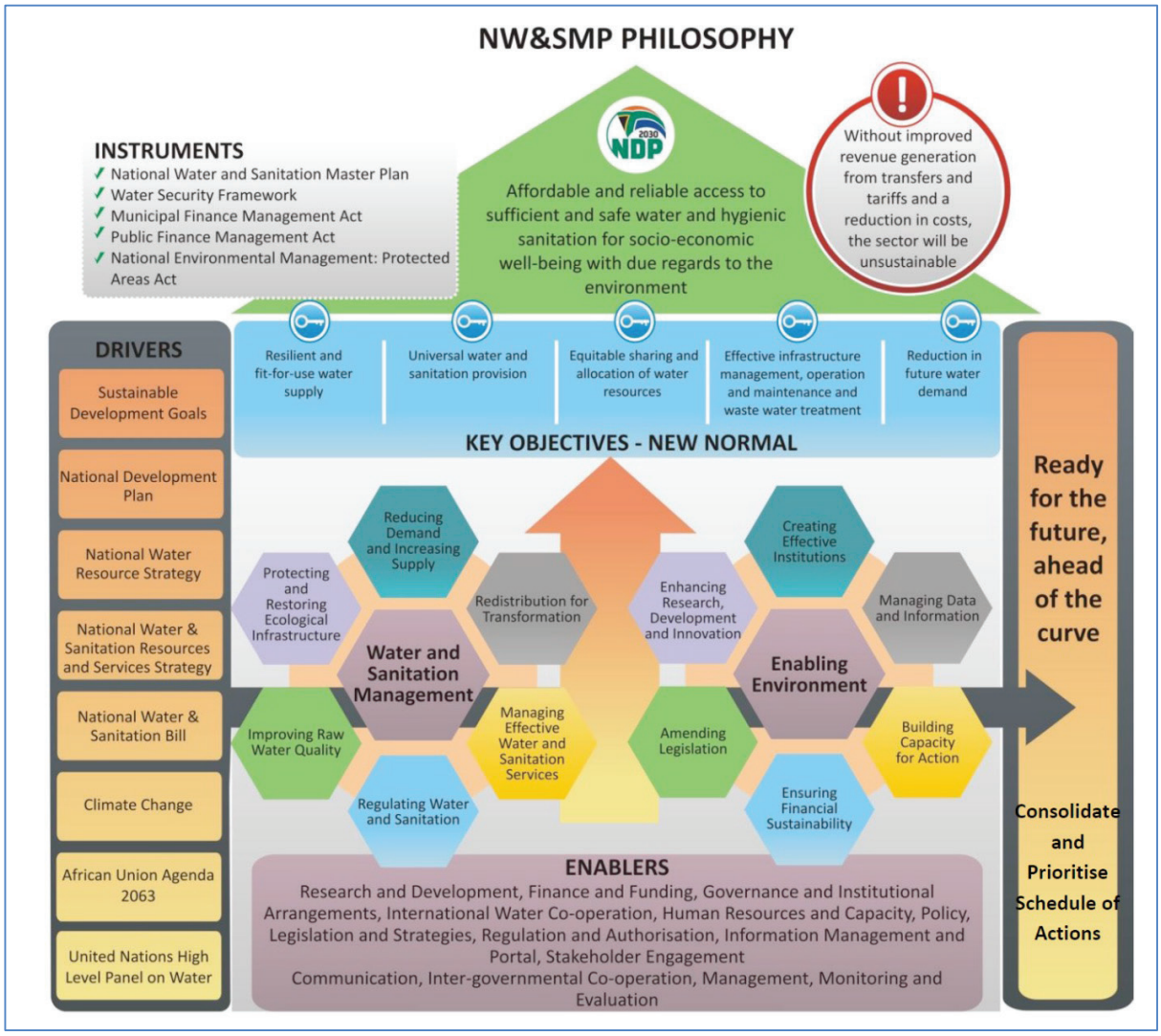


Figure 2-3: NW&SMP Philosophy

2.4 NW&SMP STATUS AND PROCESS

As indicated above, the NW&SMP identifies critical priorities for the water sector, in alignment with the SDGs, African Union Agenda 2063, the NDP and the MTSF. Ownership and support of the NW&SMP by all stakeholders is critical as actions will be implemented by these stakeholders in a collaborative manner. The successful implementation of the plan requires the stakeholders to fully assume their roles and responsibilities and apply their resources within the agreed timeframes.

Relevant stakeholders jointly developed this plan, and support the articulation of the critical challenges, were engaged as follows:

- Provincial workshops with facilitated discussions with stakeholders
- Presentations and discussions at stakeholder forums
- Direct engagement with government departments to identify areas of duplication and to improve integrated planning *and*
- Online engagement with the document.

A copy of the NW&SMP Stakeholder engagement report is available on request

SECTION 1: WATER AND SANITATION MANAGEMENT

3 REDUCING WATER DEMAND AND INCREASING SUPPLY

3.1 INTRODUCTION

South Africa has a semi-arid climate, with an average annual rainfall of 465 mm, compared to the world average of 860 mm, as a result, South Africa's water resources are scarce and extremely limited. The mean annual rainfall varies substantially across the country from about 3 000 mm in the east and on the high-lying mountains, to less than 50 mm on the dry west coast, shown in **Figure 3-1.** The rainfall is also highly variable within seasonal distribution patterns, with evaporation and transpiration increasing inversely from the wetter east to the arid west[11].

[11] Climate report

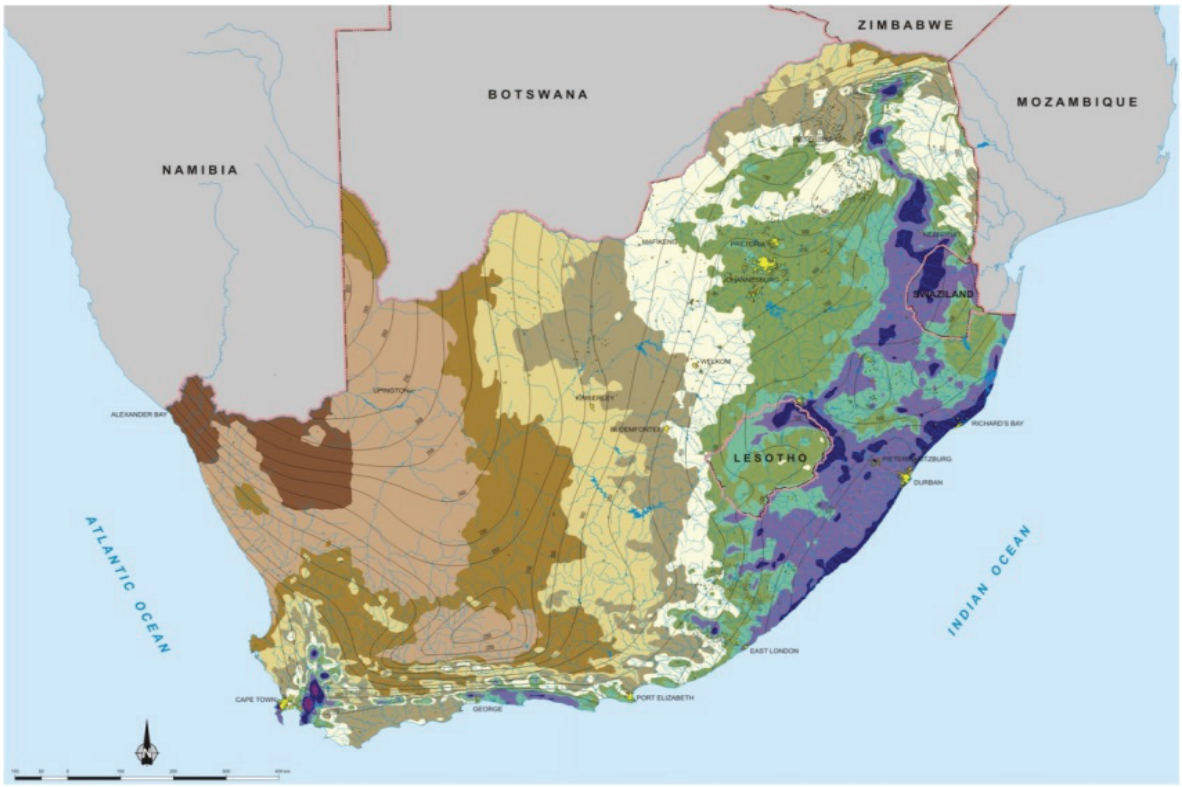


Figure 3-1: South Africa's hydrological situation

South Africa's water resource is highly developed, especially surface water systems through a myriad of large dams around the country. This limits opportunities to augment future supply through the building of additional dams. Optimal sites for dams have already been developed and future sites will come at a high social, economic and environmental cost.

Water conservation and water demand management (WC/WDM) is an integral part of broader strategies needed to reconcile available supply with demand for water.

WC/WDM is needed across all water use sectors to balance supply and demand. Water use in South Africa is dominated by irrigation, which accounts for around 61% of all water used in the country. Domestic and urban use accounts for about 27%, while mining, large industries and power generation account for some 8%. Commercial forestry plantations account for a little less than 3% of total use by reducing runoff into rivers and streams[12].

[12] Department of Water Affairs and Forestry. 2004.National Water Resources Strategy.
Pitman, W, V. 2011. Overview of water resource assessment in South Africa: Current state and future challenges.

Integrated water resource management and planning ensures that water fit for use is available for urban and rural growth, whilst ensuring that industrial and agricultural requirements at local, regional and national scale are met at adequate assurances of supply. It must take into account the potential for reducing water demand, through water conservation and water demand management (WC/WDM), as well as options for further infrastructure development to increase supply. For this, water resource information must be available to inform national planning functions. At a most basic level, a water resource plan accounts for allocations to the different water use sectors, ecological requirements (maintaining or improving river ecosystems) and international obligations.

This section proposes interventions that will guide the management of water resources management, planning and infrastructure in the future. These interventions, if implemented on time, will endeavour to achieve and maintain the balance of available water with projected water requirements in the short to medium term.

3.2 PRESENT STATE

3.2.1 Available Water Resources

Surface Water

The total national annual runoff is approximately 49 000 million m³/a giving a reliable yield of surface water at an acceptable assurance of supply at 98% of approximately 10 200 million m³/a[13]. Key water source areas are mostly situated in the north east of the country, with 8% of the land area that contributes 50% of the mean annual runoff (MAR).

There are more than 4 395 registered dams in South Africa, of which 794 are considered large dams (i.e. dams with a wall height ≥ 15m, or a wall height between 5 and 15 m and a storage capacity exceeding 3 million m³)[14]. The combined storage capacity of large dams is in the order of 31 000 million m^3. Several dams and other resources are combined in a system to supply water to an area, such as the Integrated Vaal River System that provides water to Gauteng, the petro-chemical industries of SASOL as well as the ESKOM power stations in Mpumalanga

Operating rules assist in the efficient management of the water supply system, and are critical during drought situations, also to trigger water restrictions when required. The DWS developed operating rules for several large water supply systems in South Africa, such as the Integrated Vaal River System, the Mngeni Water Supply System, the Orange River System, the Algoa System, the Amatole System, the Western Cape System and the Groot Letaba System, as well

[13]Department of Water Affairs. 2013. Strategic overview of the water sector in RSA.
[14] Department of Water and Sanitation. Dam Safety Records.

as rules for several stand-alone schemes. The large water supply systems in the country are described in *Reconciliation Strategies*, further discussed in **section 3.4.4** and with greater detail provided in **Annexure 2**. DWS has also developed a *Disaster Management Plan* and a *Guideline to Flood Management*.

The long-term climate change predictions in South Africa are for a drier western half of the country and for far more variability, with more extreme events, towards the north and the east. Average temperatures are expected to rise, and thus also an increase in evaporative losses.

To facilitate the management of water resources, the country has been divided into 9 catchment-based water management areas (WMA) which are shown in **Figure 3-2.** The WMA boundaries do not necessarily follow administrative or political boundaries (e.g. district municipality or provincial) and in some instances this aspect presents water resource planning, management and administrative challenges.

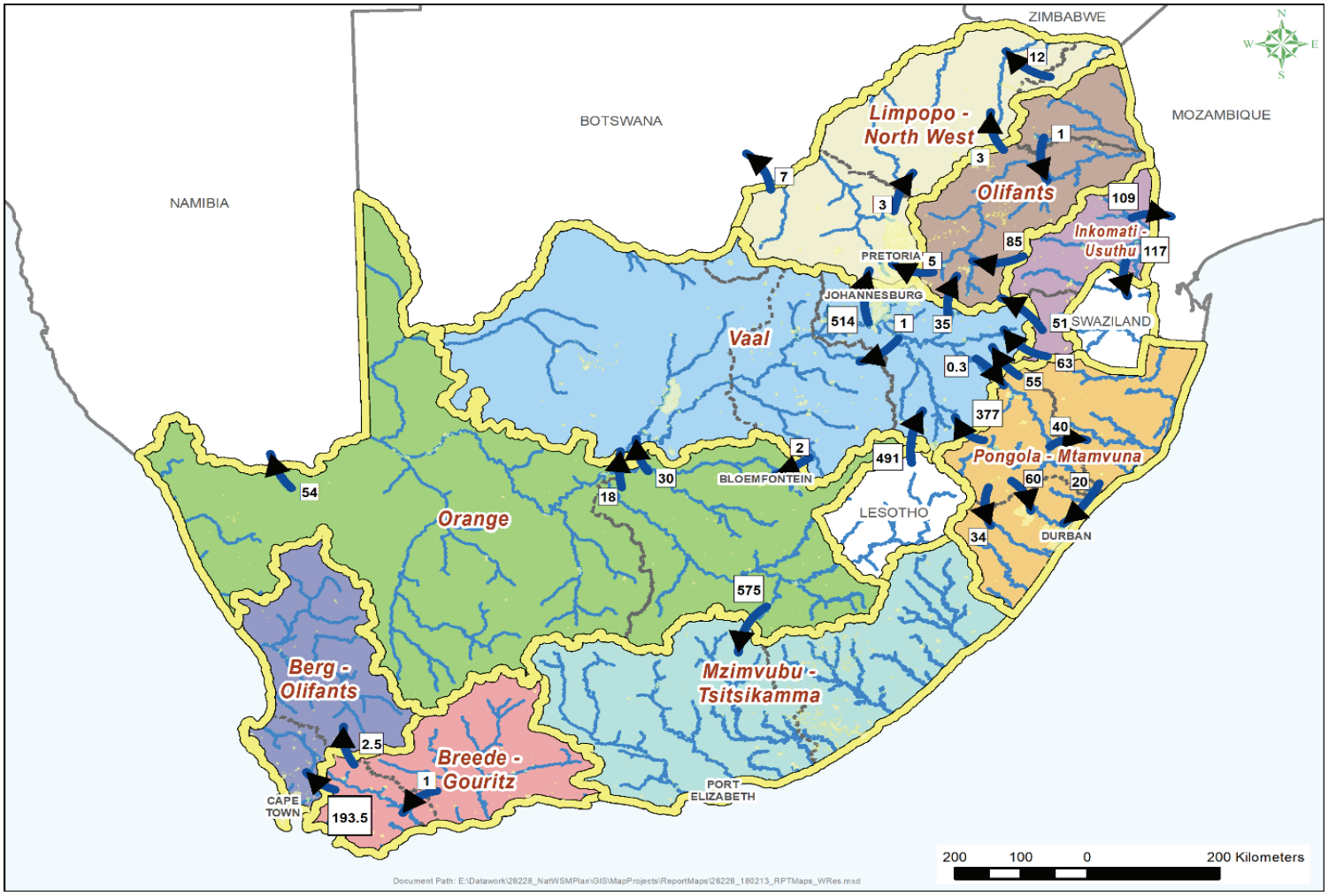


Figure 3-2: Inter-basin water transfers in South Africa

A unique feature of South African water management is that approximately 3 000 million m³/a of the surface yield is moved via approximately 30 inter-basin transfers from water-rich source catchments to water-poor areas in the country where in-basin requirements exceed available supplies. **Figure 3-2** shows the major inter-basin transfer schemes in South Africa.

Groundwater

The realistically accessable groundwater potential in South Africa is about 4 500 million m³/a of the estimated sustainable potential groundwater yield of around 7 500 million m³/a, widely distributed across the country, as shown in

Figure 3-3. The present use of groundwater is estimated at between 3 000 and 4 000 million m³/a[15]. Most groundwater infrastructure for municipal domestic water supply was developed and is operated and maintained by municipalities.

[15] Department of Water and Sanitation. 2013. National Groundwater Strategy.

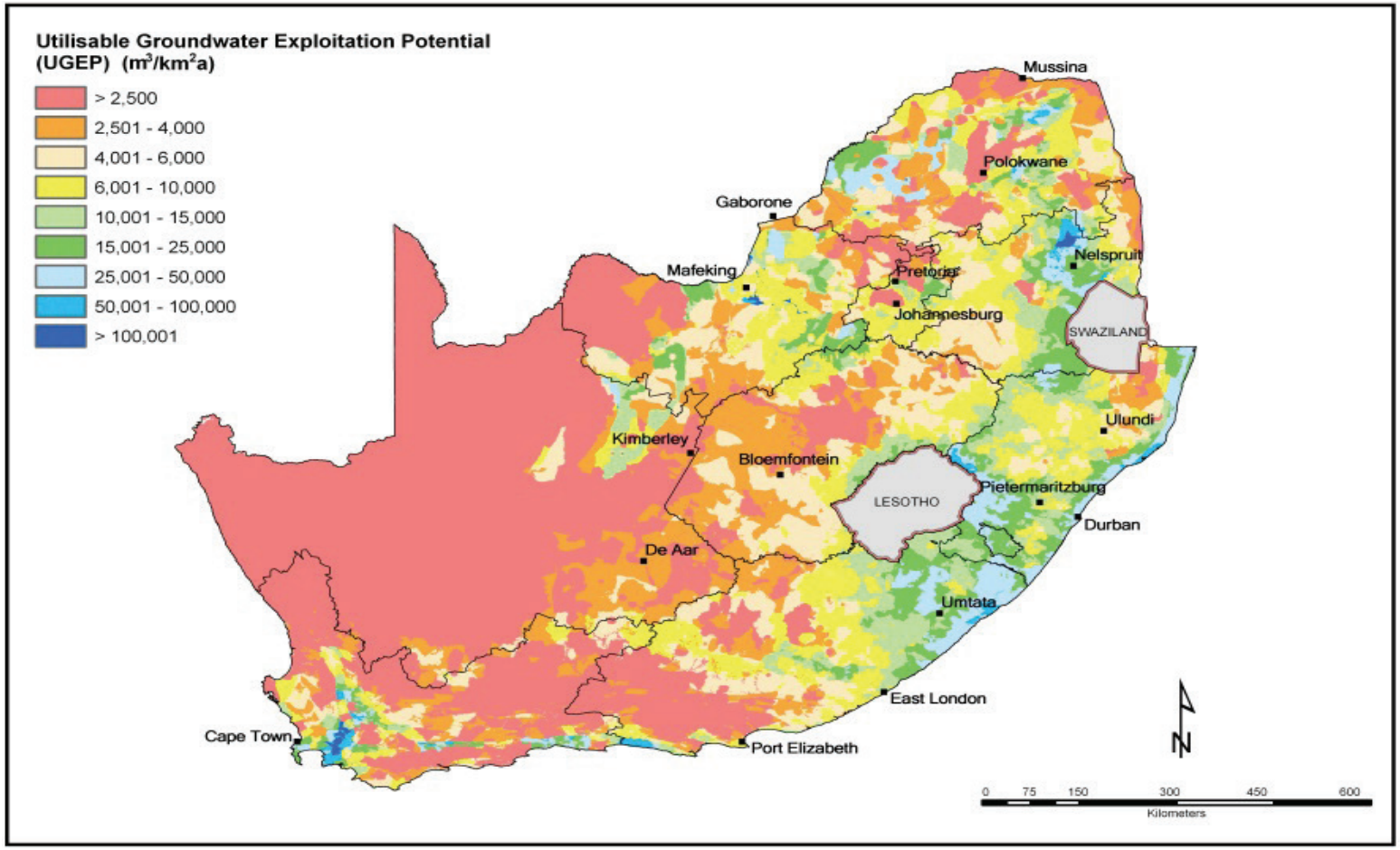


Figure 3-3: Groundwater availability in South Africa

The National Water Act (NWA) allows for "the intentional recharging of an aquifer with any waste or water containing waste". As the water quality of an aquifer will almost always be altered through the artificial recharge process, this should only be allowable if it can be proven that no altering of the water quality will take place.

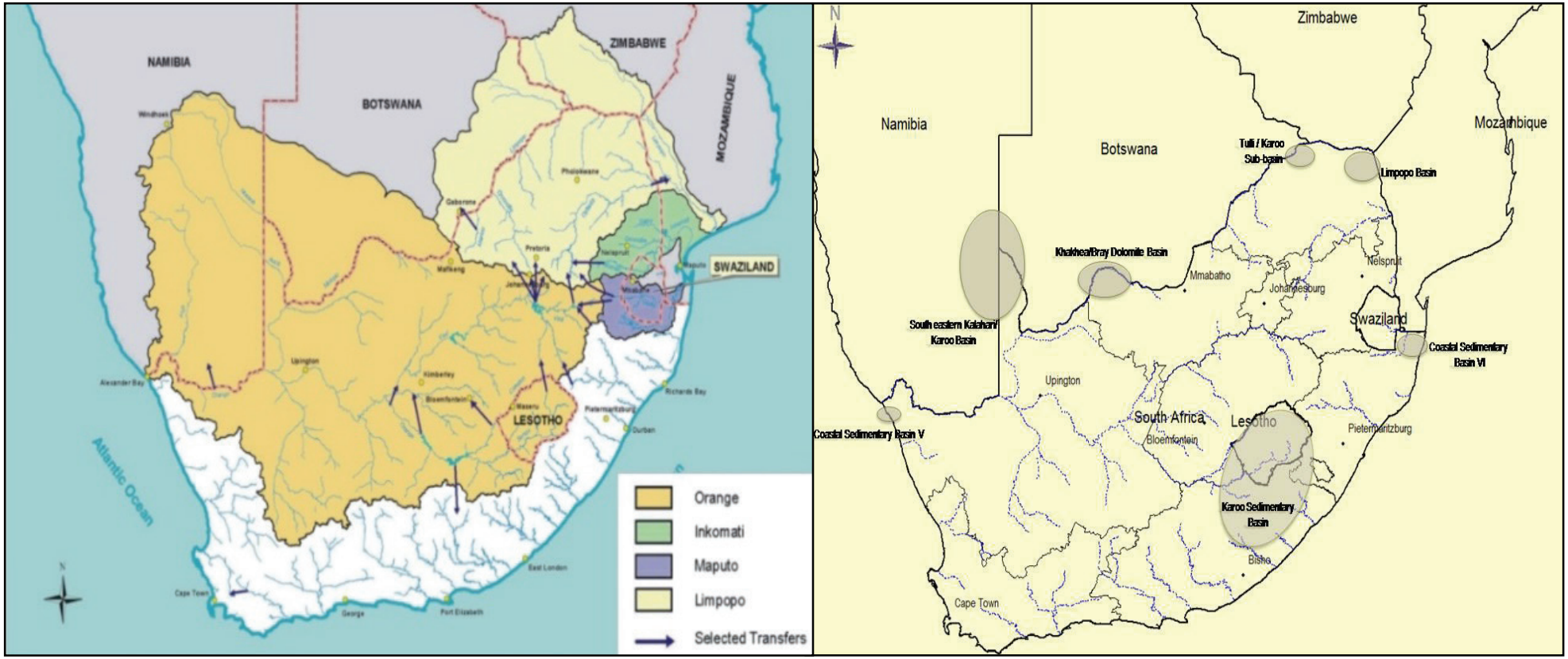
There are currently two artificial recharge schemes in South Africa - at Atlantis (just north of Cape Town) and Polokwane - that are using treated waste water to recharge groundwater. Also, two licences were issued in the last few years to the Kolomela mine near Postmasburg (Northern Cape) and Elandsfontein mine near Saldanha (Western Cape) to abstract groundwater to dewater the aquifer for mining purposes and recharging (through injecting) the abstracted water elsewhere.

Internationally-shared river basins

South Africa has four internationally-shared river basins: the Limpopo, Inkomati, Pongola/Maputo and Orange rivers, that cover about 60% of the country's land area, shown in **Figure 3-4.** International river basins contribute 45% to the country's total river flow, and support about 70% of the country's gross domestic product (GDP) and 70% of its population. Several international, inter-catchment transfers and inter-country systems have been introduced.

These resources must be shared equitably with neighbouring states who also have increasing water needs due to growing populations and economies. Signed partnership framework agreements exists that have paved the way for different South African sectors to enter into cooperation agreements, also known as Memoranda of Understanding (MoU) with these neighbouring states. it is critical that co-basin organisations adequately support IWQM in these shared river basins.

Figure 3-4: International context of surface (left) and groundwater (right) resources in RSA[16]



[16] Water Research Commission. 2005. A compilation of all the freshwater agreements entered into by South Africa with other states (right)
Department of Water and Sanitation. 2013. National Groundwater Management Strategy (left)

Groundwater aquifers also extend across international borders, resulting in joint responsibility for management of these aquifers. South Africa shares seven aquifers with neighbouring countries, locations of these aquifers are shown in a simplified map in **Figure 3-4**.

South Africa has water sharing agreements with the countries with which it shares water resources, and a number of projects are being implemented under these agreements, including:

- Lesotho: Phase II of the LHWP is nearing readiness for implementation
- Namibia: The feasibility study on the Noordoewer/Vioolsdrift project is nearing completion
- Botswana: Several transboundary water management projects have been implemented *and*
- Zimbabwe: A framework has been approved to jointly commission a study to assess the feasibility for South Africa to get water from Zimbabwean water sources.

Non-conventional resources/management options

Further to surface and groundwater resources, non-conventional resources, including re-use, desalination, rainfall harvesting and water demand management are already part of the water resources mix. These resources mostly make up the shortfall in surface or groundwater resources, as described in the Reconciliation Strategies. (Further discussion on the Reconciliation Strategies will be provided in **section 3.7.4** with additional information contained in Annexure 2 of this report).

Desalination: Desalination of brackish groundwater has been in operation for decades in various small towns and settlements in the Northern Cape and along the coast, sometimes for emergency supply during droughts. The coastal town of Bushmans River Mouth in the Eastern Cape is also being served by a seawater desalination plant for more than 20 years. During the devastating drought of 2009-2011 in the Southern Cape, several small desalination plants were established at coastal towns, i.e. Sedgefield, Knysna, Plettenberg Bay and Mossel Bay, the latter being the largest plant at 15 Ml/day. The plant at Mossel Bay has been mothballed since its completion as an emergency scheme in 2011, as its water has not been required since then.

Re-use: The indirect re-use of water at present is estimated to already account for about 14% of all available water. Water is re-used indirectly on a large scale in in-land areas, such as in Gauteng in the Vaal and Crocodile-West catchments, as the return flows from the wastewater plants forms part of a down-stream raw water abstraction from the same river. The water re-use schemes in Beaufort-West (direct re-use) and George (indirect re-use), which were also built as a result of the 2009-2011 drought, are operating full time and supply good quality water to the inhabitants.

The Department of Water and Sanitation developed a National Strategy for Water Re-use (NSWR) in 2011. The intent of the water re-use strategy is to encourage wise decisions relating to water re-use at different scales and levels. The performance of existing wastewater treatment

plants in terms of meeting discharge standards and reliability is critical to the successful integration of water reuse into reconciliation strategies and into water supply systems in SA

Control of Invasive Alien Vegetation: Estimates suggest that close to 3% of the national mean annual runoff is intercepted by invasive alien vegetation, that intercept and evapo-transpirates more water than natural vegetation. Removal and containment of such vegetation improve water availability. The Working for Water program, first under the auspices of DWS and now the responsibility of the Department of Environmental Affairs (DEA), is an initiative that has been actively eradicating invasive alien plants (IAPs) for the past 20 years.

Rainfall harvesting: Rainwater harvesting involves the collection and storage of rainwater, either for immediate use or use before the onset of the next rainy season and has been practised world-wide for millennia. In South Africa, rainwater harvesting is growing, specifically in rural areas, and where municipal systems are failing.

Water conservation and water demand management (WC/WDM): In addition to making more water available, WC/WDM reduces water requirements. It is key to ensuring the sustainable use of our water resources, and to ensure that sufficient water is available for the current and future requirements. Water Conservation and other measures to manage demand will be actively promoted as a preferred option to achieve these objectives, as discussed in **Section 3.2.3**.

3.2.2 Water Requirements

The distribution of water use by sector is shown in the diagram below:

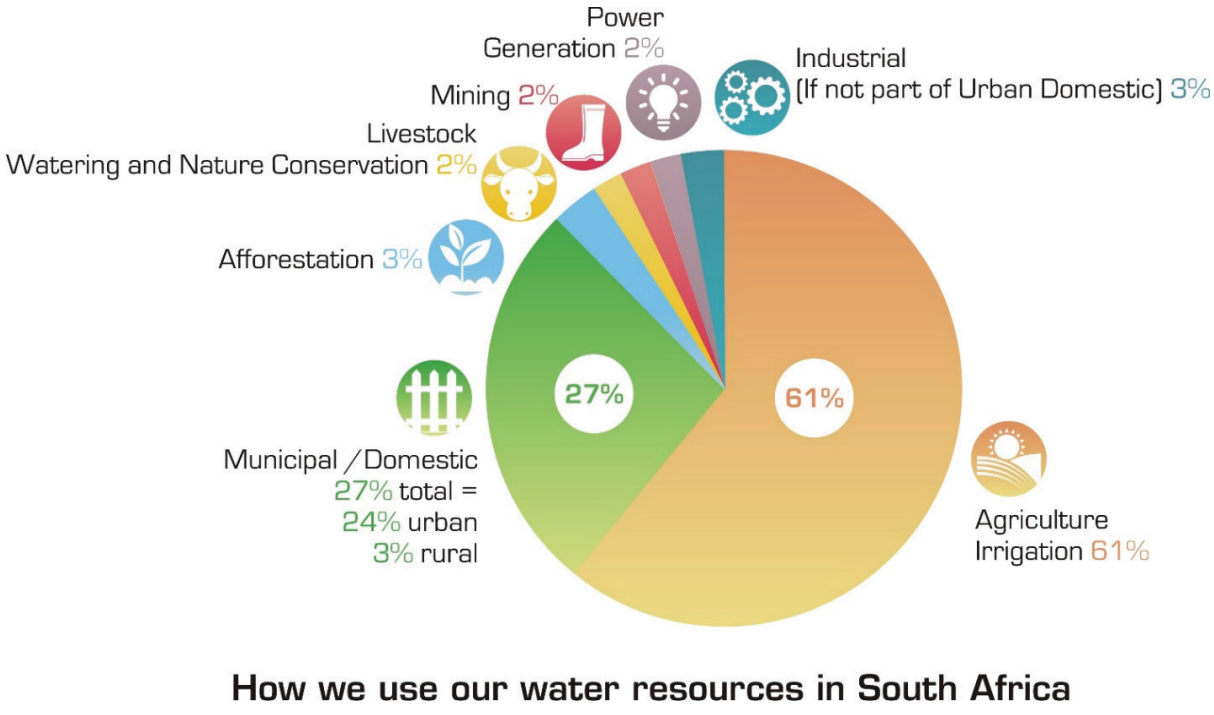


Figure 3-5: Water Use by Sector

Agriculture, including afforestation and livestock watering, is the largest user at 66% of the total water use, followed by municipal and domestic use at 27% (including industrial and commercial users provided from municipal systems), with power generation, mining and bulk industrial use, livestock and conservation and afforestation jointly making up the remaining 12%. The level of assurance at which agricultural water is supplied is lower than that of the other sectors (90%). Water for power generation is seen as strategically important and is provided with the highest assurance of supply (99.5 %) (which translates to 1: 200-year risk of failure).

Table 3-1: Water Use Requirements (Source: DWS Directorate: National Water Resources Planning – NWRP)

No	User sector	2015 requirements* (million m^3/a)
1	Agriculture (irrigation and livestock watering)	9 000
2	Municipal (industries, commerce, urban and rural domestic)	4 447
3	Strategic/Power generation	362
4	Mining and bulk industrial	876
5	International obligations	178
6	Afforestation	431
	Total	**15 294**

** Water for the environment as enshrined the National Water Act, 1998 take priority over all the other water uses, hence, in most instance water available is shown after the provision for the ecological water requirements, as discussed in section 8.*

Hydropower systems

The global and South African shift towards renewable energy have created an environment where renewable energy projects such as hydropower are both environmentally and financially attractive due to existing suitable infrastructure. South Africa has several pumped storage schemes (Ingula of 1332 MW, Drakensberg of 1000 MW, Palmiet of 400 MW and Steenbras of 180 MW schemes), some conventional hydropower systems as part of existing dams, such as Gariep, Vanderkloof Mbashe dams, as well as some small-scale hydropower. Conventional hydropower systems do not consume any water, other than what is released due to downstream environmental and other requirements. Pumped storage schemes only require some augmentation to make up for evaporation losses, after the initial storage of water for the system.

3.3 STATE OF WATER LOSSES AND WATER USE EFFICIENCY WITHIN THE WATER SECTORS

Water conservation is the minimisation of loss or waste, the care and protection of the water resource and the efficient and effective use of water. Water demand management is the adaptation and implementation of a strategy by a water institution or consumer to influence the water demand and usage of water in order to meet any of the following objectives: economic

efficiency, social development, social equity, environmental protection, sustainability of water supply and services and political acceptability.

WC/WDM is also a fundamental step in promoting water use efficiency and is consistent with the National Water Act (Act 36 of 1998) which emphasises effective management of our water resources (DWAF, 2004). This builds on the principles of the *National Water Policy* (DWAF, 1997) which state: Water resources shall be developed, apportioned and managed in such a manner as to enable all use sectors to gain equitable access to the desired quantity, quality and reliability of water.

One of the biggest challenges in ensuring the effectiveness of water conservation and water demand management programmes is the paradigm shift required amongst all South Africans to understand the importance of conserving the nation's water resources. Traditionally there are stereotypes and mindsets that exist characterized with social beliefs among others that water comes from above and is free thus resulting in high water wastage.

3.3.1 Agriculture Sector

The irrigation sector is by far the largest water user in South Africa. Any percentage reduction in water use in this sector will therefore have a significant effect on the total water requirements. Efficiencies can be targeted both in terms of distribution networks (leaking pipelines and canals) and application (choice of crops and irrigation technologies employed).

About 8.5 million people are directly or indirectly dependent on agriculture for employment and income (GCIS, 2011). The sector contributes about 3% to the GDP and 7% to formal employment. The agricultural sector is made up of commercial farmers and subsistence farmers: about 1.3 million hectares are irrigated. It has a huge potential socio-economic impact in rural communities.

The DWS through the Strategic Water Partnership Network (SWPN)[17] has implemented the Water Administration System (WAS) Release Module at a number of irrigation schemes i.e. Hartbeespoort Irrigation Board (IB), Sand-Vet Water User Association (WUA), Orange-Riet WUA, Vaalharts WUA, Impala WUA, Lower Orange River WUA and Loskop IB. With the WAS Release Module, it is possible to release the correct amount of water from a dam (source) according to applications (demand) and prevent wastages**.** Irrigation schemes are submitting Water Use Efficiency Accounting Reports on a monthly basis reporting on their water use efficiency. Reports are received from 75% (59 of 78) of the large irrigation schemes. The

[17] Strategic Water Partnership Network. 2016. Water Administration System – Final Report Phase 1 Water Release Module.

average water loss of the reporting schemes is about 27%. It was determined that the seepage and evaporation loss in concrete canals, which is unavoidable, is about 12% of the total loss.

Most of the country's water supply systems and dams are controlled by Water Control Officers (WCO). Their task is to distribute water to DWS clients and to improve water use efficiency in the Agricultural Sector. As WCO`s need to ensure timeous delivery of irrigation water to water users at a certain flow rate with the minimum water loss, they are capacitated through Water Measurement, Water Distribution and Dam Control courses.

A proposed programme of high level key WC/WDM activities, measures, projects and programmes for the water services sector are outlined in Volume 3 of the NW&SMP, to be read together with this document.

3.3.2 Water Services Institutions and Local Government Sector

The National Development Plan (NDP) - 2030 sets out the priorities for water demand management and projects the importance for a reduction in water demand by 2030. The NDP projects an average reduction in water demand of 15% below baseline levels[18] in urban areas by 2030, where the baseline is taken as year 2012. The Plan acknowledges and refers to the detailed targets that have already been set for different catchments through the Reconciliation Strategies and *All Town Strategies*[19]. Achieving demand reductions on this scale will require active programmes to reduce water leakage in distribution networks, and to increase the efficiency of water use by domestic and commercial water users. The NDP requires targets to be in place for up to the 2022 horizon.

The National Water Resource Strategy, 2013 (NWRS2) emphasizes WC/WDM as a top strategic intervention to reconcile water requirements with water availability.

The eight large water supply systems (WSS) include: the Integrated Vaal River Water Supply System (WSS), Crocodile West River WSS, Kwa-Zulu Natal Coastal Metropolitan WSS, Western Cape WSS, Algoa WSS, Amatole WSS, Greater Bloemfontein WSS and Olifants River WSS. The municipalities in these eight WSS are situated in areas of high economic significance and should increase their efforts to achieve the targets set under the various water reconciliation strategies to ensure water security. The following map represents the eight large water supply systems areas with water use efficiency targets for to 2022 and water savings performance for the year 2016 for each system in **Figure 3-6**.

[18] National Planning Commission. 2011. National Development Plan
[19] Department of Water and Sanitation. All Towns Reconciliation Strategies for the Northern Planning Region

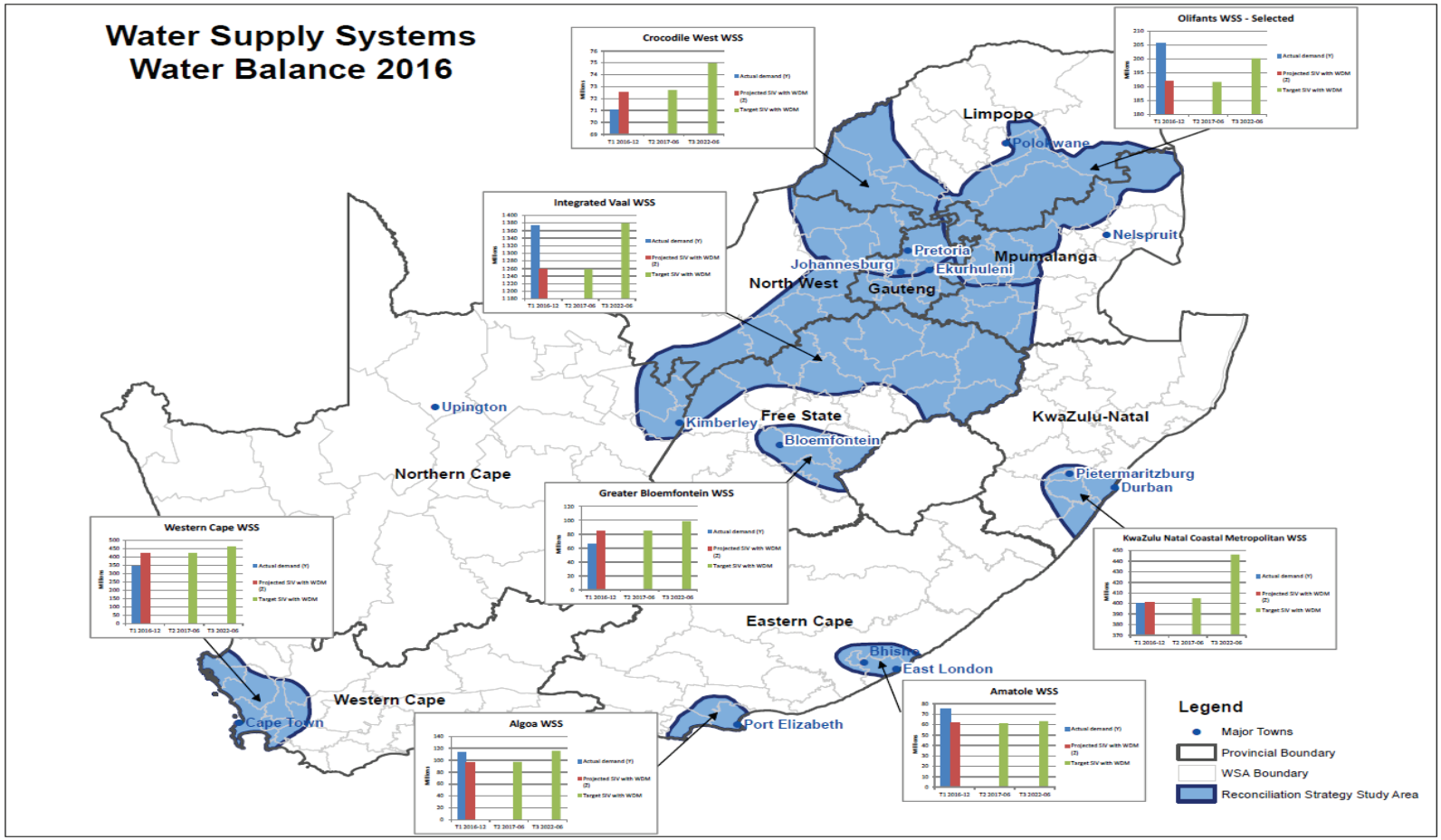


Figure 3-6: Map of eight water supply systems that indicate water use efficiency targets for 2017 and 2022 and water savings performance for the year 2016 for each system

The DWS monitor and analyse the progress made with the implementation of WC/WDM and targets set during the development of Reconciliation Strategies, at municipal level, within the eight large water supply systems (WSS).

The results for the target versus actual savings achieved for these systems are summarised in **Table 3-2** and **Figure 3-7** below, which indicate a total of 8.6% achieved savings by December 2016 compared with a target of 11.3%. Savings of 3.6% have been achieved between June 2016 and December 2016 which is encouraging as water restrictions were imposed in most of the water supply systems. The Western Cape WSS, Kwa-Zulu Natal Coastal Metropolitan WSS and Greater Bloemfontein WSS have reached their targets while the remaining five WSS are generally representative of high populations that do not implement WC/WDM measures (DWS, 2017).

Table 3-2: Summary of the desired target versus actual savings for municipalities

System	Projected System Input Volume (SIV) without WDM kl/annum	Projected SIV with WDM kl/annum	Projected % savings	Actual demand kl/annum	Actual % savings	Situation analysis
IVRS (Integrated Vaal River System)	1 414 954 845	1 259 521 968	11.0 %	1 374 064 291	2.9%	The 2.9 % reduction in demand is positive considering that these municipalities have experienced a higher population growth than estimated. WC/WDM demand projections need revision
CWRWSS (Crocodile West Water Supply System)	81 896 986	72 505 548	11.5%	75 149 020	8.2%	Results indicate that progress has been made, although municipalities are experiencing a higher population growth than estimated without corresponding WC/WDM demand projections
KZNCMWSS (Kwa Zulu Natal Coastal Municipality Water Supply	440 429 750	400 929 750	9.0%	399 750 304	9.2%	Municipalities have been able to reduce their demand and achieved their

System	Projected System Input Volume (SIV) without WDM kl/annum	Projected SIV with WDM kl/annum	Projected % savings	Actual demand kl/annum	Actual % savings	Situation analysis
Systems)						target
WCWSS (Western Cape Water Supply System)	481 866 055	420 515 925	12.7%	363 416 316	24.6%	Municipalities achieved savings of 24.6% which is higher than their 12.7% target.
AWSS (Algoa Water Supply System)	131 372 286	95 678 395	27.2%	113 623 290	13.5%	Municipalities have experiences a higher than estimated population growth without revised WC/WDM demand projections and achieved 13.5% savings compared with 27.2% target
AmWSS (Amatole Water Supply System)	66 893 713	61 493 713	7.2%	74 797 137	-0.6%	Municipalities have seen higher than planned population growth without WC/WDM demand projections revised. No savings achieved
GBWSS (Greater Bloemfontein Water Supply System)	94 743 067	84 663 067	10.6%	65 780 175	30.6%	The status could only be made based on data from Mangaung Municipality, which achieved a 30.6% savings compared with a 10.8% target, mainly due to 20% restrictions
ORWSS (Olifants River Water Supply System)	204 882 982	191 858 953	5.7%	199 681 021	1.1%	Results show that progress has been made with reduction in demand although at a very low confidence level
Total	2 917 039 684	2 587 167 319	11.3%	2 666 261 554	8.6%	
Capital investment required to implement the programme						**R 10 Billion/ 10 years**

From the base year 2012 to 2014 the actual demand was below the target demand and projected demand without WC/WDM (high growth scenario). But for the years 2015 and 2016 the actual demand was higher than the target demand which confirmed WC/WDM was not effective enough and never impacted on the actual growth in demand.

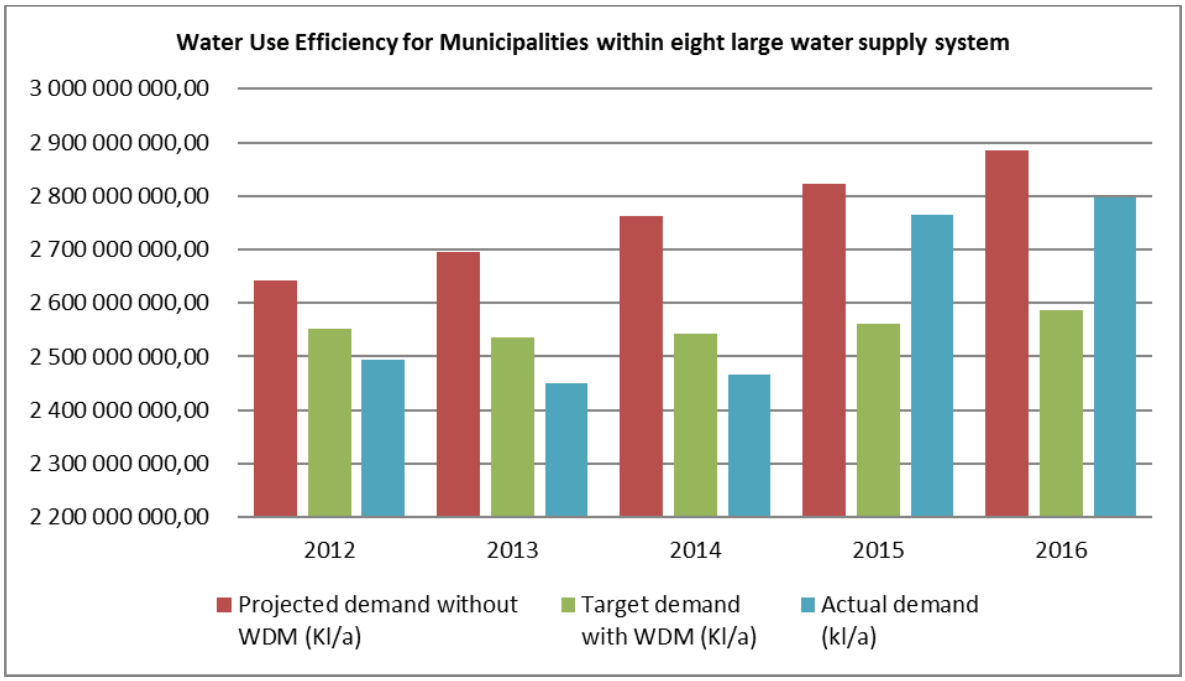


Figure 3-7: Historical trend of water use efficiency within the eight large water supply systems

The following represents general WC/WDM challenges:

- Municipalities put little or no effort to achieve the targets set, i.e. limited or lack of adequate planning and funding to support the implementation of WC/WDM projects. Budgets are allocated towards new infrastructure projects through capital grant programs such as the Accelerated Community Infrastructure Programme (ACIP), Municipal Water Infrastructure Grant (MWIG), Regional Bulk Infrastructure Grant (RBIG) and the Municipal Infrastructure Grant (MIG). The management of these funds is fragmented with emphasis on new infrastructure and insufficient focus on WC/WDM.
- Lack of continuous monitoring and analyses of water balance data against which the progress made with the implementation of WC/WDM could be measured.
- Closer involvement and collaboration with National Treasury, the Auditor General and the Department of Cooperative Governance and Traditional Affairs (COGTA) to ensure issues related to funding of WC/WDM programmes, metering and billing issues are resolved.

The national International Water Association (IWA) water balance for water losses and non-revenue water indicates that both items are growing at a higher rate in spite of WC/WDM work and projects implemented. In the year 2012, it was recorded as 38% (WRC Report TT 522/12)

but it has since grown to 41% in 2016 (DWS, 2017a). This means stakeholders have to intensify implementation of WC/WDM measures to ensure growth of both variables is contained within acceptable parameters and targets as set out in the Reconciliation Strategies are achieved. The IWA water balance reflects the current state of water losses and non-revenue water as part of work done in the year 2015/16 and is a serious concern (DWS, 2017a).

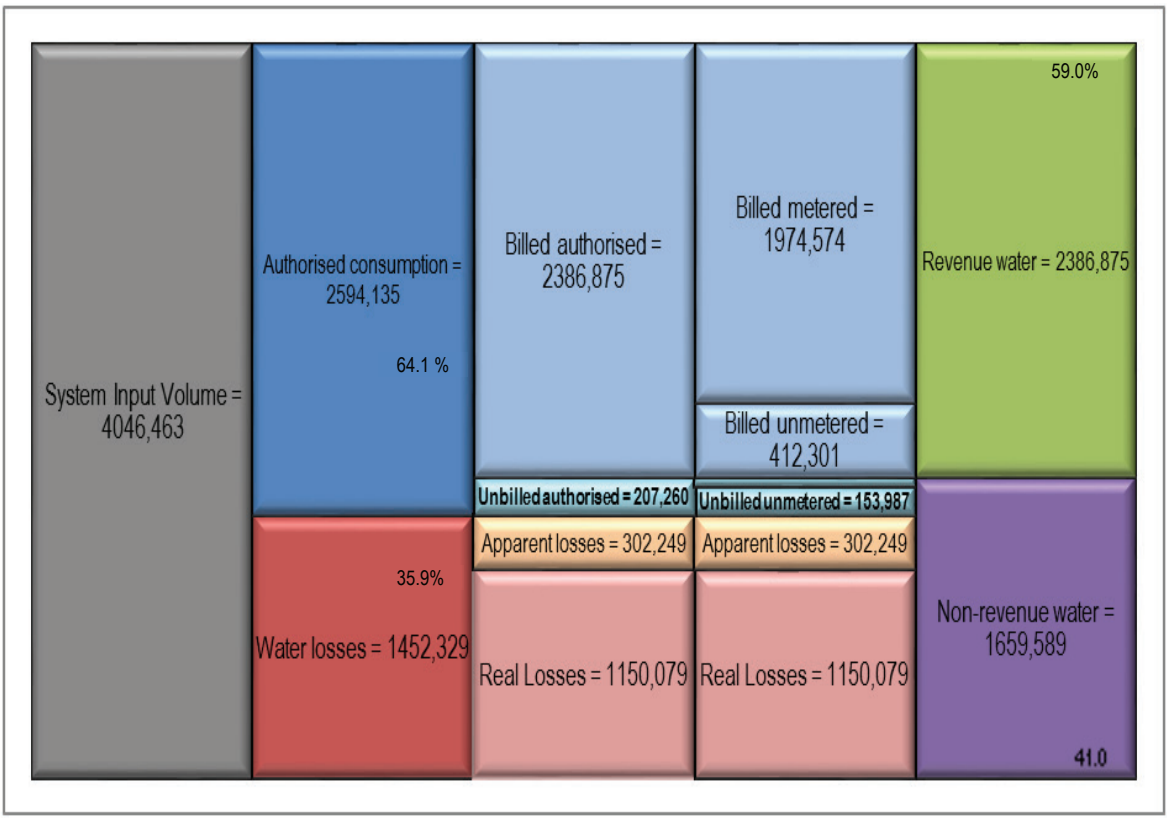


Figure 3-8: National IWA Water Balance for Water Losses and Non-Revenue Water Mm³/a

The DWS as the custodian of national water resources is concerned about water security and the knowledge that large volumes of water (and revenue) are lost at municipal level. Therefore, DWS has sought avenues to collaborate and work in partnership with stakeholders to 'close the water gap by 2030. The Strategic Water Partners Network-SA (SWPN-SA) is one such partnership. The SWPN resulted from a partnership with private partners launched by DWS and the Water Resource Group at the World Economic Forum in 2011. One of the first projects conceptualised under this partnership, was the No Drop Programme. The No Drop Programme is an incentive-based regulatory programme that builds on the successful Green Drop and Blue Drop Programmes of the Department to assist municipalities to assess and improve their water use efficiency, water losses and non-revenue water. The No Drop Programme is based on assessments against specific criteria to evaluate a municipality's performance against legal and international best practice requirements (No Drop Strategy, 2015).

3.3.2.1 Summary of the No Drop Results

Fisrt Order No Drop Assessment Results

The results are based on the findings of a No Drop assessment which formed part (3%) of the 2014 Blue Water Services Audit as Criteria 6. The No Drop component focused on 3 KPAs namely: 1) water balance (30%); 2) strategy, planning and implementation (30%), and 3) performance and compliance (40%). All 152 water services authorities (WSAs) having 949 water supply systems participated in the 2014 No Drop assessment.

For the first order No Drop assessment, a municipality that achieved >90% No Drop score, was considered to be knowledgeable of their current status in terms of WC/WDM. In total:

- Only 30 % of the water supply systems assessed obtained more than a 50% No Drop Score, and
- Of the 152 WSAs assessed, good data sets were received from 71 municipalities representing a total population of 32 580 710 and 9 043 534 households, which is approximately 62 % of the country's total population.
- The national average No Drop score of 56.5% was achieved, which is considered an average performance. The score is influenced by the good scores achieved (> 50 %) by Gauteng, KwaZulu-Natal, Western Cape, Eastern Cape, and Free State Provinces. The National Barometer for the country with a weighted average No Drop score of 56.9% is shown in the figure below:

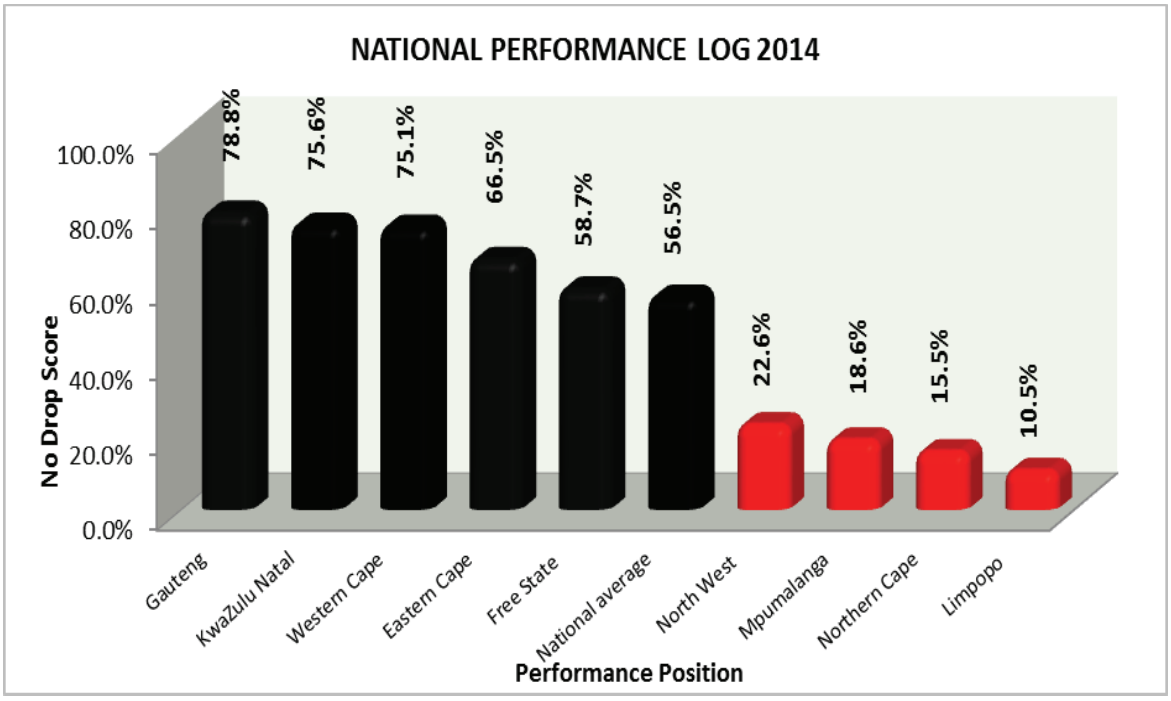


Figure 3-9: No Drop National Performance Log 2014

The results show that 51% of 152 WSAs have proper WC/WDM plans and strategies in place and are busy with some form of implementation in the field. A total of 38-40%[20] of 152 WSAs have proper or partial water balances in place, which is a baseline requirement for planning and project scoping. The current status makes a strong case to focus on improvement in the quality of planning and the intensity and acceleration of implementation going forward. The following figure shows the submissions made for No Drop assessment as pertaining to WC/WDM planning:

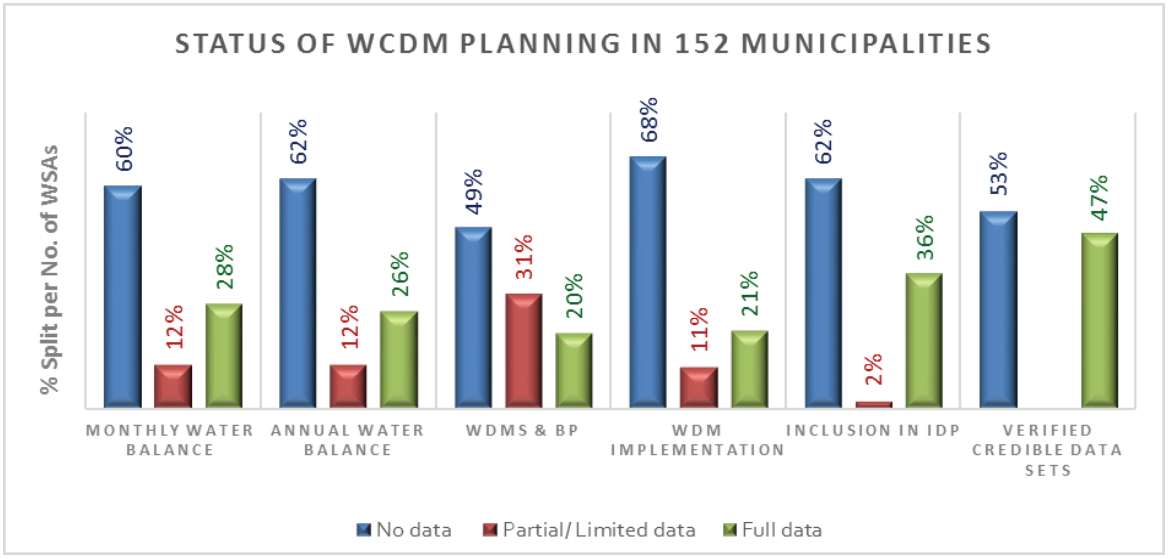


Figure 3-10: Status of WCDM Planning in 152 Municipalities

The National Water Balance indicates a total System Input Volume of 2 997.58 million kl/annum, which was based on the data set received from 71 municipalities. The country average per capita consumption is 237 ℓ/c/d (the global average is only 173 l/c/day).

Non-Revenue Water (NRW) is defined as the volume of water supplied by a water services provider (water utility), but for which it receives no income. The national weighted average NRW is 34.6% of the total System Input Volume (SIV). Seven (7) of the nine (9) provinces have NRW in excess of 30 %, which is considered poor performance. When comparing NRW per province, the highest is noted for Eastern Cape, Limpopo, and North West. This can be due to

[20] DWS 2017. MuSSA for Water Services for South Africa, 2016/2017"

the high number of rural areas and the challenges associated with billing and metering in these provinces.

A total volume of 1 038 million kl/annum is lost as NRW which, calculated at a unit cost of R6/kl, amounts to R 6 228 million per annum for the country as a whole. By implementing WC/WDM projects, a potential saving of 331 million kl/annum can be achieved, which means that almost R 2 billion can be saved every year.

2015 NO DROP FULL AUDIT RESULTS: METROPOLITAN MUNICIPALITIES

There are eight metropolitan municipalities (metros) in South Africa with a combined annual demand of 2 158 million kl /annum, serving a population of 21.5 million. Metropolitan municipalities represent 40% of the South African population and 47% of the urban water consumption, which is the reason why the metropolitan municipalities were selected for a full No Drop audit.

None of the metros received No Drop Certification (i.e. all scored <90%). The City of Cape Town performed well, closely followed by Ekurhuleni, eThekwini and the City of Tshwane, which all have above average scores. Nelson Mandela Bay, the City of Johannesburg, Mangaung and Buffalo City all have scores below the average of 69%. Whilst reasonably good performance was noted for the first round, metros are expected to perform better in the next audit as a result of improved provision of evidence and understanding of the No Drop requirements.

The IWA water balance for metros for 2013/14 FY indicates a total System Input Volume (SIV) of 2 158 million kl/annum. The City of Johannesburg with the largest population in South Africa accounts for 27% of the total metro consumption and is the largest urban water user, followed by Ekurhuleni that accounts for 16 % as a result of the concentration of wet industries in the country. Of concern to DWS, is that the combined Metro SIV is 2.4 % above the available supply from the water resource this means that all the metros combined are actually “living above their means” by using more water than what the resource can sustainably provide.

The total NRW for the metros is 923 million ^{kl}/ annum (34 % of the SIV). Six metros (three quarters) have NRW in excess of 35%. This clearly shows on average the metros are not performing well compared with the international benchmark at 10 - 20% NRW. The average litres / capita / day within metros is 267. The average consumption is above the international benchmark of 180 ℓ/c/d (WRC, 2012) and metros are encouraged to target an average consumption of below 200 ℓ/c/d.

By comparing potential savings on a Municipal Category level, it has been observed from the No Drop, first order assessment Report (2014) that the majority of potential savings (84%) can be generated by investing in WC/WDM in metropolitan municipalities and the secondary cities.

3.4 INDUSTRIES, MINING AND POWER GENERATION SECTOR (IMP)

Manufacturing Industries

The manufacturing sector contributes 15.5% to the GDP and 13.3% to jobs in 2009 (GCIS, 2011). South Africa's New Growth Path (NGP) has set a target of 350 000 new jobs for this sector by 2020[21]. Water is an input in the manufacturing processes and it also used for cooling. The food and beverage sectors are highly dependent on water for the production of their products. As the manufacturing sector is the pillar sector required to drive economic growth and social development of the country and rightfully earmarked for future growth in the water demand. The need for WC/WDM in the sector cannot be over emphasized.

Mining Sector

According to the Chamber of Mines of South Africa, the mining sector contributed 8.8% directly and 10% indirectly to the GDP of the country in 2009 (GCIS, 2011). This sector creates about 1 million direct and indirect jobs. The sector accounts for approximately one third of the market capitalization of the Johannesburg Stock Exchange (JSE) and it is also the major attractor for foreign investments. The NDP has set a potential employment target of 140 000 new jobs by 2020 for the mining sector (DED, 2010). Mining and related activities require significant quantities of water whilst also impacting on the environment with associated potential pollution. The development of new mines in water scarce areas requires forward planning to make arrangements for the transfer of water and development of new sources. The water allocation to the mining industry currently represents about 2.5 % of total water allocation in South Africa. The efficiency of water usage by different mining sub-sectors has not yet been systematically determined. However, data from a study commissioned by DWS in partnership with the Chamber of Mines in 2012 does provide some indicative water use efficiency benchmarks for common minerals mined in South Africa. This highlights potential opportunities for WC/WDM initiatives in the mining sector. This along with a range of technical interventions developed in association sector partners like the Water Research Commission (WRC) and the Council for Scientific and Industrial Research (CSIR) aimed at improving water usage in mining, as well as water treatment and re-use options such as the eMalahleni Water Reclamation project and others, further illustrate room for improvement.

[21]Department of Economic Development. 2010. New Growth Path Framework.

The DWS has developed a methodology to guide the implementation of WC/WDM within the mining sector. This methodology which is based on the generic implementation methodology developed as part of the study to set water use efficiency benchmarks provides for a clear distinction between the responsibilities and roles for the mining industry and for the regulator.

Power Generation Sector

The energy sector although only using 2% of water, contributes about 15% to the GDP of South Africa and creates jobs for 250 000 people (GCIS, 2011). The sector generates about 95% of the electricity in South Africa and also exports it to countries in Africa. The energy sector, including Eskom, the national power generator, is highly dependent on reliable supplies of water for the generation of electricity (steam generation and cooling processes). An elaborate and sophisticated network of water transfer and storage schemes has been developed specifically to support this sector and ensure high levels of reliability. The water sector is on the other hand highly dependent on a constant and reliable supply of electricity to "move water".

At present Eskom's coal-based power plant fleet consists of 10 base load power plants (used during normal demand) and 3 return to service (RTS) power plants (used during peak demand), also refer to **Section 3.3.2.3**. These power plants have diverse technical parameters and use a combination of cooling technologies which is bound to provide different water usage profiles. Within the context of the current *Integrated Resources Plan* (IRP), South Africa's energy mix is bound to change in order to provide sufficient energy security. However, the abundance of local reserves of coal is likely to keep coal a dominant fuel source (Pouris and Thopil, 2015).

Eskom has set itself a target of 1.39 l/kWhSO. It performed well below the target for the FY 13/14 and 14/15. The performance for the 15/16 year was however undesirably above the set target.

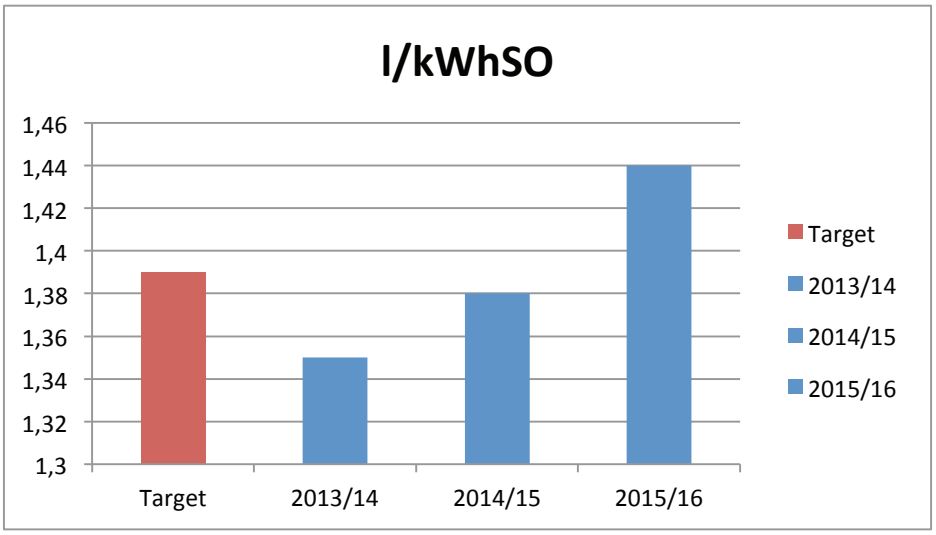


Figure 3-11: Eskom's Performance (Water Intensities for the past three years)

3.5 WC/WDM SOCIAL AWARENESS AND ADVOCACY PROGRAMMES

One of the biggest challenges in ensuring the effectiveness of water conservation and water demand management programmes is the paradigm shift required amongst all South Africans to understand the importance of conserving the nation's water resources.

Evidence has shown that most technical interventions without adequate social engagement and education of communities often lead to failures of good technical interventions. The social pillar is thus driven mainly to ensure community buy-in and support of technical programmes aimed at reducing water losses and wastages within communities. The WC/WDM education and awareness campaigns that the DWS has implemented are as follows:

"Be water wise" The truck / puppet shows campaign

This campaign is a road show campaign. The Truck Campaign is aimed to create awareness and educate South Africans about water use efficiency. It became successful with the help of all relevant stakeholders involved such as municipalities and other relevant stakeholders. The Truck Campaign consists of a truck which is used to carry water use efficiency messages. The truck is branded with the DWS logo and water saving tips. The Department also distributes water use efficiency promotional material to community members, at all different stops during this campaign. Most of the promotional material includes brochures, water bottles, cups, 25l buckets and school bags. All these carry very powerful messages of water use efficiency. The Department appointed the Water Ambassadors, who are celebrities and professional actors. These water use efficiency ambassadors do industrial theatre performance which is an integral part of the campaign. The performance conducted by water use efficiency ambassadors is aimed at creating awareness and educating people on how water is being wasted on a daily basis and how people can save water by giving them water saving tips to avoid unnecessary water wastage. Communities reached have interacted very well with the water use efficiency ambassadors.

Campaigns and awareness workshops

The DWS and participating municipalities conduct door to door campaigns educating and creating awareness for water use efficiency. This campaign is mostly dependent on the municipality that has invited the Department. Promotional materials are also distributed, such as water saving tips and how to fix leaking taps. The municipal officials in this campaign provide the plumbers and do live demonstrations on how to fix leaking taps and toilets.

The DWS runs schools' competitions to involve learners in solving water issues, especially within the water use efficiency spectrum. The South African Youth Water Prize, which is a science & technology-based project, begins at provincial level and proceeds to the national level. The national winner then represents South Africa at the annual Stockholm Junior Water Prize (SJWP) in Stockholm, Sweden where they compete against learners from 30 countries.

The DWS host workshops on irrigation schemes on water use efficiency and WC/WDM, as it is estimated that the water losses through canals of the irrigation schemes are between 35 to 45%. Efficient use of water by the sector has the potential to play a significant role towards making more water available for use not only within the agricultural sector, but also for other sectors.

Education and awareness is not the function of national government only, all sector institutions, private sector organizations and civil society should be institutionalising the promotion of WC/WDM.

The proposed WC/WDM aspects of the national water and sanitation plan (see Volume 3) serves as the blue print of key high-level measures, actions and programmes that must be implemented to improve water use efficiency, cut down water losses and wastages. This will ensure water security and sustainable use of water in the country.

3.6 DRIVERS

3.6.1 Water Resources

The challenge of a water scarce country is inadequate and limited supply of water resources available to meet all growing requirements for humans and the economy, and this is aggravated by climate change, increased competition for water between the various water use sectors, and frequent and prolonged droughts. This challenge is deepened by the geographic misalignment of the water resources and requirements in the country. When water shortages are experienced in any part of the country, it has a negative bearing on the health sector, food security, development, economic growth and job creation.

To meet these challenges, the country must shift focus towards the sustainable management of water resources through initiatives like integrated catchment management and optimisation of existing water use through implementing water conservation and water demand management measures, the re-use of water, as well as the desalination of brackish groundwater, mine water, and seawater, and supporting the harnessing of rainwater.

3.6.1.1 Surface Water

Although some large surface water schemes, such as the Lesotho Highlands Water Project Phase 2 (LHWP-2), are currently planned and developed, South Africa is approaching full utilisation of available surface water yields and is running out of suitable sites for developing large dams, therefore other resources, which include groundwater, re-use and desalination, are considered and further investigated in the Reconciliation Strategies. Inter-basin transfer schemes are also considered, while the donor catchment should still retain the ability to sustain current and future water requirements in the catchment in addition to such a transfer, and these schemes may be fairly expensive due to long distances crossing catchment boundaries, either with a tunnel or pumping.

Water resources planning and development involve long lead times (10 to 15 years on average from start of planning for building a large dam to first water delivery, shown in **Figure 3-12)** and high capital costs, while planning for an uncertain growth in requirements well into the future. Due care must be exercised in planning and undertaking water resource infrastructure interventions in time.

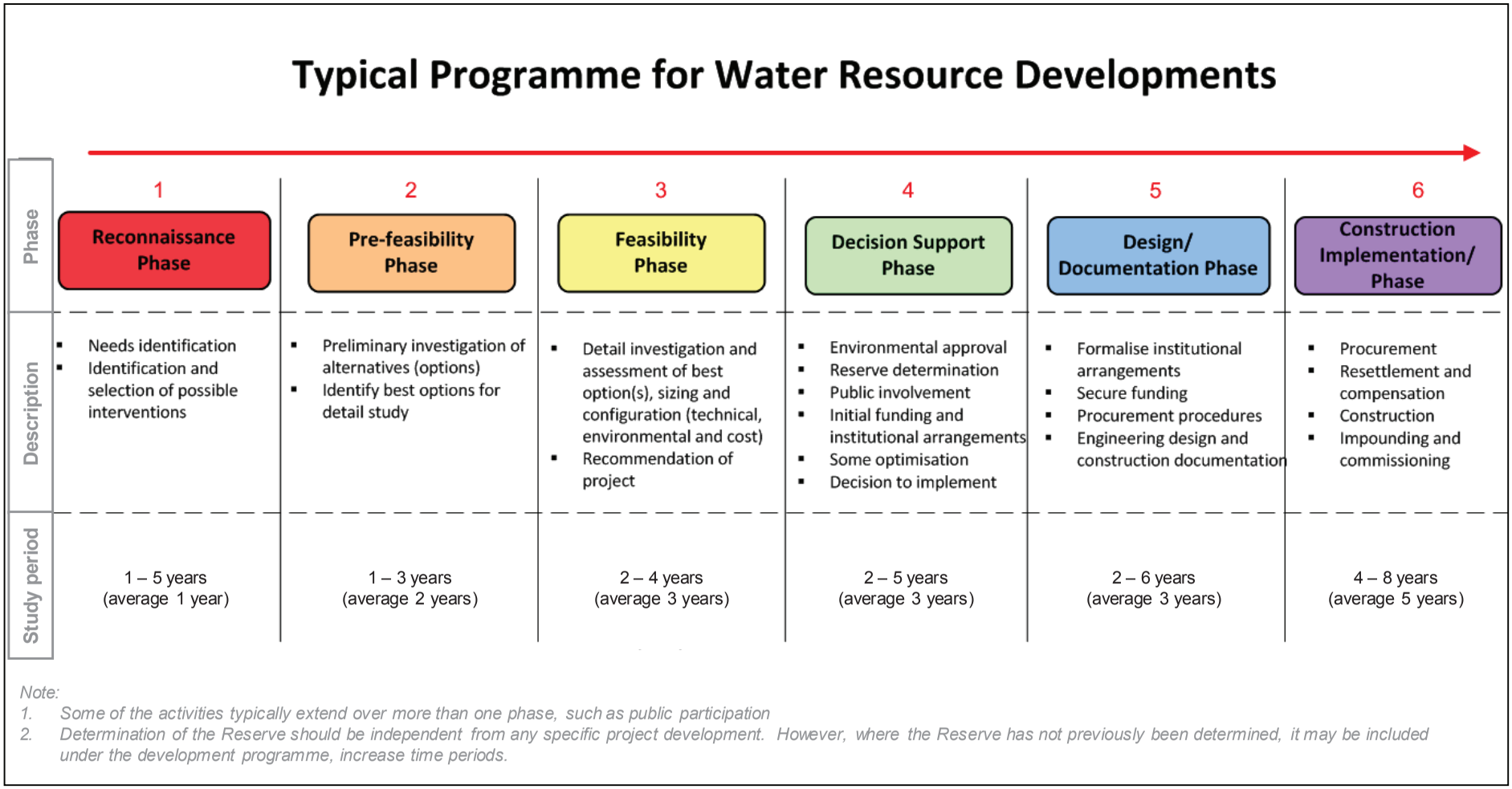


Figure 3-12: Typical programme for the development of water resources interventions

Other issues pertinent to the water resource management in the country include poor catchment management, which is also a problem with high levels of erosion resulting in the increase of silt deposition in the country's dams and a subsequent reduction in yield, as for instance Welbedacht Dam in the Caledon River.

The study on Future Climates in South Africa (DEA, SANBI, GIZ, 2013)[22] concluded that climate change will have a limited impact on water supply at a national level but could be quite significant at regional level under particularly drier futures. The greatest concern regarding climate change, are the isolated water resource systems that are dependent on a single resource or small geographical area with limited hydrological variability**,** including small farm dams in headwater catchments and water supply schemes for rural towns. Systems with greater integration and diversification have greater resilience to climate change uncertainty, such as the Integrated Vaal River System. The Western Cape System, being dependent on limited resources, and located in the west, may experience substantial climate change impacts. Also, more variability due to climate change, including more flush floods, may require more storage to provide the required yield of a system.

Although climate change brings an added uncertainty to water resources, the impacts can and should be mitigated. The relatively gradual nature of climate change allows time for well-considered adaptation and mitigation measures. However, there is growing concern that the decreasing monitoring through rainfall and flow gauging networks are no longer sufficient to accurately detect these trends to ensure mitigation measures are planned and put in place timeously.

3.6.1.2 Groundwater

Although groundwater currently is an underutilised resource, in some areas it is totally over-utilised and groundwater levels are over abstracted.

Failure of groundwater supply schemes, such as typical conclusions that "the borehole dried up", or "the groundwater ran out", is also often blamed on the resource (i.e. the aquifer or the groundwater levels). In reality the cause is rather on poor maintenance and operation of the infrastructure (including boreholes, pump, pipes and valves, pumping at very high rates for short periods of time) used to abstract the groundwater or the poor monitoring or management of the aquifer.

[22]Department of Environmental Affairs. 2013. The Economics of Adaptation to Future Climates in South Africa: An integrated biophysical and economic analysis.

These challenges create the wrong impression about groundwater and make groundwater unpopular with communities, resulting in them rather preferring water supply from a dam.

Groundwater is also subjected to climate change, as groundwater aquifers will not recharge without suitable rain. The increase in temperatures due to climate change will also result in drier root zones of plants, abstracting water from available groundwater.

Artificial groundwater recharge, with either surplus surface water or treated wastewater, is recognised as an important alternative source, however, the impact on the receiving source must be minimal (aquifer hydraulics), injection water must be almost the same quality (<10% difference or pre-treated to similar quality) and the impact on the environment must be assessed and minimised.

3.6.1.3 Internationally-shared river basins

The purpose of international water cooperation is to strategically develop, promote and manage international relations on water resources between countries through bilateral and multilateral cooperation instruments and organizations in line with the provisions of the National Water Act, Act 36 of 1998 and to pursue the national interest at both African multilateral and global multilateral organizations and forums in support of the water sector.

The Republic of South Africa (RSA) endeavours to meet all its international water obligations which require maintaining specific flows in rivers crossing its borders and/or groundwater abstraction from aquifers, at a reasonable quality. International obligations, although fixed, are always subject to change through review of the agreements that give effect to these obligations, in order to keep abreast of development and to stay relevant.

3.6.1.4 Alternative Sources

Alternative sources of water, although already part of the water resources mix, will be further promoted and developed to fill the gap in available water.

Desalination of seawater and brackish water

Desalination is still a relatively expensive augmentation alternative, and it should only be implemented as and when augmentation becomes necessary to form part of the permanent water supply**.** Although it can be implemented as an emergency supply during a drought, it is probably not feasible or sustainable, and may result in mothballing of the plant. While dormant the plant will still need a fixed maintenance cost.

It is preferable that desalination plants form part of our coastal municipalities' basket of water resources for continuous water supply, and not be implemented as an emergency scheme, only to be used intermittently or during times of drought and inadequate supply from the conventional water resources. These schemes are too costly to be moth-balled for any length of time.

Water re-use

Direct re-use is where the discharge from a wastewater treatment works (WWTW) is treated to process or potable standards and fed back into the water distribution system.

There is huge scope for developing this source, especially in the larger towns and cities where suitable wastewater treatment technology is employed, suitably skilled staff is available to ensure proper treatment and monitoring of the water, and it is economically feasible. The scope is especially important for coastal cities where further freshwater resources are becoming very scarce and costly to develop, while the outflow from WWTWs is often discharged into rivers close to estuaries or directly into the sea.

The National Water Re-use policy aims to develop clear and practical guidelines for typical water re-use projects on what regulatory approvals are needed, the status of reclaimed water in terms of right to use and how these can be obtained cost and time effectively. There is also a need to work with other institutions to align legislation, reduce the regulatory burden wherever practical, and unblock regulatory obstacles to water re-use.

When considering the development of direct re-use inland, cognisance should be taken of the impact of reducing return flows in the system on downstream users.

Acid Mine Drainage

In the Witwatersrand area, in Gauteng, gold mining has taken place since 1886 in the three underground mining basins of the East, Central and West Rand, sinking more than 120 mines that required to be dewatered to allow for safe mining conditions. As the mines were worked out and abandoned, the mine voids (tunnels, drives and shafts) started filling with water, generating Acid Mine Drainage[23] (AMD) when sulphide bearing minerals are exposed to oxygen and water. When the AMD starts overflowing from the mines, it will have a devastating impact on humans and the environment, impacting much of the Vaal River System.

Recognising the challenge for South Africa, DWS led initial short-term interventions to protect the environment. The opportunity to turn a pollution problem into a water source has been investigated at feasibility level. The potential to treat the water, approximately 54,8 million m³/a, to potable standard or for industrial use in the Witwatersrand was found to be feasible.

[23] Department of Water Affairs. 2013. Feasibility Study for a Long-Term Solution to address the Acid Mine Drainage associated with the East, Central and West Rand underground mining basins.

Rain Water Harvesting

Domestic rainwater harvesting should be encouraged as a way of improving household food security, income savings and improved reliability of water supply, especially in rural areas. Although mostly only suitable as augmentation, it has been proven that, with good management, rainwater harvesting can yield more economical water than formal municipal water supply.

Water Conservation and Water Demand Management (WC/WDM)

WC/WDM targets will be set for all water use sectors: agriculture, industries, mining, power generation, municipal and domestic water supply, to reduce total the water requirements, as discussed in **Section 3.2.3**.

3.6.1.5 Flood Protection Infrastructure

Floods are a common occurrence in South Africa and they lead to the loss of lives and hundreds of millions of rands worth of property destruction. Flooding occurs in all river systems in the country with notable floods in the North-West province (2017), Lephalale (2014), Somerset West (2013), Vereeniging (2010), Vaal (1996), KwaZulu-Natal (1987) and Laingsburg (1981). Other flood prone areas include the towns of Douglas, Prieska and Upington along the Orange River.

Measures for protecting lives and property from floods can be both non-structural and structural. The former aims to mitigate or reduce the impacts of floods by influencing human behaviour and practices through policies and laws, public awareness raising, training and education.

The structural approach entails the creation of physical defence systems in order to control the flood waters through the reduction of its destructive power or by redirecting the flood waters away from exposed human settlements and property. It also includes measures such as planting vegetation to retain extra water; terracing hillsides to slow flow downhill; the construction of floodways (man-made channels) to divert floodwaters and construction of levees, lakes, dams, reservoirs and retention ponds to hold extra water during times of flooding. The protection and restoration of natural ecological infrastructure is also critical in flood management.

Owing to the high capital and maintenance costs, dedicated structural flood control measures are not widespread in South Africa. The only major flood control dams in South Africa are Beervlei and Qedusizi dams. Instead, major water storage infrastructure doubles as a flood control measure. Those with gated spillways, such Vaal and Bloemhof dams, have supplementary storage and specific operating rules for flood control.

Flood protection must create a safe environment. All dams will be designed to safely control floods. Operating rules, based on a dynamic monitoring system of our rivers during flood events, will be implemented, with appropriate warning systems.

3.6.2 Water Requirements

Rainfall, runoff and stream flow vary from year to year. As a result, 100% assurance of water supply to any water user is not achievable. Implicit in this is the acceptance that some degree of failure with respect to supplying of the full yield, will occur. For a specific river and water resource infrastructure, the higher the assurance of supply required (or the smaller the risk of failure which can be tolerated), the smaller the yield which can be abstracted, and vice versa.

In South Africa, water resource development projects have been designed, developed and operated with allocation criteria or standard operating rules that allow for user classification and their tolerance to failure of water supply.

Water for power generation is seen as strategically important and is provided with the highest assurance of supply (99.5 %) (which translates to 1: 200-year risk of failure). Water to meet international obligations is also given a high priority. These priorities are built into the determination of the operating rules. **Table 3-3** presents a simplified typical user classification for different water users.

Table 3-3: Simplified assurance of supply per user sector

User sector	Assurance of supply	
	Recurrence interval	Annual reliability %
Strategic (power generation)	1:200	99.5%
Domestic – basic	1:200	99.5%
Industrial	1:100	99%
Domestic – other	1:50	98%
Irrigation – high value	1:20	95%
Irrigation – cash crops	1:10	90%

A brief description is given in the following sections on the perception of problems, challenges for water requirements per water use sector.

3.6.2.1 Municipal and domestic, including commerce and industry in municipal areas

The current official census puts the population of South Africa at approximately 56 million. Further growth in the population, eradication of backlogs and general improvement of water services will see a steep increase in water requirements for this sector in the short to medium term. It is expected that most of the new water that will have to be made available in future will be to meet the growing requirement for this sector.

As indicated elsewhere in this document, average domestic water use in South Africa is around 237 litres per person per day, 64 litres per person per day more than the world average of 173 litres per person per day. The high-water use is partly due to significant distribution losses and wastage in this sector and must be addressed to reduce the high growth in requirements.

A stricter approach towards implementation of WC/WDM measures by municipalities should be adopted.

The provision of waterborne sanitation is unsustainable and South Africa must adopt alternative sanitation practices, such as waterless sanitation, which will also reduce water per capita consumption and should be implemented where appropriate.

3.6.2.2 Agriculture and Forestry

Water use in agriculture is largely dominated by irrigation of crops, stock watering and by forestry. Agricultural consumption is largely unmetered, and there are concerns about unauthorised abstraction and water wastage in the sector. In addition, agricultural users pay a much lower tariff than other users of untreated water and the relatively cheap water has not incentivised the adoption of water efficient irrigation practices. However, the agricultural sector is important in terms of jobs and contribution to GDP. The value of primary agricultural production in South Africa was R263,2 billion in 2016[24].

The potential for future water resources developments purely for irrigation are limited and in **Section 4.2** of this NW&SMP an indication is given of the possible expansion of irrigation with an additional 34 863 hectares (Irrigation Strategy [2013] of DAFF). Implementation plans will carefully consider the capital and operational costs needed to provide affordable additional water to this sector. The cost of raw water from newly developed schemes and high pumping costs can limit the additional expansion of irrigation areas. Agriculture is encouraged to move to more efficient methods of irrigation to allow for future expansion with the water already allocated to it.

New forestry expansion in stressed catchments will also be discouraged.

3.6.2.3 Strategic Power Generation

Eskom is the biggest power generation utility in Africa, and water supply to the power stations is regarded as a strategic water use that is supplied at 99.5% assurance of supply, refer to **Table 3-3**.

[24] Statistics South Africa. 2016. Gross Domestic Product by Industry.

DWS signed a Memorandum of Understanding (MoU) with Eskom in which the utility committed to systematically move from wet-cooled to dry-cooled power generation systems, to reduce their water foot-print. This undertaking was already implemented for the new coal power stations, Kusile and Medupi with a water allocation estimated at 15.4 million m³/a.

In 2004 the National Environmental Management: Air Quality Act was promulgated, followed by the publication of the Minimum Emission Standards (MES)[25] in April 2010, heralding a new approach to air quality management in South Africa. As the MES requires all plants to comply with the new emission standards from 1 April 2020, this will have significant water use implications for Eskom, as the best available technology to remove pollutants from effluent gases utilizes significant quantities of water, as shown in **Table 3-4**. The water requirements allocation for the new Kusile and Medupi power stations include some provision to comply with the MES.

[25] Department of Environmental Affairs (DEA). 2010. Minimum Emission Standards.

Table 3-4: Summary of Water Requirements for the existing Eskom Power Stations (Source: Eskom, 2013, and Eskom Webpage[26])

Power Station	Installed capacity (MW)	Current water requirements (million m³/a)*	Additional water requirements (million m³/a) to implement MES$
Majuba	4 110	29	5 to 8
Matimba	3 990	3	5 to 8
Kendal	4 116	4	5 to 8
Tutuka	3 654	39	5 to 7
Lethabo	3 708	42	5 to 7
Duvha	3 600	39	5 to 7
Matla	3 600	45	5 to 7
Kriel	3 000	41	4 to 6
Arnot	2 352	27	3 to 9
Hendrina	2 000	25	3 to 9
Camden	1 510	20	2 to 8
Grootvlei	1 200	9	2 to 6
Komati	940	10	2 to 11
Total	**37 780**	**333**	**51 to 101**
New power stations			
Medupi	4 788	4 / 15.4	8
Kusile	4 800	4	8
Total	**47 368**		

Table 3-4 summarises the current water requirements at the existing power stations and the additional water requirements[27] at each power station should the relevant MES technology be implemented, increasing the demand between 15% and 30% for existing power stations, depending on the type of technology. This first order assessment indicates the possible impacts on Eskom's water use with the implementation of the emission reduction technology

[26] Eskom. 2013. fttp://www.eskom.co.za/Whatweredoing/ElectricityGeneration/PowerStations/Documents/EskomGenerationDivMapREV8.pdf

[27] Eskom. 2013. Compilation of an application for exemption from Minimum Emission Standards and extension of the Minimum Emission Standard timeframes for Eskom's Power Stations: Water Resources Assessment.

has the potential to worsen the already existing water security challenge in South Africa. Further studies are urgently required to quantify the impact, including a cost-benefit analysis to ensure that the costs of augmenting water supply to the Eskom power stations to implement the best emission reduction technology process option. This is in consideration of the fact that South Africa is a water scarce country and that additional water may be used more beneficially to address the transformation requirements in this sector and to increase assurance for domestic supply.

Water resource planning and development will need to take into consideration these additions to the strategic water requirements for power generation in the country.

3.6.2.4 Mining and Industry

The economy of the country largely depends on mining and various large industries. Water availability should not be a limiting factor to growth in this sector. Water resources developments should prioritise the availability of water to this sector. However, mining and industry will also be required to practice WC/WDM and to consider re-use of both mining and industrial wastewater in their processes, to reduce raw water requirements. A target of a maximum of 15% water losses should be set for all industries. Penalties for non-compliance should be considered.

3.6.2.5 International Obligations

South Africa has four internationally-shared river basins, the Orange, Limpopo, Inkomati and Maputo river basins, covering about 60% of the country's land area.

Climate change and economic growth in shared basin states may result in the re-assessment of current arrangements with respect to transboundary water resources (surface and groundwater). South Africa will always endeavour to meet all its international obligations hence any new water resources development with a trans-boundary impact will be planned and implemented in consultation with the relevant basin states.

3.6.2.6 Hydropower[28]

South Africa has potential to develop mainly small-scale hydropower at existing DWS infrastructure such as dams, canals, pipelines as well as making use of the water resources in the country, including that in shared river basins. Instead of dams being constructed for the

[28] Department of Water and Sanitation. 2016. Draft Policy on Sustainable Hydropower Generation

purpose of hydropower, existing reservoirs that are used for other purposes can be fitted with hydropower plants in order to augment electricity supply towards meeting peak electricity demands.

An objective of the NWRS2 (2013) is to "promote the optimal development of hydro-electricity generation at all sites in South Africa where this is economically viable and can make a useful contribution to electricity generation." Hydropower development and its operation must be developed and operated in accordance with the principles of the National Water Act, namely sustainability, equity and efficiency.

Challenges with hydropower technology include: dependence on rainfall (no control over amount of water available); changes in stream regimens (can affect fish, plants, and wildlife by changing stream levels, flow patterns, and temperature); flooding of land and wildlife habitat (creation of reservoir). Maintaining minimum flows of water downstream of a hydropower installation is critical for the survival of riparian habitats.

3.6.2.7 Ecosystems

Providing for the ecological water requirements is a legal priority and is inherent in all water resources planning that environmental water requirements will be catered for. In addition, critical ecological infrastructure must be identified, protected and restored, including in high yield catchment and aquifer areas (see **Section 8** on ecological infrastructure). Currently the ecological condition of rivers and wetlands is deteriorating at an alarming rate.

3.7 PRIORITIES FOR THE FUTURE

The objective for water resources planning is to ensure water security for the country by matching the increasing future water requirement in a situation of constrained resources by being innovative and optimising a suite of interventions which include the management of resources (including water conservation and water demand management, system operation and drought management and the re-establishment of existing groundwater schemes), catchment support activities (including catchment care and ecological infrastructure, rainfall harvesting and water quality monitoring) and the infrastructure development of resources.

3.7.1 Water availability

The challenge of a water scarce country is to provide water security to all users while meeting the growing future requirements with an optimised mix of all available water resources. **Figure 3-13** shows the projected medium- and long-term available water resources mix of conventional and unconventional water sources, including increased groundwater use, desalination, re-use and artificial recharge.

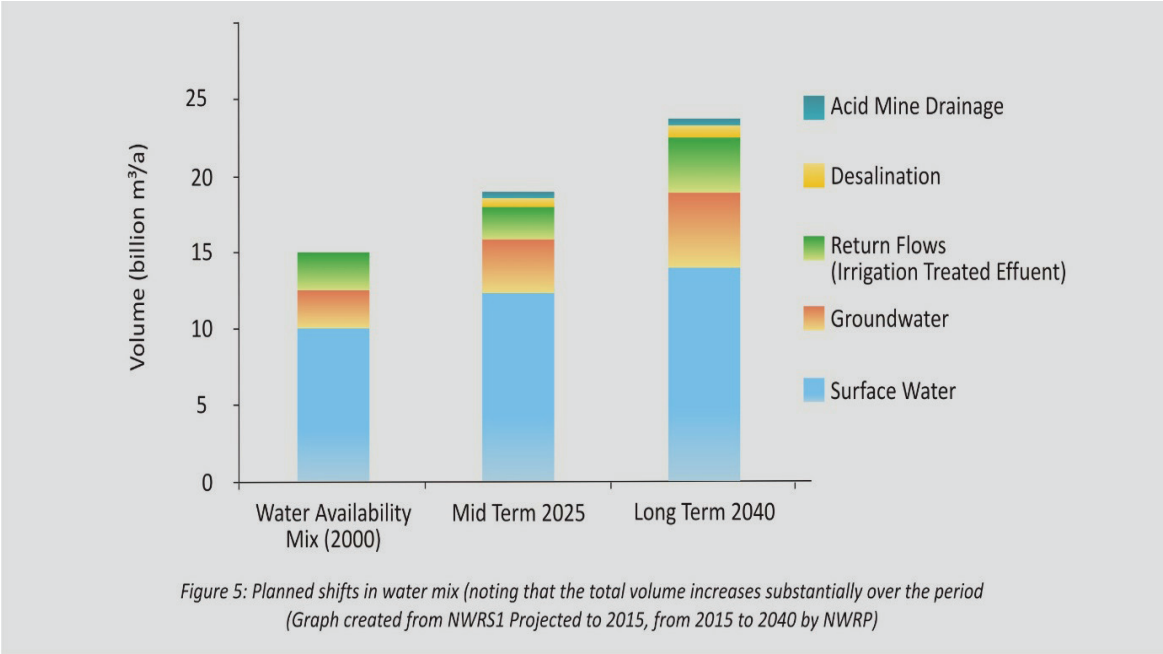


Figure 3-13: The planned shifts in water mix in the medium and long term, noting that the total volume increases substantially over the period (Graph created from NWRS1 Projected to 2015, from 2015 to 2040 by DWS Directorate: National Water Resources Planning - NWRP)

This figure includes the various interventions as explained in the Reconciliation Strategies. Planned future storage dams include among others the Polihali Dam in Lesotho (Phase 2 of the Lesotho Highlands Water Project), a dam on the Orange River near Vioolsdrift, the Ntabelanga and the Lalini dams on the Itsitsa River (Umzimvubu), the Zalu Dam on the Xura River, the Foxwood Dam on the Koonap River, Smithfield Dam on the uMkhomazi River, a dam on the Mvoti River, a dam in the Crocodile River East Catchment, Nwamitwa Dam on the Groot Letaba River as well as the Jana and Mielietuin dams on the Tugela River.

Table 3-5: The planned shifts in water mix in the medium and long term, noting that the total volume Water availability per sector (Source: DWS Directorate: National Water Resources Planning - NWRP)

User sector	**Source**	**Available yield million m³/a**				
		2015	**2020**	**2025**	**2030**	**2040**
Municipal and Industrial	Surface water	3000	3200	3500	3500	3600
	Ground water	800	900	1000	1100	1200
	Re-use	400	450	650	850	1000
	Desalination	90	150	160	200	300
Strategic/Energy	Surface water	360	350	348	344	300
	Ground water	2	5	6	7	10
	Re-use	0	39	61.	86	132
Agriculture	Surface water	6400	6500	6700	6790	6800
	Ground water	1800	1880	1900	1900	1900
	Re-use	919	942	966	971	976
International transfers out	Surface water	178	178	178	178	178
TOTAL water per source	Surface water	***9 938***	***10228***	***10726***	***10812***	***10878***
	Ground water	***2 602***	***2785***	***2906***	***3007***	***3110***
	Re-use	***1319***	***1431***	***1677***	***1907***	***2108***
	Desalination	***90***	***150***	***160***	***200***	***300***
TOTAL water available		**13949**	**14594**	**15469**	**15926**	**16396**

It is important, that communities in the vicinity of new large water resource developments, without local resources, will be supplied from these developments as a matter of principle.

It must also be noted that from a purely ecological viewpoint there are a number of rivers that were identified to stay dam-free, or 'free-flowing' in South Africa. (See **section 8.3.1** of Volume 2) This will call for a serious debate and wisdom based on sound investigations. The rivers are identified in the National Freshwater Ecosystem Priority Areas (NFEPA)[29].

[29] Department of Environmental Affairs. 2011. National Freshwater Ecosystem Priority Areas.

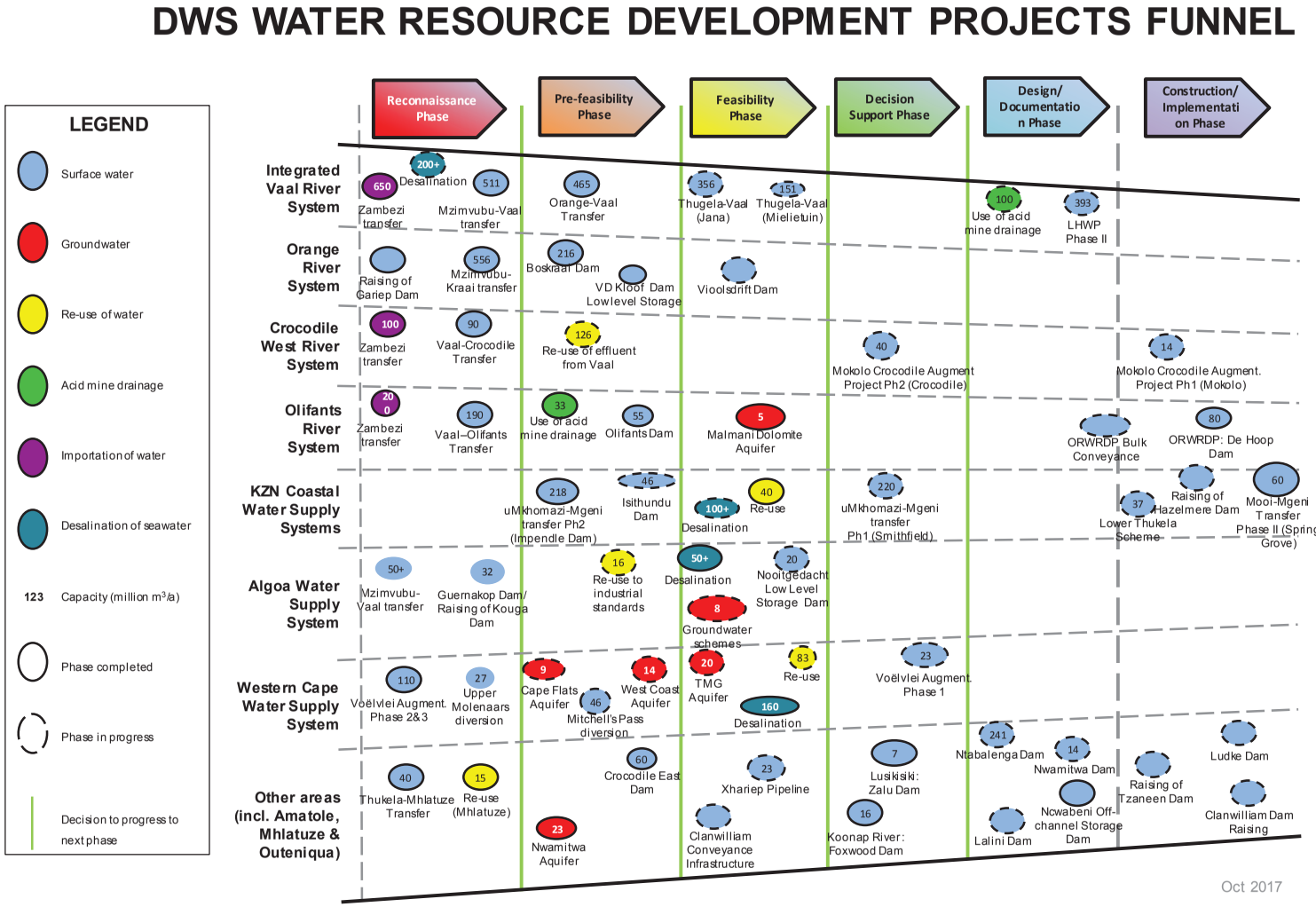


Figure 3-14: Planning and Implementation of the Water Resource Development Projects (Source: DWS Directorate: National Water Resources Planning – NWRP, October 2017)

The additional potential of accesable groundwater between 1 500 and 2 500 million m³/a, is very widely distributed across the country and its potential availability offers particular opportunitiesy for small towns, villages, mines, and individual users to meet their water requirement for domestic use, irrigation and stockwatering. Groundwater availablity will continously be assessed in the Reconcilaiton Strategies and All Town Studies.

All future schemes, shown in **Figure 3-15**, will be developed utilising good planning and engineering practice appropriate technology and must be cost effective.

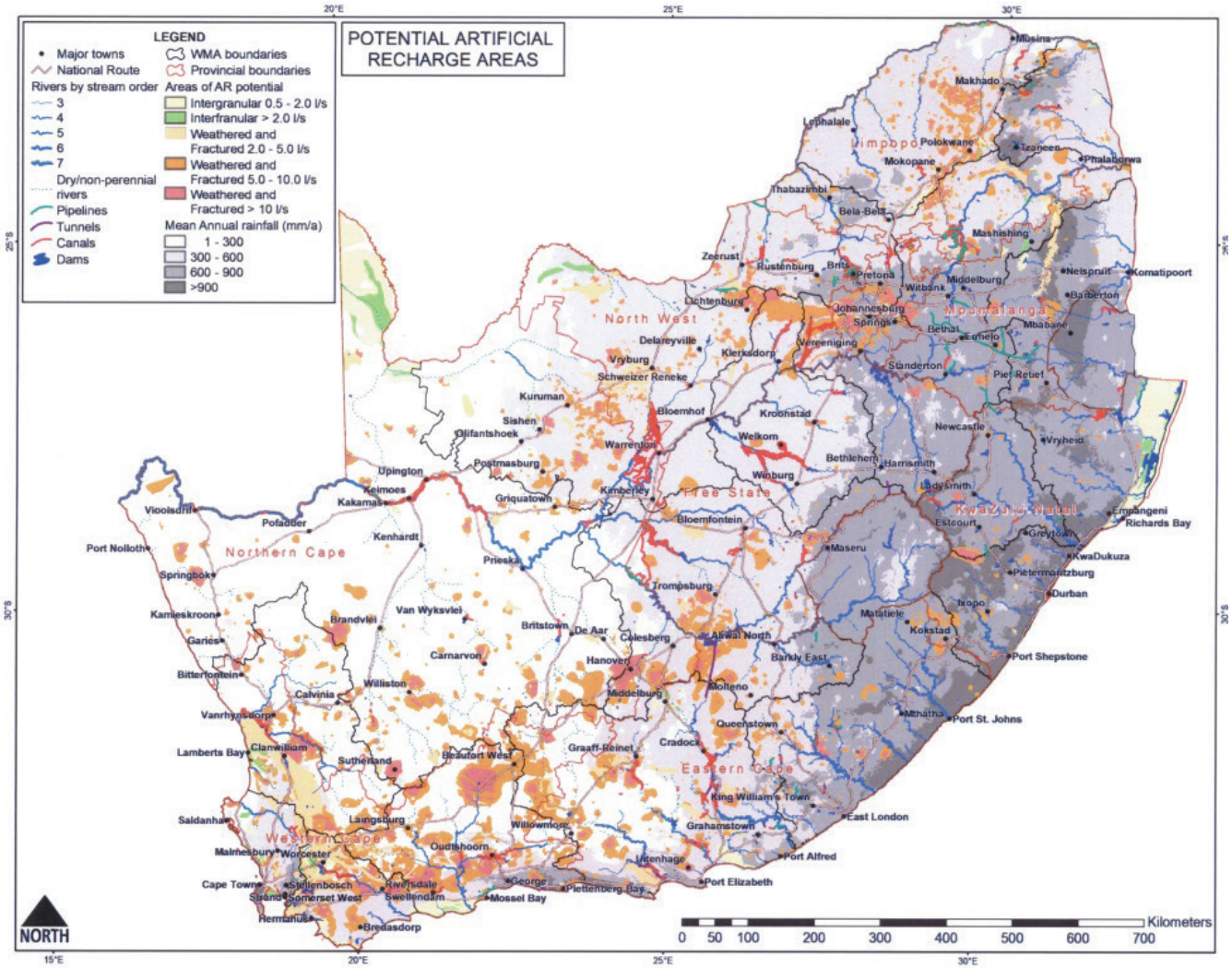


Figure 3-15: Potential Artificial Recharge areas in South Africa

Artificial recharge of groundwater in certain areas will become a strategic focus in ensuring sustainable and reliable water sources in future.

Alternative sources of water, although already part of the water resources mix, will be further promoted and developed to fill the gap in available water.

Desalination: Feasibility studies for large-scale seawater desalination projects on a scale of 150 to 450 Ml/day have already been completed for both eThekwini and Cape Town, with the Nelson Mandela Bay Municipality currently also investigating large-scale seawater desalination for future augmentation of its resources[30]. Technical feasibility was established in both eThekwini and Cape Town, even though cost considerations have led to other smaller water augmentation projects being given priority.

The persistent drought and water crisis in the Western Cape has resulted in a call for short-term desalination solutions. This may well precipitate a renewed consideration of the earlier large-scale, permanent projects evaluated. Two or even three large-scale seawater desalination projects are likely to be launched nationally within the next five years in the major coastal hubs.

Water re-use: Several successful projects to re-use treated municipal wastewater for industrial processes are in operation in South Africa. At a river system level, it is estimated that return flows account for 13% of the total available water. At the treatment facility level, the 1 150 municipal wastewater treatment works, discharging approximately 2 100 million m³ per annum of treated effluent, back to the river systems. DWS needs to develop guidelines for the implementation of water re-use projects. These guidelines will have to support sound decision making and implementation. The guidelines must also address the management and control, project implementation, choice of technology, operations and maintenance, project financing, development and implementation of tariffs and public and stakeholder education, engagement and consultation for different types of water re-use projects.

Acid Mine Drainage: Approximately 54,8 million m³/a AMD water will be treated to potable standard or for industrial use in the Witwatersrand. The Olifants River Water Supply System Reconciliation Strategy also identified the use of treated mine water for future augmentation to the system.

Re-allocation of Water: Identify re-allocation of water between water use sectors in the systems where no alternative resource is available, in the relevant Reconciliation Studies.

Rain Water Harvesting: Encourage rainwater harvesting to improve the reliability of water supply in rural areas and municipalities where services are unreliable.

[30] Department of Water and Sanitation. 2016. KZN Metro Reconciliation strategy.
Department of Water and Sanitation. Reconciliation Strategies for Western Cape Water Supply System

Water Conservation and Water Demand Management: Encourage and promote WC/WDM practices for all water use sectors.

The impact of climate change on resource availability and water requirements should be taken into account in all future planning, including Reconciliation Strategies. Mitigation measures can then be introduced as their necessity becomes evident, but then adequate data is essential to support the decisions to be made. Therefore, it is vital that the monitoring of rainfall, evaporation and runoff be continued rigorously, and the hydrological monitoring network improved to ensure that the actual effects of climate change are measured accurately and brought as quickly as possible into the analysis of resources. A specific climate change-related focus should be to find alternative resources for the Western Cape System and other single source systems, to improve resilience to future climate change uncertainty.

With the development of any water resource on an internationally-shared river basin, South Africa endeavours to meet all its obligations through the recognised processes and protocols. South Africa will also participate and cooperate in joint trans-boundary studies, joint projects and development of common decision-support tools to ensure monitoring and decision making are based on a common understanding.

Two projects are underway attempting to promote cooperative trans-boundary groundwater governance and management between sharing countries. These are the South Eastern Kalahari/Karoo Basin (known as the Stampriet Aquifer System) entering Phase 2 and funded by the Swiss Agency for Development and Cooperation and the Khakhea/Bray Dolomite Basin (known as the Ramotswa Aquifer) nearing the end of Phase 1 and funded by the United States Agency for International Development (USAID).

3.7.2 Water requirements

Growth in water requirements depend on many factors, including the future economic growth, existing policies and memoranda of understanding (MoUs) and agreement (MoAs) between various industries and government. Current projections of future water requirements for each sector are shown **Table 3-6.**

Table 3-6: Current Projections of Future Water Requirements

No	User sector*	Water requirements (million m³/annum)				
		2015	2020	2025	2030	2040
1	Municipal (industries, commerce, urban and rural domestic)	4 447	4 900	5 400	5 800	6 600
2	Agriculture (irrigation and livestock watering)	9 000	9 500	9 600	9 700	9 800
3	Strategic/Power generation	362	390	410	430	450
4	Mining and bulk industrial	876	921	968	1 017	1 124
5	International obligations	178	178	178	178	178
6	Afforestation	431	432	433	434	434
	Total	15 294	16 321	16 989	17 559	18 586

* *Water for the environment as enshrined the National Water Act, 1998 take priority over all the other water uses, hence, in most instance water available is shown after the provision for the ecological water requirements, as discussed in* ***section 8****.*

The water requirements growth trends can be observed from **Figure** 3-16. Growth in the municipal sector is mainly, driven by improved services, eradication of backlogs, population and most importantly systems attrition resulting in huge real losses and this needs to be urgently addressed. Growth in agriculture will soon reach a threshold level that expansion in this sector will only be achievable if the sector capitalises on water savings or water re-allocated.

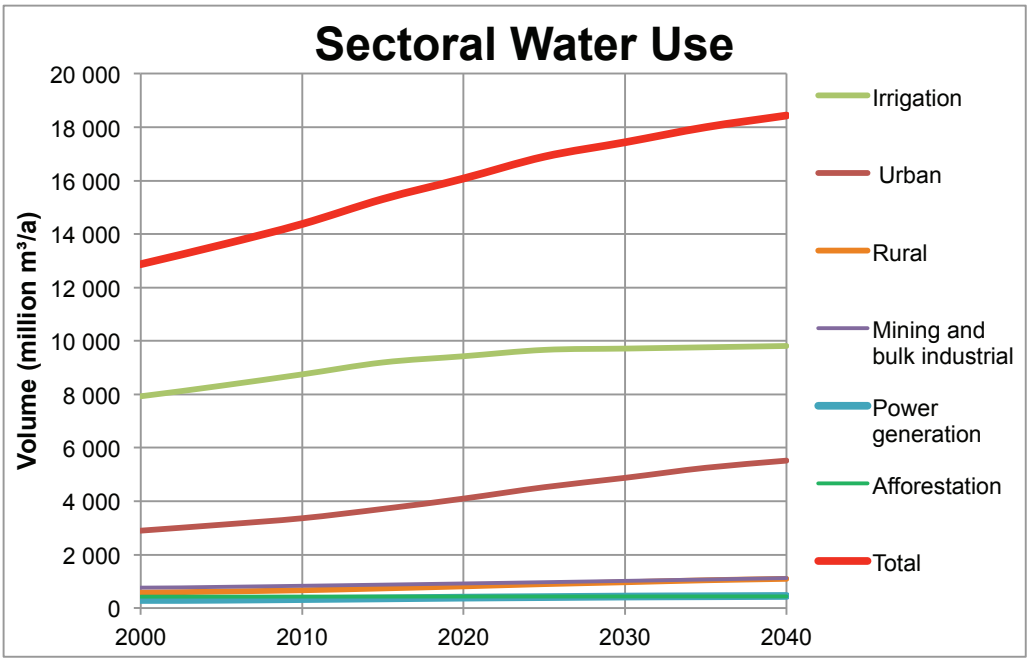


Figure 3-16: Overview of South Africa's water requirements (Source: DWS Directorate: National Water Resources Planning - NWRP)

3.7.3 Water balance

The national water balance is a reconciled account of the entire country's water resource availability versus current and future estimated water requirements for all users. However, the spatial distribution of water availability and requirements are not shown in the balance.

It should be noted that the future water balance is dependent on future economic and population growth and the timely implementation of interventions. Effective operation and maintenance of infrastructure (water resources and water services) results in improved water use efficiency, reduced losses, and the ability to use water resources sustainably even in periods of drought.

Table 3-7: Provisional national water balance with and without critical interventions[31]

Water use sectors	2030 water requirements projections (million m³)		
	Without demand management interventions	With urban losses reduced from 35% to 15%	Reduce domestic demand from 237 l/c/d to 175 l/c/d
Agriculture (irrigation and livestock watering)	9 700	9 700	9 700
Municipal (industries, commerce, urban and rural domestic)	5 800	4 941	3 696
Strategic/Power generation	430	430	430
Mining and bulk industrial	1 017	1 017	1 017
International obligations	178	178	178
Afforestation	434	434	434
Total water requirements (2030)	**17 559**	**16 700**	**15 455**
Total water available (2015)	13 949		
Increased surface water yield	874		
Increased groundwater use	405		
Desalination (including treated AMD)	588		
Re-use	110		
Total water available (2030)	**15 926**	**15 926**	**15 926**
Deficit/surplus	-1 633	-763	527
Deficit/surplus	**-10%**	**-5%**	3%

[31] Department of Water and Sanitation. 2013 National Water Resource Strategy.

3.7.4 Reconciliation Studies

Reconciliation Strategies for the large water supply systems and metropolitan areas were developed by DWS and are being updated regularly (annually) to establish the *status quo* of water balances and to recommend interventions for ensuring sufficient future water resources are developed to ensure a sustainable water for supply.

Reconciliation Strategies at a lesser scale of detail have also been developed for all other towns and clusters of villages in the country in the All Town Studies. The figure below indicates where water shortages are likely to occur in the next 10 years, and where they already exist.

Category	Count of schemes	% of schemes
no shortage > 10 yrs	334	37%
water resource shortage 5 - 10 yrs	113	12%
water resource shortage 1 - 5 yrs	120	13%
water resource currently in deficit	273	30%
unknown	65	7%
Grand Total	905	100%

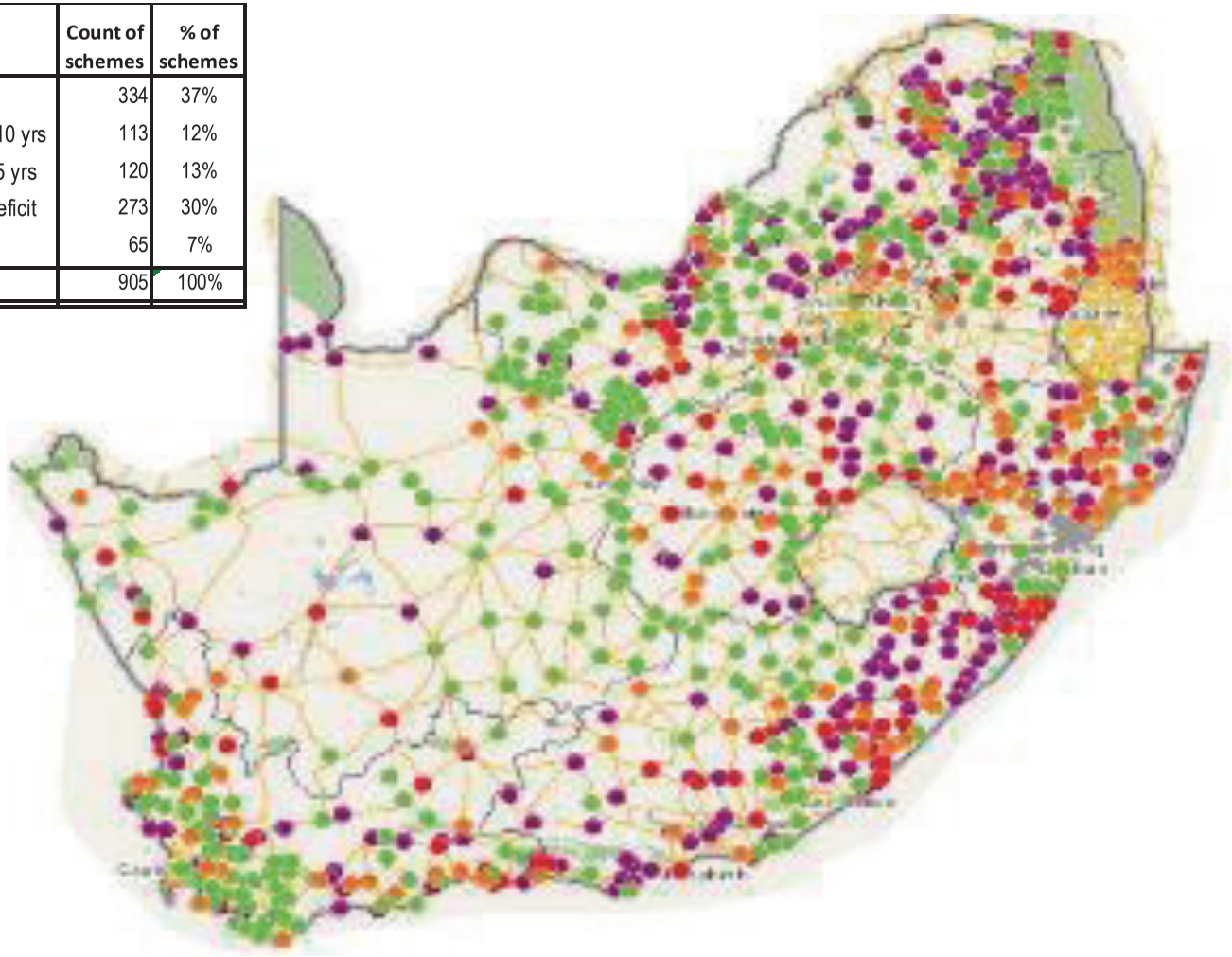


Figure 3-17: Water Balance at Municipal Level from All Town Studies

These Reconciliation Strategies are available on http://www.dwa.gov.za/projects.aspx, and the concluded interventions from these inform and are inputs into the NW&SMP. See Annexure 2 for a summary of these Reconciliation Studies.

The following sections present the reconciliation of the requirements for and availability of water for each of the main systems in the country, summarised in **Table 3-8**. Interventions have been identified for all these systems to resolve imbalances, together with more stringent implementation of WC/WDM, regarded as non-negotiable. Implementation of development options were scheduled according to the projected future water requirements, after provision was made for the best estimates of the savings that could be achieved through WC/WDM.

Table 3-8: Water balances for different water supply system (million m³/a)[32]

Water Supply System	Major Towns and other users	Million m³/a	2015	2020	2025	2030	2035	2040
Vaal River System	Johannesburg, Pretoria	Requirements	3 000	3 120	3 290	3 430	3 530	3 600
		Availability*	3 000	3 154	3 457	3 600	3 617	3 640
Orange River system	Bloemfontein, Irrigation (Orange Fish Sundays transfer)	Requirements	2 980	3 097	3 100	3 130	3 140	3 150
		Availability*	3 000	2 950	3 250	2 966	2 830	2766
Kwa-Zulu Natal Coastal Metropolitan Bulk WSS**	eThekwini (Durban), Msunduzi (Pietermaritzburg)	Requirements	499	561	583	679	720	705
		Availability*	471	499	542	791	789	736
Richards Bay WSS	Mhlatuze City	Requirements	195	225	247	260	278	292
		Availability*	241	239	247	284	283	290
Mbombela Bulk WSS (Crocodile East WMA)	Mbombela	Requirements	58	62	67	70	73	76
		Availability*	60	69	71	72	74	76
Western Cape WSS	Cape Town, Agriculture	Requirements	520	590	710	850	1 000	1 125
		Availability*	550	590	800	880	1 090	1160

[32] Water balances as per relevant Reconciliation Strategies, including the implementation of relevant interventions, as summarized in Annexure 2.

Water Supply System	Major Towns and other users	Million m³/a	2015	2020	2025	2030	2035	2040
Amatole Bulk WSS	Buffalo city and King Williams Town	Requirements	108	115	121	123	124	125
		Availability*	98	104	115	115	115	124
Algoa WSS	Nelson Mandela Bay, irrigation and industry	Requirements	169	182	203	220	240	258
		Availability*	170	195	195	208	225	225
Limpopo WMA WSS* **	Polokwane, mining, coal fire power generation	Requirements	193	261	312	362	374	408
		Availability*	178	268	409	418	422	433.15
Olifants River WSS	Agriculture, mining and Kruger National Park	Requirements	405	458	496	524	546	566
		Availability*	409	425	422	427	435	442
Crocodile (West) River System	Rustenburg, Thabazimbi, agriculture, mining, power generation	Requirements	1 075	1 170	1 220	1 285	1 330	1 365
		Availability*	1 115	1 200	1 260	1 350	1 410	1460
Greater Bloemfontein Bulk WSS	Mangaung Municipality and surrounding areas	Requirements	89	104	123	143	168	191
		Availability*	94	105	130	162	162	162
Luvuvhu and Letaba WSS	Thohoyundou, Giyani, Tzaneen, Kruger National Park, Irrigation, mining	Requirements	164	215	240	251	266	277
		Availability*	220	243	259	263	272	276

Colour code

DEFICIT *BALANCED*

* *The water availability figures into the future in most of the systems are showing the implementation of the recommended interventions to augment those systems, as per Reconciliation Strategies.* ***If interventions are not implemented, water availability figures will be constant from 2015.***

** *Kwa-Zulu Natal Coastal Metropolitan Bulk WSS includes the Mgeni System, the Northern (to the Thukela River) and Southern (to the uMtwalume River) Coastal areas.*

*** *Some of the Limpopo WMA WSS exclude the irrigation.*

**** *Reconciliation Strategy not yet developed for Mahikeng Municipal Water Supply System.*

Delays of intervention in the national critical water supply systems, such as the implementation of Phase 2 of the Lesotho Highlands Water Project (LHWP) (to augment the Vaal River System for greater Gauteng), the uMkhomazi Water Project Phase 1 (to augment the Mgeni System for the KwaZulu-Natal Coastal Metropolitan Region) and the augmentation of the Western Cape Water Supply System, significantly impacted the water security, and subsequently the socio-economies of these areas. The recent water crisis in Cape Town serves as a stark reminder of the impacts of delayed action.

Thirteen (13) out of the fourteen (14b) large systems Reconciliation Strategies that have been developed are discussed in Annexure 2. It should be noted that continuous implementation and monitoring of WC/WDM is critical in all systems.

3.8 PRIORITIES FOR THE FUTURE

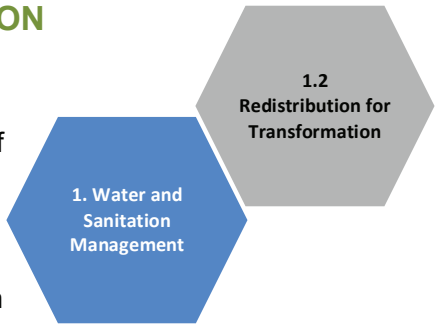
The following table provides a summary of priority actions (as copied from Volume 1 of the NW&SMP Call to Action):

Table 3-9: Priority Actions

Action	Responsibility	Completion date
PLANNING		
Develop, update and maintain reconciliation planning studies to achieve optimal water mix (surface water, groundwater, re-use and desalination, and incorporate climate change into studies) (Volume 3, Action 1.1.5)	DWS, CMAs, WSAs	2030
Do detailed feasibility study (including EIA) of high priority interventions (identified in Reconciliation Strategies) and develop bankable projects, with business case of required infrastructure, financing, institutional arrangements for ownership and operations as implementation mandate (1.1.6)	WSAs, DWS, CMAs	2030
Water Resources Catchment studies (Continuously undertake hydrological monitoring in order to improve the resiliency and sustainability of the available sources on account of future climate change) (1.1.7)	DWS, CMAs	2050
Develop a guideline for the protection, recharge, use and monitoring of groundwater (1.1.8)	DWS, WRC, CSIR	2022
Integrate results of All Towns studies and reconciliation studies into sectoral plans (domestic, agriculture, energy, mining, industrial development, land reform and rural development) (1.1.9)	DWS, DAFF, DoE, DMR, the dti, DRDLR	2022
Develop and implement Provincial Water Services Delivery Master Plans to provide reliable and sustainable water supply and sanitation services to all households within South Africa: • **Provincial Bulk Services Master Plans** • **Reliable Services Delivery Action Plans that includes a backlog analysis and infrastructure asset management plans (1.3.6)**	DWS, WSAs, CoGTA, SALGA, NT, WBs	2030
REDUCING DEMAND		
Reduce Non Revenue Water (NRW) and water losses in all municipalities to 15% below the business as usual (1.1.1)	DWS, CoGTA	2030
Set cap on water use with reducing targets over time (1.1.2)	DWS, CMAs, WSAs, CoGTA	2030
Reduce the water demands and water losses at all major irrigation and agricultural schemes by 2030, without affecting productions (1.1.3)	DWS, DAFF	2030

Action	Responsibility	Completion date
Reduce water demand and increase water efficiencies of industrial users (1.1.4)	DWS, the dti	2026
Implement the Water Administration System on all government irrigation schemes for transformation (1.2.3)	DWS, DAFF/PDAs	2024
Develop and implement a long-term plan for the turn-around of water supply and sanitation services in the country based on a sector-wide approach, that recognises DWS as regulator of W&S provision that includes the development of centralised programmes to obtain economies of scale and to ensure impact (e.g. driving municipal non-revenue-water improvements, and assessing the cost-effectiveness and appropriate systems for desalination) (1.3.1)	DWS, CoGTA, NT, SALGA	Annually
Revitalise the Green, Blue and No Drop programmes and publish results. Revise and establish norms and standards (1.4.1)	DWS, WSAs	Annually
Include water use efficiency and water loss reduction targets in the KPIs of municipal managers and municipal water supply and sanitation managers, and in municipal implementation plans (1.4.2)	CoGTA, Municipalities	2019
Establish Water Efficiency Labelling and Standards (WELS) Scheme (1.4.3)	SABS, DWS	2025
Identify (Blue Scorpions) and prosecute major non-compliant abstractors (water thieves) across the country, with a national communication campaign to accompany the action (1.4.4)	CMAs, NPA, SAPS, DEA, Regulator, DMR, DWS, Blue Scorpions	10 by 2020 Additional 10 by 2023
INCREASING SUPPLY		
Development of strategic water resources infrastructure (1.1.10)	DWS, LHDA, WSAs, WBs, TCTA	2025
Refurbish gauging stations (1.1.11)	CMAs, DWS	2027
Increase groundwater use (including artificial recharge) and re-use of water (1.1.12)	WBs, WSAs, DWS, CMAs	2024

4 REDISTRIBUTING WATER FOR TRANSFORMATION



4.1 PRESENT STATE

Transformation is critical in three areas: ensuring that the use of water for productive purposes is equitable, making sure that the governance of water is representative, and ensuring access to decent water and sanitation services for all. The latter two issues are dealt with in the institutional chapter and the chapter on effective water and sanitation services.

This chapter deals specifically with the issue of ensuring that black South Africans have access to sufficient water for productive purposes, whether small scale farming, commercial farming, afforestation, or any other use. Since, in most catchments in South Africa, there is little unallocated water still available, this requires the proactive transfer of water from current users to black water users – a process similar to that of land reform.

The National Water Act (NWA) and the White Paper on a National Water Policy (NWP), as well as the Second Edition of the National Water Resource Strategy (NWRS2) provide the legislative and policy framework for water allocation. However, these documents do not provide the detailed strategies and actions necessary to promote equity, sustainability and efficiency in water use, in a fair, reasonable and consistent manner.

The NWA stipulates that equity, sustainability and efficiency are the guiding principles of water resources management in South Africa. However, since the promulgation and implementation of the NWA, one principle that has not received the desired attention is equity, resulting in perpetuation of the status quo where the few large-scale water users still dominate access to and use of the resource. This is due to the historical legacy, on the one hand, and the lethargy in completing the roll-out and delegations to catchment management agencies (CMAs). This is an operational reality that the Water Allocation Reform (WAR) programme within the Department of Water and Sanitation (DWS) seeks to address. The *Water Allocation Reform Strategy* (WAR) developed by the Department serves as the strategic link between policy intent and the practical implementation of the provisions of the NWA. (DWA, 2008[33]).

[33] Department of Water and Sanitation (DWS). 2008.Water Allocation Reform Strategy.

In the agricultural sector, around 95% of the water is estimated to be used by white commercial farmers, many of whom continue to use water under the Existing Lawful Use clause of the National Water Act. Existing Lawful Use (ELU) was intended as a transitional arrangement. However, 20 years after the NWA was promulgated, ELUs still authorise the biggest volume of water used in the country.

While the restitution of agricultural land has been slower than intended, the reallocation of water has not always even kept pace with the transfer of that land. In some instances, the previous owners traded away their existing lawful water use rights, so that the water allocation was not transferred to land reform beneficiaries. According to The Institute for Poverty, Land and Agrarian Studies[34], more than 70% of commercial farms in the country are owned by white farmers with about 39 000 white commercial farmers and 5 300 black farmers, according to the African Farmers Association of South Africa. Most of the black commercial farmers have relatively smaller farms.

For a water resource system in a mature phase of development, the re-allocation of water between water use sectors is an obvious and powerful method to move water from low to higher economic use, although it does not add additional water to the mix. Of critical importance in the re-allocation of water is the issue of achieving racial equity in access to water. At times this may conflict with the movement of water from low value to higher value use, and priority must be given to achieving racial transformation in access to water.

Transformation of representivity in water governance has also been slow. Membership of water user associations generally reflects land ownership and water use, so that the governance of those associations is often focussed on the interests of white commercial farmers.

The Irrigation Strategy[35] developed by the Department of Agriculture, Forestry and Fisheries (DAFF) has identified water schemes where there is the potential for irrigation expansion. This expansion can contribute to access to water for black farmers.

[34] Institute for Poverty, Land and Agrarian Studies. Fact Check No. 1 Land Reform, The Distribution of Land in South Africa: An Overview.

[34] Department of Agriculture, Forestry and Fisheries. 2015. Irrigation strategy for South Africa.

4.2 DRIVERS

The Constitution, the NWA and NWRS2 have laid down the foundation for water allocation reform. The water allocation strategies are meant to be implemented using various long-term and short-term mechanisms in order to ensure the realisation of the transformation mandate contained in the above policies.

The demand for land is high on the political agenda and will remain so until adequately addressed. Where the land that is being transferred is irrigable, a water allocation is necessary to enable the new land users to make full use of the land. However, it would appear that, under the land reform programme, some irrigable land has been transferred to land reform beneficiaries without the water allocation that was historically used on that land – the water rights have, essentially, been sold prior to the transfer of the land. How widespread this issue is, is difficult to ascertain due to the lack of an integrated approach between the Department of Rural Development and Land Reform (DRDLR) and DWS in land and water reform. What is clear, however, is that there are a number of black farmers, and other potential water users, such as business owners, who wish to get access to water for productive purposes.

To date, the response from government has been largely reactive, waiting for licence applications from black water users to be lodged with DWS. The prevalence of this situation has limited the ability of recipients to make productive use of the land. In addition, there are black farmers and entrepreneurs who have expressed their concerns about lack of access to water, and the challenges in getting water allocated for farming and enterprise development. The pressure to reallocate water to achieve more equitable water use thus remains high.

There are several opportunities that provide low-hanging fruits in providing raw water for productive purposes to black South Africans. These are discussed briefly, below.

Implementing the Irrigation Strategy for South Africa

Capital costs for new storage infrastructure are too high to provide any significant amount of affordable additional water to the agricultural sector. Agriculture is encouraged to move to more efficient irrigation to allow for future expansion with the water already allocated to it. The critically important re-allocation of water to black water users will need to take place within these constraints, and where affordable additional water is available.

The Irrigation Strategy (2013) of DAFF states that “Although it is generally considered that South Africa has very little areas left with irrigable soils that can be put under irrigation, there are a number of substantial areas with soils of relatively good irrigation potential close enough to rivers and at low enough elevation above them to make irrigation development on them a possibility”.

It also indicated 34 863 ha may be available for expansion as indicated in the table below, although some of the 5 000 ha in the Northern Cape may already have been allocated. The water allocated for irrigation areas listed in the table below will only be made available to HDI applicants.

Table 4-1: Water Allocation for Irrigation Areas

Province	Scheme/Area	Potential Expansion (ha)	Comments
Eastern Cape	Upper Orange River Catchment	4 000	Orange River re-Planning Study (ORRS) (DWS 2014)
	Umzimvubu Dam	2 354	Mzimvubu Water Project Feasibility Study
	Foxwood Dam	1 250	Foxwood Water Project Feasibility Study
Free State	Upper Orange River Catchment	3 000	Orange River re-Planning Study (ORRS, DWS 1990)
Gauteng		0	No possible expansion
Kwa-Zulu Natal	Makhathini Irrigation Scheme	10 000	Makhathini Master Plan
Limpopo		0	Over allocation of water resources (DWS reports)
Mpumalanga		3 000	Information supplied by official from Mpumalanga Depart of Agriculture
Northern Cape	Upper Orange River Catchment	5 000	Orange River Planning Study (ORRS, DWS 1990). Indications are that most of this has been allocated
North West	Taung Irrigation Scheme	1 259	Budget Planning Report by Endecon Ubuntu 2011
Western Cape		5 000	Availability of hectares depends on increased capacity from raising of Clanwillian Dam wall.
Total		**34 863**	

There are also a number of ex-homeland irrigation schemes that require rehabilitation to enable black farmers to use water effectively for production of crops. For example, according to the Irrigation Strategy, there are 11 139 ha of small holder irrigation schemes in Mpumalanga that need rehabilitation, for which R893 million is needed.

In addition, there are areas in which water use patterns are changing, such as where mines are closing down, where the war on leaks and water conservation have reduced water use, where validation and verification has identified registered water that is not being used, or areas where groundwater or small dams may be able to provide extra water for agricultural development. DWS should identify these opportunities and allocate such water to black applicants. This requires, however, a partnership with DRDLR, DAFF and provincial departments of agriculture to identify the location and need of black farmers, and to provide support to them to use the water productively.

The reallocation of water is driven by the need to redress the inequities of the past and to ensure more equitable access to key natural resources such as land and water for the black majority. The reallocation of water is necessary, but not, in itself, sufficient, to achieve the

ultimate development outcome of the country, which is the eradication of poverty and inequality. What this raises, is that any reallocation of water should be done in collaboration with the Departments of Agriculture and Land Reform and Rural Development, to ensure that sufficient support is provided to recipients of water to enable them to use it productively and optimally.

This is why the NWRS2 calls for an integrated land, water and agrarian reform programme. Within such a programme, it is critical to recognise and respond to the specific needs of small-scale water users, not only commercial enterprises.

4.3 PRIORITIES FOR THE FUTURE

The re-allocation of water to historically disadvantaged individuals will redress the historical imbalance in access to water for productive purposes in South Africa and contribute to the broader redress envisaged in the Constitution. It will also contribute to meeting the targets of the NDP. General authorisations will be used proactively to support reallocation of water to black users, and to legalise small scale water use without the need for a licence.

If done appropriately, and in conjunction with land and agrarian reform, it will contribute to rural development and the reduction in inequality and poverty in the country.

In order to do this, water allocations must be carried out in a manner that promotes equity, addresses poverty, supports economic growth and provides opportunities for job creation. The allocation process recognises that redressing the effects of previous discriminatory legislation is necessary for social stability and to promote economic growth.

DWS will work closely with all spheres of government and other institutions to promote the productive and responsible use of water since these objectives go well beyond the Department's primary mandate and require the active pursuit of cooperative governance arrangements to support the productive use of water.

Call to Action

"the water sector has, over the past 20 years, failed to deliver on its mandate for water allocation reform, or the reallocation of water to black water users. This, along with land reform, remains a major challenge facing the country, and one that must be addressed. It is proposed that a joint land, water and agrarian reform programme, to be led by the Department of Rural Development and Land Reform be established to ensure that the reallocation of both land and water are aligned and take place within a framework of agrarian reform and effective rural development"

Summary of Priorities:

The following table provides a summary of priority actions (as copied from Volume 1 of the NW&SMP Call to Action):

Table 4-2: Summary of Priorities

Action	Responsibility	Completion date
Identify alternative sources of water and water that is not utilised (e.g. as mines are closing resulting from War on Leaks, etc) for transformation (Volume 3 Action 1.2.1)	DWS, CMAs, WSAs	2019
Identify where more water can be made available in government water schemes for transformation (1.2.2)	DWS, CMAs, WBs, DAFF/PDAs,	2019
Implement the Water Administration System on all government irrigation schemes for transformation (1.2.3)	DWS, DAFF/PDA	2024
Implement pilot project on voluntary contributions from farmers for water reallocation in prioritised catchments (1.2.4)	DWS, DAFF	2020
Identify areas where small dams or groundwater development can provide water for small scale black farmers (1.2.5)	DWS, CMAs	2019
Align water, land and agrarian reform programmes and link to the Irrigation Strategy (1.2.6)	DWS, CMAs, DAFF, DRDLR	2030
Use General Authorisation to enable small scale water use by black farmers (1.2.7)	DWS, DAFF	2019
Investigate, revitalise, refurbish existing under-performing Black Owned schemes (1.2.8)	DAFF, DWS	2020
Define and implement process to allocate water (new/saved) to black applicants (1.2.9)	DWS, DAFF	2030
Establish the National Water Resources and Services Regulator (NWRSR) (2.1.6)	DWS, NT	2020
Establish regulations on required qualifications and experience for senior and technical positions in DWS, CMAs, water boards and municipal services institutions (2.3.1)	DWS, CoGTA, SETA	2023
Develop regulations in terms of Section 139 (8) of the Constitution, which allows for a national entity to take over the water service functions, including revenue and billing, in a municipality if service deliver criteria are not met (2.4.4)	DWS, CoGTA	2022
Fund research into new models to better understand implementation approaches for water allocation reform, and equity issues (2.6.6)	DWS, WRC, CSIR, DST	Ongoing

5 MANAGING EFFECTIVE WATER SUPPLY AND SANITATION SERVICES

96% of households have access to a basic water supply, but only 65% of households are estimated to have a reliable and safe water supply service – a lower figure than in 1994

11% of water supply schemes are completely dysfunctional.

In the 27 priority district municipalities the water reliability is only 42%, with the worst 10 WSAs below 30% reliability.

56% of waste water treatment works (WWTW) in South Africa have functional challenges

44% of water treatment works (WTW) do not work properly posing a huge risk to the health of the nation

Some 77% of rural households are indigent and are not required to pay for basic municipal services

This chapter focuses on the provision, operation and maintenance of water supply and sanitation services.

5.1 WATER SUPPLY AND SANITATION SERVICES

Access to sufficient water is a basic human right enshrined in the Constitution of South Africa. Access to adequate sanitation services is a critical element of the right to dignity and the right to an environment that is not harmful to health or well-being.

The South African Government has set clear and ambitious targets for water supply and sanitation services:

- Achieve universal, sustainable, safe and reliable water supply provision:
  - 90% by 2019
  - 100% by 2025
- Achieve universal, sustainable and safe sanitation provision:
  - 90% by 2020
  - 100% by 2030

5.1.1 Present State

South Africa's 56 million inhabitants live in more than 28 thousand communities, each requiring a reliable and safe water supply and sanitation services. 144 municipalities have been assigned the function of water services authorities (WSAs). District municipalities generally oversee the delivery of services to the most vulnerable, rural poor citizens. At least 33% of municipalities are regarded as dysfunctional and more than 50% have no or very limited technical capacity[36].

South Africa is one of the most unequal countries in the world, with extremely high levels of poverty. 63% of households earn less than R38 000 per year (indigent level) resulting in high levels of grant dependency with related impacts on affordability and services viability. In rural areas, this figure averages 77%. The percentage of individuals that benefited from social grants consistently increased from 12,7% in 2003 to 29,7% in 2016[37].

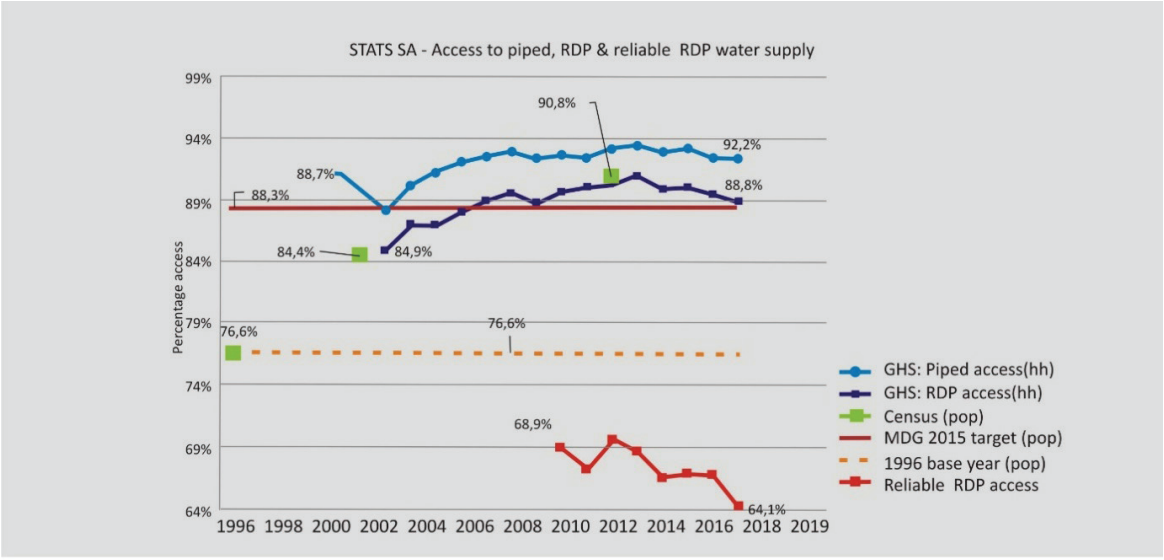
While population growth is, on average, 1,2% per annum, this varies from negative to positive across communities. The growth in the number of households is much higher and is currently at around 3% per annum nationally. This is due to migration (mainly urbanisation) and the dedicated housing programme of government, leading to sub-division of previous large households.

While only 33% of the population currently live in the rural areas, they represent 81% of the national count of settlements due to their small, scattered nature. Urbanisation continues to have a major impact on water supply and sanitation provision with many rural people moving to urban centres in search of jobs and improved services.

Municipal water user profiles also include commercial, business and industrial users as well as schools, hospitals, sports and recreation facilities, parks and government institutions.

Substantial new infrastructure for water supply and sanitation has been added since 1994 so that it is estimated that 95% of the South African population have access to a basic water supply. Unfortunately, the reliability of these services is currently declining. This is due to poor management of and insufficient investment in water services and sanitation operation and maintenance with the result that the reliability of these services is declining. This is a critical issue that needs to be addressed. In 2016, nationally, 63,0% of households rated the quality of water-related services they received as 'good'. Satisfaction has, however, been eroding steadily since 2005 when 76,4% of users rated the services as good and the current percentage of the population receiving reliable water services being lower than it was in 1994[38].

[36] MuSSA for Water Services for South Africa, 2016/2017
[37] Statistics South Africa. 2016 General Household Survey 2016 Statistical release P0318
[38] Statistics South Africa. 2011. Census 2011 Statistical release P0301.4.



[2] Stats SA general household survey
[3] Stats SA community survey 2016

Figure 5-1: Access to piped, RDP and reliable RDP water supply (Source: StatsSA)

The water services functions are dispersed between several role players with ineffective programme alignment, governance and supply chain management. There is an urgent need to address issues of accountability, coordination and leadership, as well as the appropriate actions to be put in place where WSAs show consistent failure in delivery of universal and reliable water services.

Municipal domestic, commercial and industrial water uses in the region of 30% of the total water used in South Africa. Water reticulation infrastructure includes more than 290 000 km of pipelines and an estimated 7 680 456 house connections, 5 078 545 yard taps and more than 2 146 146 households served by street taps (StatsSA Community Survey 2016).

Statistics South Africa. 2016. Community Survey 2016 Statistical release P0301.

Baseline figures on access to water supply and reliable sanitation service delivery are regularly collected by StatsSA through the national census and through the General Household Surveys.

Figure 5-2 below indicates the latest figures for water supply, which reveal that although 96% of South Africans have access to RDP level or higher water supply infrastructure, only 65% have access to reliable services, where reliability is measured as water of an appropriate quality being available for 300 days of the year with interruptions in supply not lasting for longer than two days at a time.

South Africa performed well in eradicating the backlog in basic water services infrastructure and access to basic services from 59% in 1994 to 96% in 2016

However, while infrastructure is in place, about 11% of schemes are fully dysfunctional and in a collapsed state, resulting in operational access being reduced to 85%. Only 65% of the population have access to safe and reliable water supply, and in ten water services authorities the figure is less than 30%.

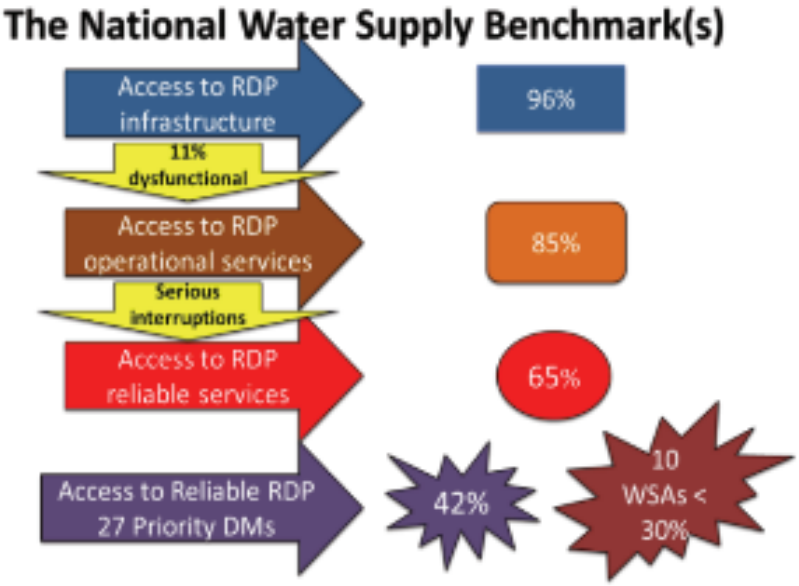


Figure 5-2: National Water Supply Figures

Figure 5-3: Reliability of Water Supply and Sanitation Services per Province (source DWS) below shows the reliability of water services per province, with the Eastern Cape and Limpopo having the lowest reliability of supply, followed by North West, Mpumalanga and KwaZulu Natal. Gauteng and the Western Cape have the highest levels of reliable water supply.

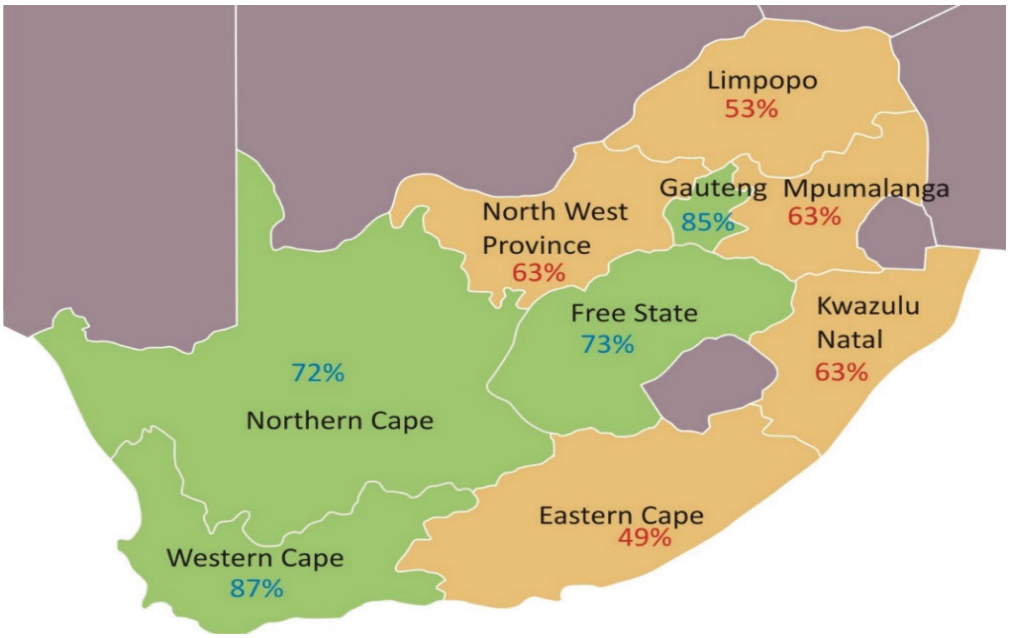


Figure 5-3: Reliability of Water Supply and Sanitation Services per Province (source DWS)

In the 27 priority district municipalities[39] the water reliability is only 42%, while the worst 10 WSAs have a below 30% reliability.

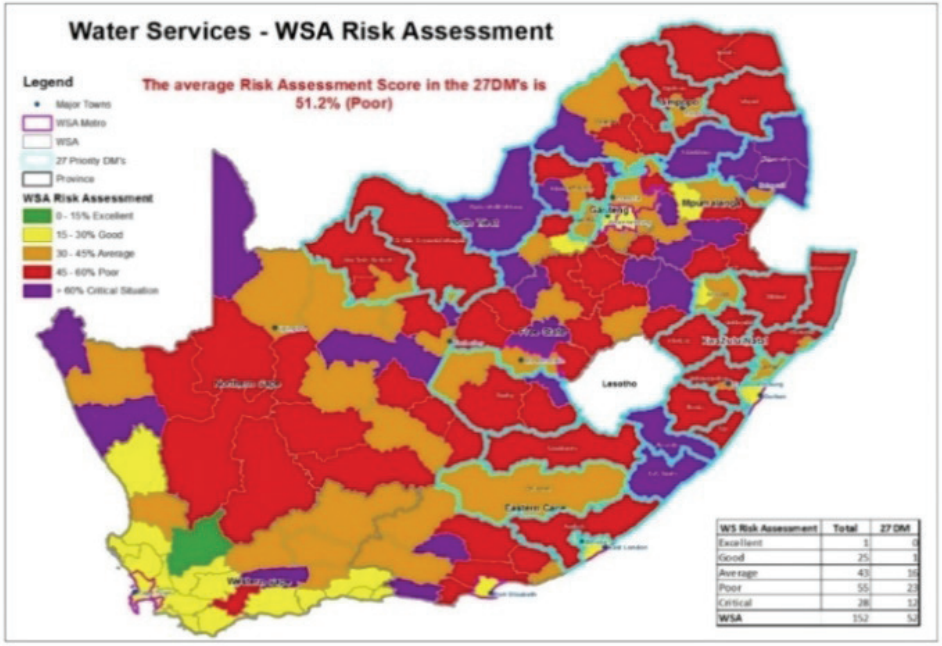
The unreliability of supply is a major source of public frustration. The StatsSA Community Survey 2016 asked participants what they perceived to be the biggest challenges they faced within their municipality. 2.7 million households listed the lack of safe and reliable water supply, making it the highest scoring issue, followed by the lack of or inadequate employment opportunities (2 million) and the cost of electricity (1.7 million)[40].

The following maps (

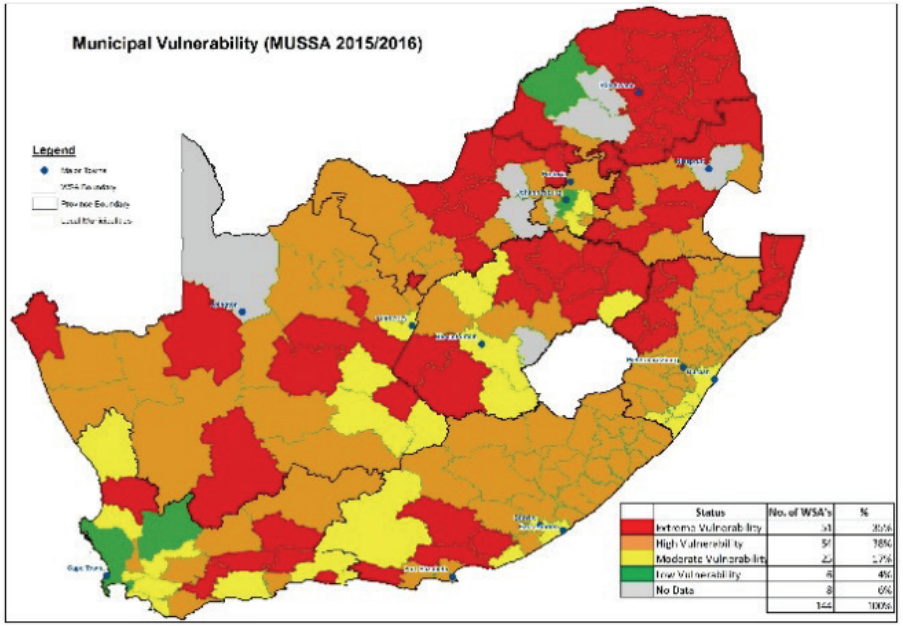
Figure 5-4) show the integrated risk per water services authority and a municipal self-assessment of their vulnerability to failure.

[39] Amatole, Chris Hani, Joe Gcabi, OR Tambo, Xhariep, Ugu, uMgungundlovu, Uthukela, Umzinyathi, Amajuba, Zululand, Umkhanyakude, uThungulu, iLembe, Ehlanzeni, Mopani, Vhembe, Capricorn, Waterberg, Bojanala, Ngaka Modiri Molema, Dr Ruth Segomotsi Mompati, Sisonke, Alfred Nzo, Joe Taolo Gaetsewe, Greater Sekhukhune, West Rand.

[40] Statistics South Africa. 2016. Community Survey 2016 Statistical release P0301.



The average risk in the rural areas (27 priority DMs) is 67% and at a national level it is 55% showing the state of WSA's



73% of municipalities indicated high vulnerability for under-performing. This figure is 86% in the 27 priority DMs

Figure 5-4: Risk and vulnerability to failure per WSA

5.1.2 Priorities

The South African Government agreed to meet the target of providing 100% reliable and safe water supply by 2030 as set in the National Development Plan (NDP) and the Global Sustainable Development Goals (SDGs).

The Government has made a further commitment by formally approving an interim target of 90% coverage of reliable water supply by 2019. This implies a 13% improvement per annum on the national scale, and even more for the 27 priority DMs (24%). For the worst WSA, an improvement of 40% per annum is required.

In addition, the ladder towards higher levels of services will be climbed progressively for domestic users with the accompanied progressive achievement of a full supply for schools, health services, business, commerce and industry.

5.2 SANITATION SERVICES

The provision of sanitation services is a key requirement for the establishment of sustainable, healthy communities, protection of the environment and to meet the human rights of all who live in South Africa. Sanitation infrastructure and practices must enhance the principles of health, dignity and the protection of the environment, ensuring an improved quality of life for all.

Changing the way sanitation services are provided and the nature of the facilities provided will have social and economic benefits aligned to the national development goals. There are two important aspects to this. The first is in recognising the nature of water scarcity in South Africa and moving to waterless sanitation options for all South Africans. The second is in recognising the nature of human excreta (faeces and urine) as a resource to be utilised, particularly for fertiliser products, but also for the reclamation of important elements such as phosphorus which is a critical and globally limited resource, essential for crop production.

5.2.1 Present State

5.2.1.1 Policy

Adequate sanitation facilities are a necessary part of achieving the rights to dignity and to an environment that is not harmful to health or well-being, as enshrined in the Bill of Rights of the Constitution.

Cabinet approved the National Sanitation Policy in 2016. This policy addresses the “seven policy pillars” to achieve hygienic, sustainable, equitable and efficient sanitation services (**Figure 5-5**), namely:

- Integrated planning
- Institutional arrangements
- Participation
- Capacity and resource development
- Financial requirements
- Sustainability *and*
- Regulation.

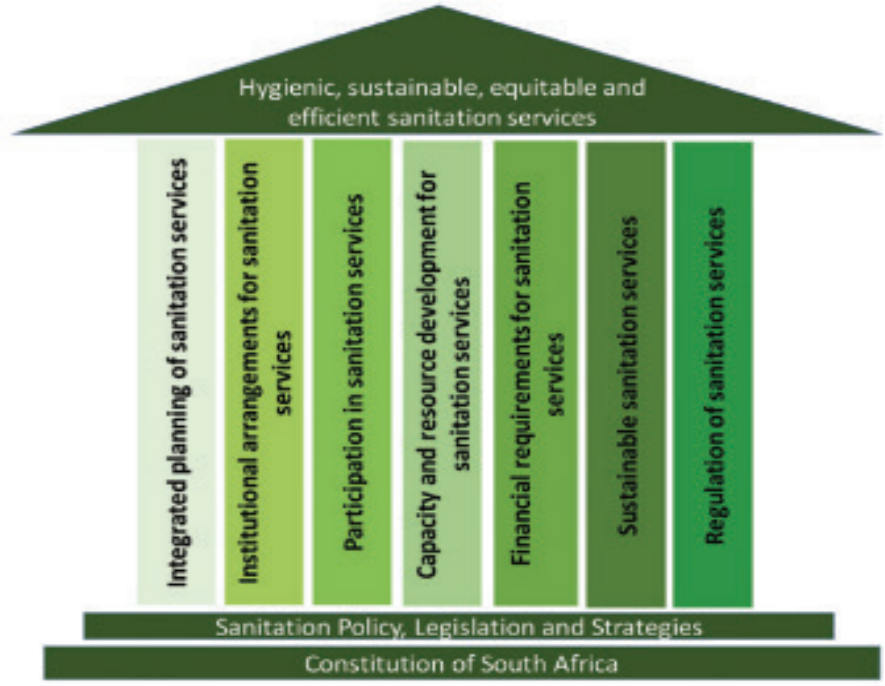


Figure 5-5: Seven Sanitation Policy Pillars

Since 2014, the sanitation mandate of the Department of Water and Sanitation has been affirmed, with the mandate including the regulation of the sanitation sector in the country, as well as provision of macro planning, regional bulk services and monitoring, in accordance with the Constitution. This requires capacity to establish national policy guidelines, national water and sanitation strategy, the authorisation of waste discharge, the formulation of conditions for State subsidies, the development and enforcement of regulations, the setting of minimum services standards as well as monitoring and regulating sanitation service provision. National and provincial government, according to the Constitution, have the legislative and executive authority to see to the effective performance by municipalities of their functions in respect of matters listed in Schedules 4 and 5, by regulating execution by municipalities of their executive authority referred to in section 156 (1).

5.2.1.2 Backlogs

Since 1994, and particularly after 2001, an estimated 5.15 million households have been provided with safe and acceptable sanitation facilities[41]. The backlog in 1994 was estimated at

[41] Statistics South Africa. 2011. Census 2011 Statistical release P0301.4.

4 million households, whereas at April 2017 it is estimated that there are still 3.96 million unserved households. The South African population increased from around 40 million in 1994 to a total of 55,6 million as recorded in the 2016 Census. Progress in the reduction of the backlog has been hampered by this substantial population growth and by households becoming smaller (and hence growing at a faster rate than the population). Urban migration has also shifted where the needs are.

In addition, the facilities provided to households previously have become inadequate in some areas due to various factors including ventilated improved pit latrine (VIP) pits not being emptied regularly, ageing infrastructure, poor facility operation and maintenance, and infrastructure operated above its design capacity.

The provincial backlogs (services below RDP level) for sanitation services are indicated in the table below:

Table 5-1: Provincial Sanitation Backlogs

Province	Total Households	No. of households below RDP level	% households below RDP level
Eastern Cape	1 807 050	416 391	23.0
Free State	969 199	190 802	19.7
Gauteng	5 153 011	469 836	9.12
Kwa-Zulu Natal	2 963 154	1 018 736	34.4
Limpopo	1 652 306	793 557	48.0
Mpumalanga	1 283 056	494 165	38.5
North West	1 288 454	431 003	33.5
Northern Cape	362 527	68 168	18.8
Western Cape	1 992 998	84 143	4.22
TOTAL	**17 471 755**	**3 966 801**	**22.7**

(Source: Census 2011 updated to April 2017 – DWS Water Services Knowledge System)

The backlogs per WSA are presented in **Figure 5-6** below. The largest backlogs, both in terms of percentage and in terms of the number of households, are in Limpopo, Mpumalanga and Kwa-Zulu Natal. The WSAs in red have backlogs of greater than 50% of total households and the efforts to eradicate the sanitation backlogs will be intensified in these areas.

Statistics South Africa. 2016. Community Survey 2016 Statistical release P0301.

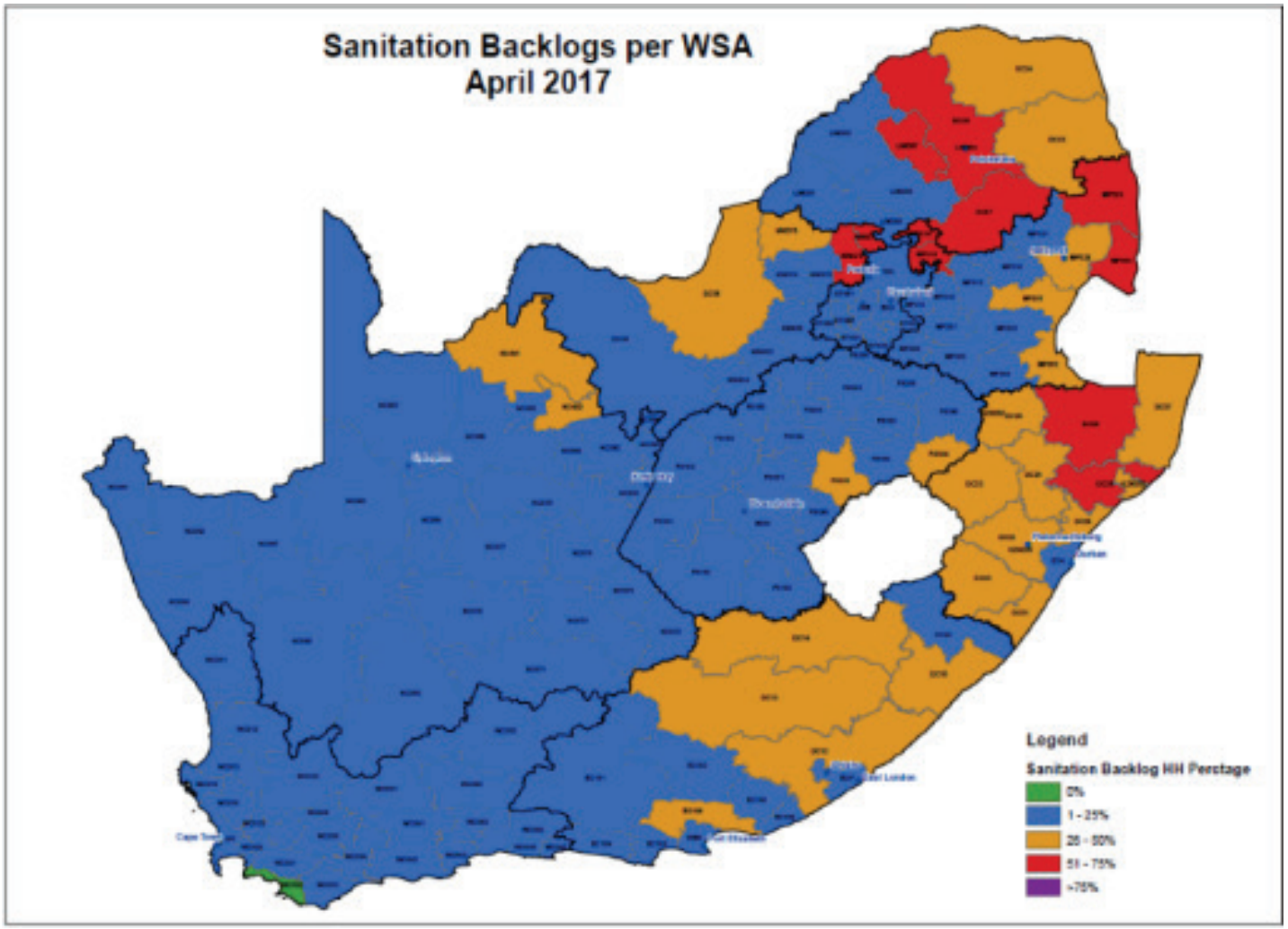


Figure 5-6: Sanitation Backlogs per WSA, April 2017

22.7% of households do not have access to an acceptable and adequate sanitation service. Approximately 3.0% of households have never received a service, while the remainder of households have access to a sanitation service, but there are various requirements needed to ensure its adequacy and sustainability.

Figure 5-7 below sets out the various issues that need to be addressed to ensure that these 22.7% of households are provided with the required level of sanitation services.

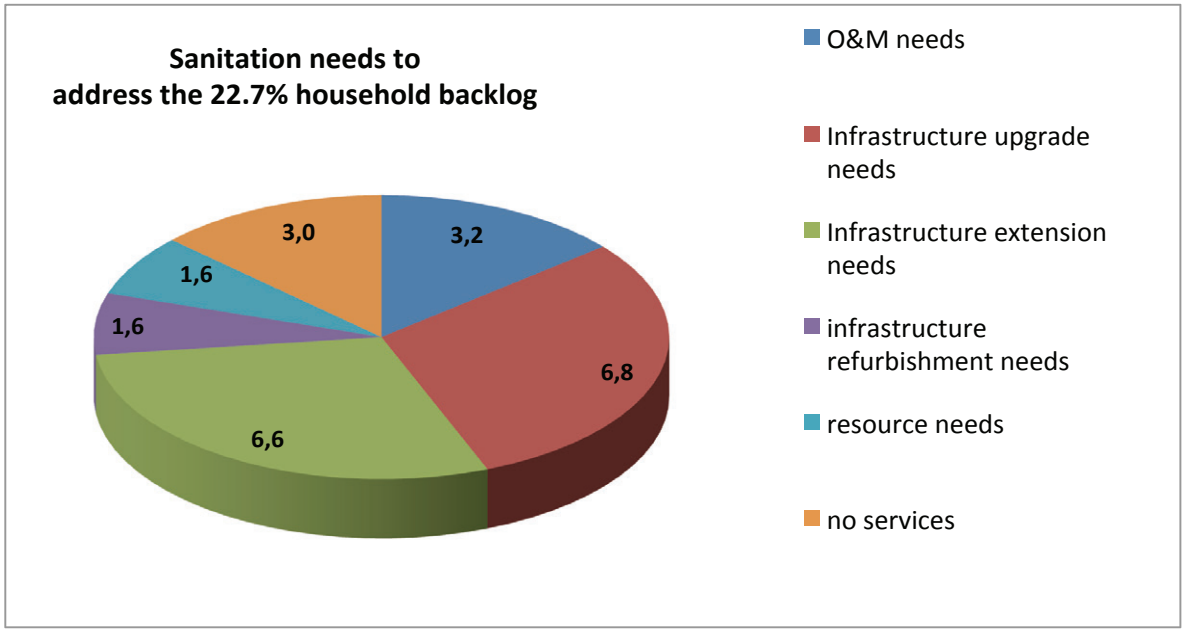


Figure 5-7: Sanitation Needs to address the Backlog

The sanitation facilities provided for low income households, particularly VIPs, do not meet the standards for ensuring that they are accessible to people with disabilities. People with disabilities are one of the most excluded groups in society, and it is important to ensure that sanitation standards are designed in a manner that meets their requirements.

5.2.1.3 Operation and Maintenance

Effective operation and maintenance is a critical element in providing sustainable and adequate sanitation services, both for water-borne sanitation and for on-site services.

Two thirds of the WSAs that have settlements served with ventilation improved pit latrines (VIPs) assume responsibility for desludging at least some of their VIPs. However, only half of the budget required for this is available and only 17% of WSAs have a policy in place to guide this function.

The frequency of emptying VIP pits varies between municipalities, with most being in the range of 5 to 8 years.

In terms of operation and maintenance of wastewater treatment works and associated sewerage infrastructure, the situation was monitored by DWS via the Green Drop assessment[42]. The Green Drop assessments have not been undertaken since 2014.

Compliance with the Green Drop requirements in 2014 was generally very poor, with 119 of the 144 WSAs achieving less than 80% compliance. This reflects the lack of attention being afforded to the proper management and maintenance of wastewater in most municipalities.

The table below indicates the Green Drop scores for 2014 for the different provinces in South Africa.

Table 5-2: Green Drop Scores per Province

Province	No of WWTW	Provincial Green Drop score (%)	Risk profile (CRR as % of CRR(max)
Eastern Cape	123	67.2	70.0
Free State	95	31.5	83.0
Gauteng	56	78.8	57.0
Kwa-Zulu Natal	143	82.0	55.0
Limpopo	67	24.0	79.0
Mpumalanga	76	56.0	73.0
North West	35	50.0	76.0
Northern Cape	71	23.0	76.0
Western Cape	155	83.1	62.0
TOTAL	**821**		

(Green Drop Report, 2014, CRR = Cumulative Risk Rating

5.2.1.4 Sanitation provision in other sectors:

The provision of sanitation services to public institutions (for example hospitals, clinics, police stations and correctional facilities) is the responsibility of the respective national or provincial departments. The backlog has generally been eradicated, but the current status of these services is not known. The budgets for the operation and maintenance of these facilities lie with the relevant departments.

The provision of safe sanitation services to schools is the responsibility of the Department of Education and has been accelerated since 2011 with the Department of Education (DoE) introducing the Accelerated Schools Infrastructure Development Initiative (ASIDI) programme, with ambitious targets for ensuring all schools have acceptable levels of sanitation.

However, the sanitation infrastructure at schools is not always safe and secure, ensuring that learners feel comfortable to use the toilets. Issues of child sensitive design, proper operation and maintenance, together with a number of social aspects, still needs to be addressed in the provision of sanitation at schools, as do issues of sanitation to meet the needs of scholars and teachers with disabilities.

There has been an increasing focus on the needs of the girl child which has resulted in both the DoE and several non-government organisations (NGOs) and private enterprises and individuals taking initiatives to provide personal sanitary supplies to keep girl children in school. The design of school sanitation facilities should also take into account the safety of girl children who are vulnerable to rape when using sanitation facilities that are far from the classrooms or hidden from view.

Sanitation in the agricultural sector includes facilities for farm workers and for farm dwellers who are not employed by the farmer. Sanitation for farm workers is covered by the Basic Conditions of Employment Act, whilst farm dwellers are the joint responsibility of the farmer and the municipality (where there is an agreement between the farm owner and the municipality). Farm dwellers are vulnerable and, in some cases, receive very poor or no services.

Industrial discharge to sewers is subject to the by-laws of the responsible municipality. However, in many cases the by-laws are out-dated and/or not specific on the quality of the effluent that may be discharged to the sewers. This results in some wastewater treatment works receiving effluent concentrations or types of pollutants that disrupt the treatment processes and a result in poor quality final effluent.

5.2.2 Priorities for the Future

The key objectives for sanitation service delivery are:

Moving the country towards “water-less” sanitation options

The acceleration of adequate and equitable sanitation service delivery and meeting the target of universal access to acceptable sanitation services by 2030 while paying special attention to the needs of women and girls, people with disabilities, and those in vulnerable situations;

- Meeting South Africa’s international obligations towards achieving the Sustainable Development Goals (SDGs);

Focusing on operation and maintenance, institutional capacity, and adequate resources for management of sanitation.

Applying smart and water efficient technology systems

- Growing the application of safe resource recovery from sanitation systems; and
- Raising the profile of sanitation.

A detailed sanitation master plan should to be formulated (and updated regularly) for each WSA. The plans must address the backlogs within their area of jurisdiction as well as operation and maintenance requirements. Municipalities must secure funding for sanitation master plan.

5.3 OPERATIONS AND MAINTENANCE AS PART OF ASSET MANAGEMENT CYCLE

5.3.1 Principles of Asset Management and Operations and Maintenance

Asset Management is the art and science of making the right decisions thereby optimising the delivery value of an asset. Common objectives should be to minimise the total life cycle cost of an asset and to ensure critical factors such as risk and/or business continuity are considered objectively as part of standard decision-making processes.

Asset Management involves the balancing of costs, opportunities and risks measured against the desired performance of assets, in support of broader organisational objectives. This balancing act needs to be considered over different timeframes.

As indicated in **Figure 5.8** there are different components and phases in a typical Asset Management Cycle. Whilst the main focus is usually on the construction of new infrastructure the Operations and Maintenance component is often neglected. The total lifespan of water infrastructure can stretch over several decades and proper operations and maintenance will eventually determine the optimal use of infrastructure. Effective operation and maintenance of water and sanitation infrastructure is critical to the delivery of reliable services. Even though Operations and Maintenance (O&M) is most often is used as a grouping of activities, these are two definitively separate business elements.

The effective operation of infrastructure is based upon the requirements to deliver services according to outcomes-based standards in terms of both quantity and quality.

Maintenance is implemented according to a programme which includes routine, planned and unplanned maintenance protocols. These practices are to sustain the condition of infrastructure to enable operations according to design limits.

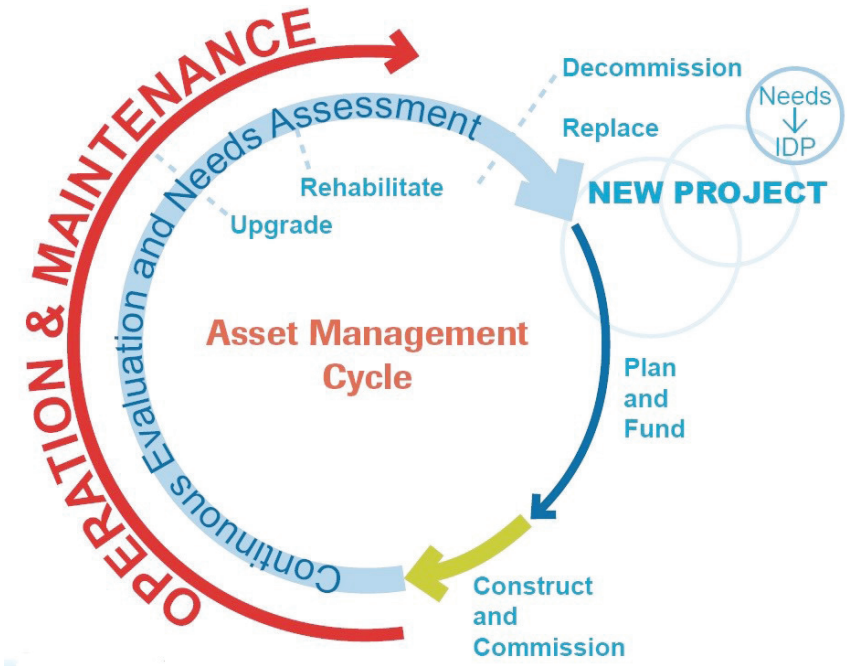


Figure 5-8: Integrated Asset Management

Figure 5-9: Elements of Acceptable Services

Asset Management principles dictates for a more detailed approach to be followed in the space of maintenance, where asset management planning informs the maintenance philosophies to be adhered to. The lack of national asset management and maintenance standards in the South African water sector leaves water supply and sanitation infrastructure and equipment vulnerable to ineffective maintenance practices which is challenging to manage and regulate. A further case could be made for maintenance to have detailed standards developed for the following reasons:

- Maintenance Managers need a set of standards to measure the implementation compliance against, especially in cases where work has to be outsourced. These

standards could be used to formulate, specifications for maintenance work to be done on water supply and sanitation installations and equipment.

- Sub-standard maintenance work does not only lead to expensive secondary work, but also exacerbates the risk of an unreliable service.
- Inadequate maintenance could lead to an increase in operational cost which would detrimentally affect the affordability of service.

A risk-based assessment needs to be performed per asset class group (not only concentrating on the operating status of a specific asset but also focussing on the sustainability for future performance). Predictive modelling (probability forecasting) methodology needs to be developed to forecast within a 90% level of confidence potential failures. Asset management plans should be developed to show the strategic importance and prioritisation of assets within specific asset class groupings. This exercise must be conducted every three years to be aligned to funding mechanisms within the MTEF budgeting cycle. This will give effect to an asset management philosophy which allows for the management of an asset throughout its life cycle, as well as to adopt a structured approach towards preventing downtime (service interruptions), due to breakdowns and unplanned maintenance.

Refurbishment and Rehabilitation programmes must be implemented according to risk-based asset management protocols to inform on capital expenditure priorities.

From a Water Services perspective the *Water Services Infrastructure Asset Management Strategy* serves as a solid foundation to guide towards improved practices towards sustaining operability of water and sanitation systems.

5.3.2 Present State of Asset Management

5.3.2.1 Water Resource Infrastructure

Water resource infrastructure consists of bulk storage, abstraction and conveyancing. This includes the major dams, pipelines and canals mostly owned and operated by DWS. The South African Institute of Civil Engineers (SAICE) publishes from time to time an Infrastructure Report Card (IRC) The latest one (2017) reflects the expert view of SAICE and its members on a wide range of infrastructure including water and sanitation. Infrastructure for bulk water resources only scored a worrying D minus with the following note: *"The unchanged low grade belies the further deterioration in the ageing bulk water infrastructure portfolio as a result of insufficient maintenance and neglect of renewal..."*

Some of the reasons behind this worrying trend are the following:

- The diverse nature (aging and highly advanced) infrastructure technology used to store and transfer bulk raw water, is rather challenging for the limited resources to effectively operate to meet the demand of users
- Inability to attract adequate numbers of specialised technical staff required to operate government water schemes

- The under-recovery of revenue prevents operational plans from being effectively implemented *and*
- Standard government procurement processes are not conducive for the implementation of effective operational philosophies.

5.3.2.2 Dam Safety (Operations and Maintenance)

Dam Safety legislation (*Regulations regarding the safety of dams in terms of Section 123 (1) of the National Water Act, 1998*) provides a clear basis for the operations and maintenance of all structures utilised to store water, with the primary objective of the ensuring the safety of people and the environment down-stream of the dam.

The Dam Safety legislation has been used as a tool in the management of water storage infrastructure as far as asset maintenance is concerned. There is however a lack of set maintenance standards for dams and reservoirs. The law requires the owner of a dam which has been classified to be a safety risk to carry out mandatory evaluations by an experienced dam specialist and for the owner to implement the recommendations of the dam specialist (i.e Approved Professional Person). It is also a requirement to have an Operation and Maintenance manual as well as an Emergency Preparedness Plan for a dam. These two documents assist the operator to better manage the infrastructure and ensure the safety of all living downstream in the event of failure.

For all state-owned dams, the Department takes responsibility for routine safety inspections, deflection monitoring and rehabilitation based upon a risk-based model. To date 42 dams were restored by the Dam Safety Rehabilitation Programme, 15 Projects are in Planning and Design stage and 2 projects are under construction.

5.3.2.3 Water supply and sanitation services

Potable Water Supply Infrastructure

- Interruption in water supply is one of the key public frustrations. Water Services Legislation sets an acceptable standard of 48 hours for interruption of water supply; as per Regulation 4 under Section 9 of the Water Services Act.
- Electrical and mechanical failures are mostly accounted to inadequate routine maintenance which relates to unplanned outages, due to inability to lift water to reservoir levels.
- Vandalism (especially cable theft) often leads to the disruption in supply for periods longer than the acceptable norm. The high levels of water losses could be linked to inadequate pressure management within the reticulation systems, which might be due to the need to supply according to an ever-increasing water demand.

Wastewater / Sanitation

- The deterioration of resource water quality is often as a result of failing sewer collector mains and pump-sets, as well as dysfunctional wastewater treatment works. The Green Drop Regulation processes revealed that most of these failures are due to wastewater treatment facilities being operated beyond its design capacity or being operated by process controllers who lack the adequate skills.
- Water treatment processes are compromised (becoming more complex) due to the deterioration of the water resource quality. Process control at these treatment facilities are required to be performed by skilled personnel to give effect to risk management controls, as informed by water safety planning principles.

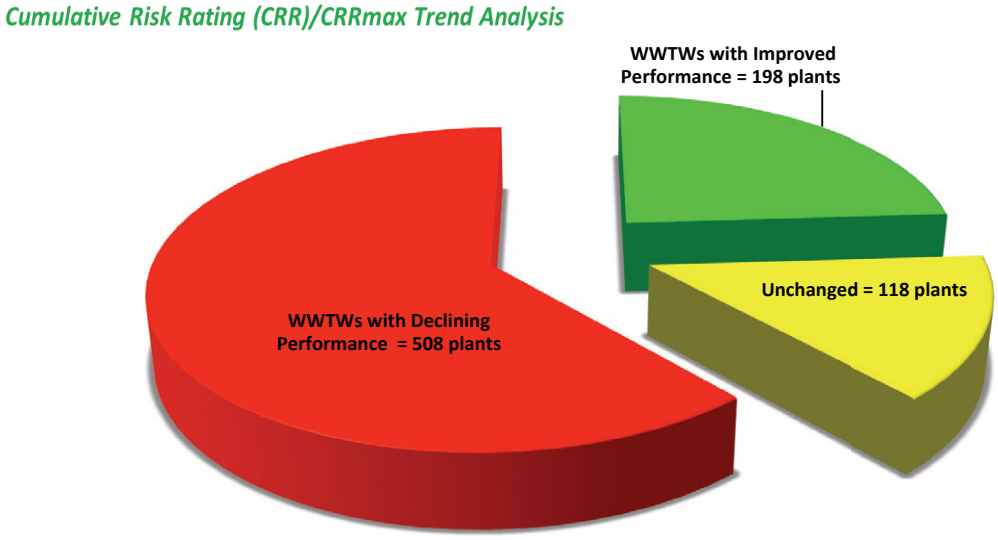


Figure 5-10: Municipal Wastewater Treatment Risk Rating Performance trend as measured in 2016. The cumulative risk rating performance measurement is based upon the wastewater risk abatement planning (W_2RAP) concept which was jointly developed by the Department of Water and Sanitation and the Water Research Commission. The purpose is to have a uniform yardstick for wastewater performance measurement and to set risk abatement/reduction targets for each municipal treatment facility.

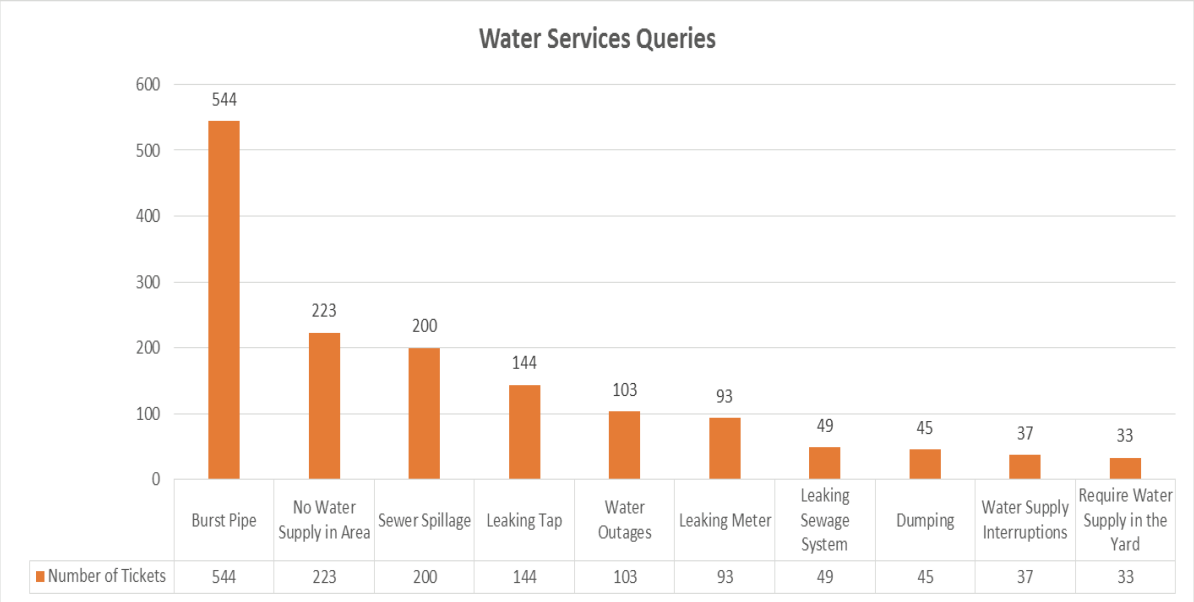


Figure 5-11: Summary of Water Services Queries to the DWS Customer Service (June 2016 – June 2017)

It is evident from the calls the Department's Tollfree Call Centre received in a period of 1 year (**Figure** 5-11) that the vast majority of citizen concerns refers to Assurance of Supply or Reliability of supply (62%; considering that "Burst Pipe", "No Water Supply", "Water Outages" and "WS Interruptions" are all indicators relating to this category). The responsible citizenry also reported unacceptable sewer operations (17% of calls) which indicate that this is a component of the water services business which requires improvement.

5.3.3 Priorities for Operations and Maintenance

The desired state for water operations is a *(1) reliable, (2) acceptable, (3) sustainable and (4) affordable* service rendered by an effective institution. Therefore, clearly defined Norms and Standards are required to guide the sector in unison towards investing in infrastructure and capability to operate and maintain according to these national expectations.

In 2003, *Norms and Standards for Water Services* were promulgated under Section 9 of the Water Services Act (Act 108 of 1997), to guide the municipal water sector towards a desired state of water supply. These standards were implemented but with limited success in the more rural areas, mostly due to the lack of municipal working capital and the lack of strong regulation in the sector. The implementation of the incentive-based regulation programmes (Blue Drop, Green Drop and No Drop certification programmes) brought a significant improvement in the drinking water quality, wastewater services and water conservation disciplines of municipal water services. This indicates that the desired state of operations should be based upon the service outcome expected, and not necessarily on detailed aspects of operations.

This principle supports the regulatory approach of setting standards within the limits of regulatory enforcement capability and affording operations management the opportunity of optimisation through innovation.

5.3.3.1 Water Operations and Maintenance Performance Standards

The following is the documented performance standard for each water and sanitation operations segment:

Table 5-3: Water Operations and Maintenance Performance Standards

Operations Segment	Standard
Storage **(Dams: Storage of raw water)**	**Existing:** Operate all dams according the requirements of: ▪ National and Local Water Resource Operating Rules; ▪ Dam Safety Legislation (Dam Safety); ▪ Emergency Preparedness Planning requirements; ▪ Resource Management Planning Requirements; and ▪ Water Resource Catchment and Dam Basin Management Principles (Minimising Siltation or Mitigating the Risk of Losing Storage Capacity due to Siltation)
	To be developed: ▪ Maintenance Standards for mechanical outlets
Storage **(Reservoirs: Storage of potable water)**	**Existing:** Operate Potable Water Reservoirs to comply with Norms and Standards for: 1. Regulations under Section 9 of the Water Services Act (Act 108 of 1997): a) Water supply not to be interrupted for more than 48hours due to unplanned outages; b) The quality of potable water supply should not compromised due to storage associated risks (SANS 241); 2. Operate on water balance principles to allow for adequate: c) Operational storage; d) Fire Storage; and e) Emergency storage.
Measurement **(Raw Water Measurement and Potable Water Metering)**	**Existing:** Regulation 11 under Section 9 of the Water Services Act: ▪ Requires water quantities supplied to each bulk zone in the reticulation network and the determination of unaccounted for water Regulation 13 under Section 9 of the Water Services Act:

	▪ Water Services Institution to ensure that all user connections are measured by a suitable water volume measuring device. Dam Safety Regulations apply for large weirs with storage capacity.
	To be developed: ▪ National Standards required to guide; Water Metering to be in-situ verified and calibrated to adhere to ±3 % (raw water) and ±2% (potable water) meter reading accuracy levels. ▪ In the light of increased water scarcity, there is a need to intensify the ability of water institutions to impose Tariff Structures (in line with current Regulation 6 under Section 10 Regulations; Step Tariffing) and Credit Control to promote water measurement.
Conveyance & Reticulation **(Pipes, Tunnels and Canals)**	**Existing (Potable water):** ▪ Water Conservation and Demand Management targets. ▪ Water Balance forms part of monthly operational targets (as per Regulation 11 under Section 9 of the WS Act). ▪ Maintaining safe potable water quality levels (SANS 241 as per Regulation 5 under the WS Act). ▪ Pressure Management required maintaining below 900kPa (Within Reticulation networks) as per Regulation 15 under Section 9 of the WS Act. ▪ Repair Leaks within 48hours; as per Regulation 12 under Section 9 of the WS Act.
	To be Developed: ▪ Standards need to set for the operations of raw water conveyance systems, i.e. canals and pipe-lines, on water balancing to operate towards minimising water losses. ▪ Set Asset Management principles for the determination and prioritisation of rehabilitation (Risk-based Rehabilitation Priority Determination Methodology) ▪ National standards for shut down (outage) procedures for the purpose of maintenance (incl. opportunity, planned and unplanned maintenance projects).
Abstraction & Transfer **(Pump-stations)**	**To be Developed:** ▪ Pumping capacity which is equal to the maximum daily demand (plus fire requirements) ▪ Redundancy required catering for unforeseen breakdowns. ▪ Back-up energy required for crucial domestic supply pump facilities. ▪ Abstraction must be monitored continuously to ensure that the resource yield is not exceeded (especially with regards to use of groundwater). ▪ National Maintenance Standards required for Mechanical and

	Electrical engineering work at pump-stations.
Water Treatment (Conventional; Desalination and Reclamation treatment facilities)	**Existing:** ▪ Potable Water Quality at SANS 241 standards. Regulation 5 under Section 9 of the Water Services Act (amended) ▪ Maintain Demand of the water supply area in terms of Quality. ▪ Reclamation and Desalination plants are also required to treat potable water to SANS 241 standards. ▪ The water treatment process is subjected to the water quality management requirements stipulated in SANS 241. ▪ Ensure correct level of process control skill to ensure effective treatment of water as stipulated by Regulation 2834 (Regulation 17) ▪ Risk Management Requirements as per Water Safety Planning standards (Blue Drop Certification Programme Requirements).
	To be Developed: ▪ Regulation 2834 to be reviewed to cater for new treatment technologies, such as Desalination and Reclamation water treatment facilities. ▪ National Maintenance Standards required for Mechanical, Electrical and Civil Engineering work for all types of water treatment works. ▪ Norms and standards for the design of treatment facilities according to the economic spectrum of the specific area of service.
Wastewater Treatment	**Existing:** ▪ Treat wastewater to comply with the Authorisation water quality limits set for the receiving water body. ▪ To regulate influent to comply with the design limits of the wastewater treatment facility as per Regulation 9 under Section 9 of the WS Act; ▪ To monitor wastewater collection systems for leakages and pump spillages for less than 48 hour turn around as per Regulation 11 under Section 9 of the Water Services Act. ▪ Ensure correct level of process control skill to ensure effective treatment of water as stipulated by Regulation 2834 (Regulation 17) ▪ Wastewater Risk Abatement Planning (as per Green Drop Requirements).

	To be Developed: ▪ Minimum Requirements for wastewater treatment works design to allow for operational cost requirements meeting the economic strength of the town/city served. ▪ National Maintenance Standards required for Mechanical, Electrical and Civil Engineering work for all types of water treatment works. ▪ Guidelines for: • The unlocking of Green Economy opportunities from wastewater treatment facilities to be used as a source for OPEX funding. • Utilising wastewater effluent as a potential water source; and prescribing minimum requirements for pre-treatment preceding reclamation.

The national capacity to operate, maintain and manage water supply and sanitation assets requires urgent attention.

The following table as copied from Volume 1 (Call to Action) provides a summary of the Priority Actions:

Table 5-4: Priority Actions

Action	Responsibility	Completion date
Set cap on water use with reducing targets over time (Volume 3, Action 1.1.2)	DWS, CMAs, WSAs, CoGTA	2030
Develop and implement a long-term plan for the turn-around of water supply and sanitation services in the country based on a sector-wide approach, that recognises DWS as regulator of W&S provision that includes the development of centralised programmes to obtain economies of scale and to ensure impact (e.g. driving municipal non-revenue-water improvements, and assessing the cost-effectiveness and appropriate systems for desalination) (1.3.1)	DWS, CoGTA, NT, SALGA	Annually
Plan for disaster management by implementing adequate flood protection and drought management on regional level (1.3.2)	DWS, CMAs, NWRSA, WBs	2022
Revisit levels of service for water supply and sanitation services against issues of affordability (1.3.3)	DWS, CoGTA, NT, SALGA	2025
Investigate and promote alternative service delivery models such as BOTT (build, operate, train and transfer), management contracts and concessions (1.3.4)	NT, DWS	2025

Action	Responsibility	Completion date
Provide direct Water Services Development Planning support to WSAs as part of a legal requirement and integration into Municipal IDPS (1.3.5)	WSAs, DWS, CoGTA, SALGA, NT	2025
Develop and implement Provincial Water Services Delivery Master Plans to provide reliable and sustainable water supply and sanitation services to all households within South Africa: **• Provincial Bulk Services Master Plans** **• Reliable Services Delivery Action Plans that includes a backlog analysis and infrastructure asset management plans (1.3.6)**	DWS, WSAs, CoGTA, SALGA, NT, WBs	2030
Deliver services to achieve (100%) universal sanitation coverage (Municipal Sanitation Projects) (1.3.7)	WSAs, DWS	2030
Deliver services to achieve (100%) universal water services provision (Municipal Water Supply Projects) (1.3.8)	WSAs, CoGTA, DWS	2030
O&M of water resources and services infrastructure (1.3.9)	DWS	2050
Align interventions with CoGTA on failing municipalities with existing support programmes e.g. MISA (1.3.10)	CoGTA, MISA, DWS	2019
Lifecycle planning (asset management) conditions to be set by DWS (1.3.11)	DWS	2020
A National water and wastewater treatment performance turnaround plan to be developed and implemented. Turn around the functionality of five, currently dysfunctional, large water and wastewater treatment works with an accompanying publicity campaign, followed by a programme addressing the rest (1.3.12)	DWS, WSAs, NT, WBs, CoGTA	2030
Roll-out of Feasibility and Implementation Readiness studies to align with national grant funding programmes (1.3.13)	WSAs, DWS	2025
Revitalise the Green, Blue and No Drop programmes and publish results. Revise and establish norms and standards (1.4.1)	DWS, WSAs	Annually
Include water use efficiency and conservation targets in the KPIs of municipal managers and municipal water supply and	CoGTA, Municipalities	2019

Action	Responsibility	Completion date
sanitation managers, and in municipal implementation plans (1.4.2)		
Ensure fiscal support for IWQM (SA38 & SA39) (1.5.11)	DWS, WSAs	2021
Establish a business case for streamlined institutional arrangements in the water and sanitation sector (2.1.1)	DWS	2020
Establish a Municipal Intervention Unit for Water and Sanitation in DWS, staffed with highly competent experts to drive a national programme of intervention at the municipal level (2.1.2)	DWS	2022
Establish financially sustainable CMAs across the country, and transfer staff and budget and delegated functions, including licensing of water use and monitoring and evaluation of water resources (2.1.3)	DWS	2020
Establish the National Water Resources and Services Authority (NWRSA)(2.1.4)	DWS, NT	2020
Determine the optimal configuration of water boards to manage regional bulk water supply, assist municipalities to perform their primary water and sanitation services mandate where necessary, manage regional water resources infrastructure, manage regional bulk WTWs and WWTWs (2.1.5)	DWS, WBs	2020
Establish the National Water Resources and Services Regulator (NWRSR)(2.1.6)	DWS, NT	2020
Establish regulations on required qualifications and experience for senior and technical positions in DWS, CMAs, water boards and municipal services institutions (2.3.1)	DWS, CoGTA, SETA	2023
Develop and implement programme for recruiting experienced technical and managerial staff in South Africa first and then internationally (2.3.2)	DWS, CoGTA, DIRCO	2030
Develop and implement a mandatory, modular hands-on qualification for municipal water managers (technical manager) to be run over 18 months and accredited by EWSETA to include aspects such as asset management, tariffs	DWS, EWSETA, Institutions of Higher Learning	Ongoing

Action	Responsibility	Completion date
and revenue management, drought management, stakeholder engagement and customer relations (2.3.4)		
Partner with institutions to fund training of water sector practitioners in the curation, management and use of data as well as the associated technologies (2.3.5)	DWS, EWSETA	Ongoing
Develop and implement institutional arrangement that recognise the diversity of circumstances across South Africa, the legacy of Apartheid and allow for regional cross subsidisation (2.4.1)	NT, DWS	2021
Implement accurate billing and effective revenue management systems in all entities in the water value chain with a strict *"No payment = no water"* approach to agriculture/industrial/commercial users and restricted supply to domestic users (2.4.2)	WSAs, WBs, DWS, AGSA	2024
All conditional grants to be dependent on meeting of current payments to the next entity in the value chain, improvements to Blue Drop, Green Drop and No Drop Scores to meeting targets and audit outcome. Allow conditional grants to be used for operational costs (2.4.3)	NT, AGSA, DWS	2023
Develop regulations in terms of Section 139 (8) of the Constitution, which allows for a national entity to take over the water service functions, including revenue and billing, in a municipality if service deliver criteria are not met (2.4.4)	DWS, CoGTA	2022
Ensure that sufficient revenue is received through tariffs and grants to operate, maintain and improve the water supply and sanitation system. The tariff structure must allow for cross subsidisation for the indigent and building of a reserve for periods of drought (2.4.5)	WSAs, WBs, DWS, NT, AGSA	2024
In all entities put in place mechanisms to deal with accumulated debts (2.4.6)	WSAs, WBs, DWS, NT, AGSA	2020
Review the Municipal Financial Management Act (MFMA) and the Municipal Systems Act (specifically chapter 8) to ensure that they provide an enabling environment for the provision of reliable water and sanitation services (2.5.4)	NT, DWS, CoGTA, SALGA	2020
Develop new policies and strategies on matters not previously addressed, in consultation with all stakeholders, to facilitate the sustainability of various water sector	DWS	2025

Action	Responsibility	Completion date
programmes (2.5.5)		
Implement and regularly review/revise Research, Development and Innovation Policies, Plans and Roadmaps across the sector (2.6.1)	DWS, DST, WRC, CSIR	2021
Unlock investment, procurement and other localisation barriers to reposition the sector to implement new/niche solutions and approaches and roadmap the NMIU (2.6.2)	DWS, NT, CoGTA, DST, NMIU	Ongoing
Fund research into new models to better understand implementation approaches for water allocation reform, and equity issues (2.6.6)	DWS, WRC, CSIR, DST	Ongoing
Develop technologies, guidelines and implementation support tools that enable SA to use alternative and appropriate sources as part of water supply (2.6.7)	DWS, WRC, CSIR, DST, SALGA, CoGTA, WSAs	2023
Scan and sort the innovation sector for solutions that are ready for application and invest in their implementation (2.6.10)	WRC, CSIR, DST, DWS	2021
Alternative Sanitation: Develop and demonstrate and validate appropriate alternative, water-less and off grid sanitation solutions (Current – 2025) (2.6.11)	DWS, WRC, CSIR, DST, BMGF, the dti, Municipalities	Ongoing
Domestic and industrial Waste Water: Develop and Demonstrate appropriate waste water technologies for cost effectiveness, energy efficiency and beneficiation (2.6.12)	DWS, TCTA, WRC, CSIR, the dti, DST, TIA, MINTEK	Ongoing
Scan and sort the innovation sector for solutions that are ready for application and invest in their implementation (2.6.13)	WRC, CSIR, DST, DWS	2021

5.4 ENSURING IMPLEMENTATION THROUGH REGULATION

All water institutions (and private owners where relevant) must take responsibility to operate and maintain water related infrastructure according to the set norms and standards.

The Department of Water and Sanitation must take responsibility to develop policy and regulations and to promulgate after consultation in the sector.

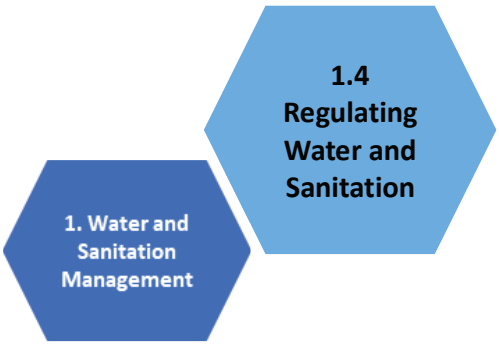
The Department will enforce regulations (including set norms and standards) according to the Regulatory Framework (as per the Strategic Framework of 2003) and revitalise/expand innovative approaches such as the incentive-based regulation programmes (Blue Drop, Green Drop and No Drop programmes). Clear timeframes will be required to inform the sector on when new regulations will be promulgated and by when regulatory programmes will be implemented.

Regulation will be discussed in detail in the next chapter.

6 REGULATING THE WATER AND SANITATION SECTOR

6.1 PRESENT STATE

Regulation of the water and sanitation sector is extremely complex, with a large number of bodies responsible for different aspects of regulation, as shown in **Figure 6-1** below. The primary regulation of the sector, however, is the responsibility of the Department of Water and Sanitation. In addition to the formal regulatory system, informal regulation, or influencing of behaviour, is done through the media, community pressure groups, and voluntary regulation.



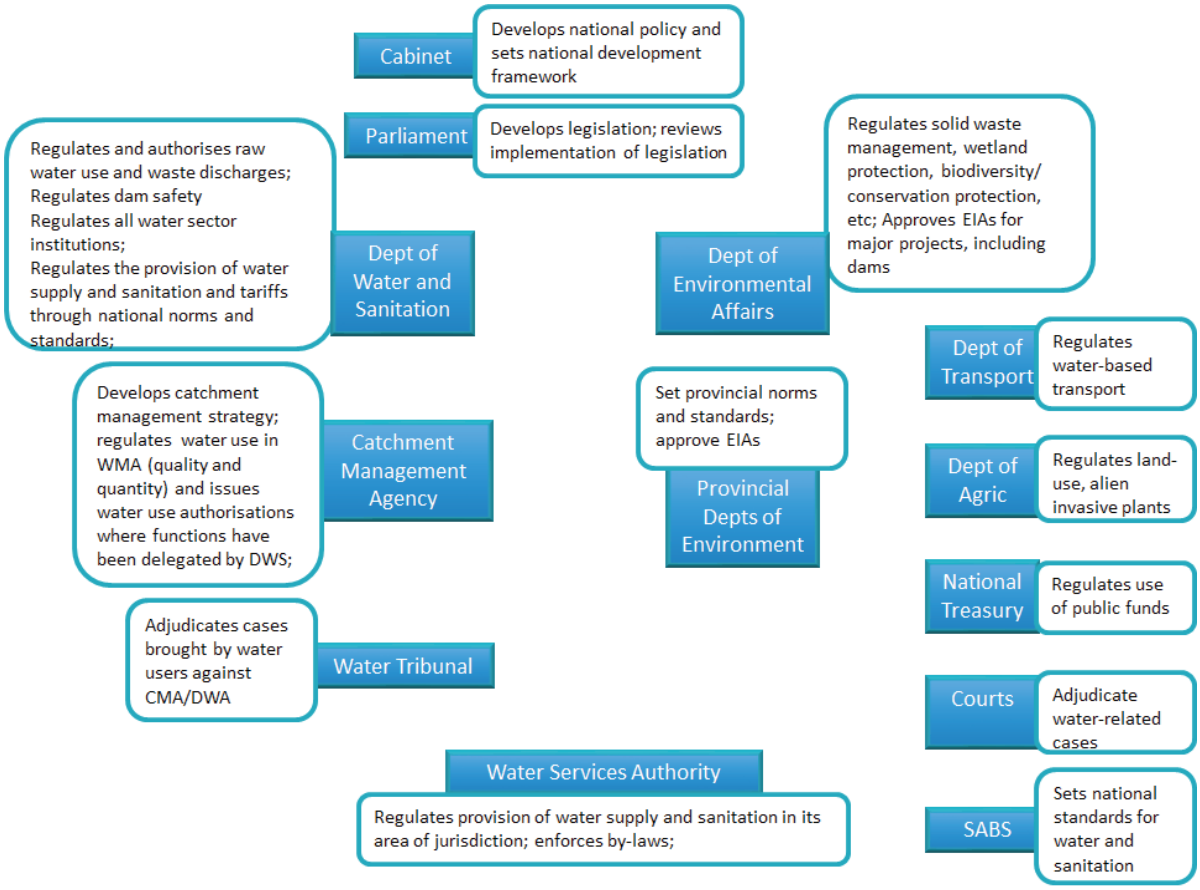


Figure 6-1: Regulatory responsibilities for the water and sanitation sector

Water resources regulation is aimed at achieving the sustainable and equitable use of a common pool resource – water. Water services regulation is aimed at ensuring the provision of financially sustainable, reliable and universal water supply and sanitation provision, with a particular focus on ensuring affordable access to the poor.

Three different types of regulation are included in this framework: technical regulation, governance regulation and economic regulation.

Technical regulation, such as 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. Economic regulation, on the other hand, 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. 'Governance regulation' refers to regulation of the governance of subsidiary water institutions, such as catchment management agencies and water user associations. 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 whether statutory requirements relating to business plans, audited financial statements, and annual reports are met. Since an institution with authority cannot delegate accountability to a contracted entity, it has to ensure that acceptable standards are maintained according to service level standards agreed to in the Service Level Agreement (SLA)/ Memorandum of Understanding (MOU) / Contract.

Broadly there are four categories of regulatory instruments used in the water sector: command and control, economic and market instruments, information as regulation, and voluntary instruments such as negotiated agreements and community-based policing.

Whatever regulatory instruments are used, some form of enforcement of those instruments is required, either by ensuring compliance with command and control requirements, ensuring payment for water use, or ensuring the accuracy of information provided.

Regulatory responsibilities

DWS is responsible for the regulation of water use (water use authorisation for the eleven uses defined in the NWA, dam safety, ensuring equitable access to water and protection of aquatic ecosystems). Dam safety is regulated through the Dam Safety Office in DWS. DWS also sets the charges for raw water (infrastructure charges and water resources management charges and the planned waste discharge charges) which, if correctly designed can play a regulatory role in water use.

DWS is also responsible for the governance regulation of CMAs, water boards, water user associations, the Trans Caledon Tunnel Authority (TCTA), WRC and the Komati Basin Water Authority (KOBWA).

In relation to water services, DWS is responsible for ensuring that water services tariffs are in accordance with regulations published under sections 9 and 10 of the WSA, and for setting technical standards for water services and sanitation provision. Drinking water quality is

regulated under standards set by the South African Bureau of Standards (SABS). SABS also plays a critical role in setting standards for water technology including taps and pipes.

Water services authorities are responsible for regulating water and sanitation provision and use through by-laws and contracts with water services providers.

The use of public funds is regulated either through the PFMA or, at local government level, through the MFMA.

Other government departments also have regulatory roles, as set out in **Figure 6-1**.

6.2 DRIVERS

There are several challenges that need to be addressed going forward to ensure an improved and streamlined regulatory framework, as well as improved regulation of the sector.

Regulatory Complexity

The existing regulatory framework (legislation, regulations, policies, strategies, by-laws etc) for the water cycle/value chain is highly complex in that multiple stakeholders/ role-players are involved and different regulatory authorities; regulatory domains and mechanisms apply at different levels. (e.g. environment, social, economic, health etc). The mandates of the various players are not always clear, for example, in relation to the roles of DWS and COGTA in relation to local government. The relative roles of DWS and CMAs are also not clear.

In addition, there are several regulatory bodies *not* in the water sector, that have functions and powers that directly affect water resources, in particular DAFF, DEA, the Departments of Mineral Resources, Energy, Human Settlements and Health. Changes to the regulations issued by, and the regulatory practices of these bodies can significantly impact on water and sanitation regulation.

A further complexity is the regulation of one sphere of government (local government) by another (DWS) particularly since national government also has an obligation to support local government to perform its functions effectively. A protocol has been developed on taking action against local government which must be implemented effectively by DWS.

An integrated approach to water and sanitation regulation, and streamlined institutional arrangements are thus required at the national level and across the spheres of government.

A significant challenge in the regulation of the water resources sector, and in achieving transformation is access to water, is the ongoing use of water under the existing lawful use (ELU) clause of the National Water Act. This clause was originally intended as a transitional one, but it still governs most water use in the country. Water used under the ELU clause is more difficult to regulate than licenced water use, as there are no specific and enforceable conditions attached to the use as there are with licenced use.

Regulatory Capacity

The regulatory authorities need to have the necessary authority and capacity to effectively enforce regulatory requirements and decisions. The current regulatory capacity in the water sector, however, is insufficient, both in terms of the number of skilled staff, and in the appropriate tools for regulation in the context of limited staff and financial resources.

In this regard, serious consideration will be given to the introduction of a system of administrative penalties, rather than relying on the court system as the only means of imposing penalties on those breaking the law. This approach will allow DWS and/or CMAs to impose significant fines on those stealing water, discharging wastewater unlawfully, or otherwise breaking the law. The fines must be concomitant with the seriousness of water crime in a water scarce country and relative to the potential impact on human and ecological health.

Regulatory Autonomy and Independence

Some network industries lend themselves to competition, but elements such as electricity grids, water pipelines and railway lines tend to be natural monopolies. They tend to have high fixed costs and the average cost of service provisions decreases with the number of users of the network. It is thus difficult to create meaningful competition or to encourage multiple market entrants in these sectors. This requires effective economic regulation to protect both customers and service providers. Some international practice has shown that such regulation works best where there is the political will for economic regulation, and where regulators are independent, publicly accountable and transparent, and where they have sufficient institutional and human capacity. The potential for independent economic regulation in South Africa is under investigation by DWS.

Information and regulation

Effective regulation of the water cycle/value chain is underpinned by the need to have access to accurate and reliable information on an ongoing basis. The capacity of relevant institutions to collect and collate such information and report on an ongoing basis and the capacity of the regulatory authorities to interpret and respond to appropriately and timeously to the information is clearly a major challenge for effective regulation of the sector.

The publication of information has also been shown, internationally, to be a powerful tool in regulating the behaviour of water users. In South Africa, the Blue Drop, No Drop and Green Drop reports have been extremely useful in changing the performance of municipalities. However, they have not been produced since 2014. The re-invigoration of these three reports is seen as a critical step in regulating the water services sector, and one that can be introduced immediately in 2018.

Internationally, water efficiency labelling and standards systems have been shown to be very effective in driving down water demand. SABS has an important role to play in supporting DWS in developing such a system for South Africa.

6.3 PRIORITIES FOR THE FUTURE

Achievement of the actions in the NW&SMP will result in a situation where there is sufficient capacity in the regulatory institutions of the water sector in terms of staff, tools and legislative backing to effectively regulate the use of water, the protection of water resources, and the provision of water services and sanitation in the country. This will include sufficient engineering capacity in DWS to carry out the dam safety regulatory function effectively.

A targeted approach will be adopted in which those whose non-compliance with legislation and regulatory requirements has the biggest impact are the primary focus of compliance monitoring and enforcement programmes. Only once the non-compliant high impact users have been brought under control are smaller impact users addressed. In this way, the greatest impact will be achieved with limited resources.

The intention is that, in introducing this targeted approach, successful prosecutions of high impact users will be widely publicised, in order to drive behaviour change amongst other users based on the realisation that DWS is taking action against defaulters. The imposition of significant administrative fines on defaulters will make this easier.

WSAs use by-laws will be used effectively to protect urban river systems and groundwater, and to meet water conservation and demand management targets in their areas of jurisdiction.

The following table as copied from Volume 1 (Call to Action) provides a summary of the Priority Actions:

Table 6-1: Priority Actions

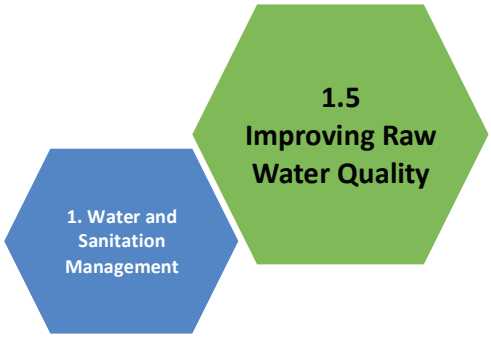
Action	Responsibility	Completion date
Set cap on water use with reducing targets over time (Volume 3, Action 1.1.2)	DWS, CMAs, WSAs, CoGTA	2030
Revitalise the Green, Blue and No Drop programmes and publish results. Revise and establish norms and standards (1.4.1)	DWS, WSAs	Annually
Include water use efficiency and conservation targets in the KPIs of municipal managers and municipal water supply and sanitation managers, and in municipal implementation plans (1.4.2)	CoGTA, Municipalities	2019
Establish Water Efficiency Labelling and Standards (WELS) Scheme (1.4.3)	SABS, DWS	2025
Identify and prosecute major non-compliant abstractors (water thieves) across the country, with a national communication campaign to accompany	CMAs, NPA, SAPS, DEA, Regulator, DMR, DWS, Blue Scorpions	2020

Action	Responsibility	Completion date
the action inclusive of reviving the Blue Scorpions (1.4.4)		
Replace all Existing Lawful Use (ELU) with licences with enforceable water use conditions (1.4.5)	DWS, CMAs	2030
Development and implementation of the MoU between the DWS and strategic users (1.4.6)	DWS, Chamber of Mines, Eskom, Industries	2020
Develop and implement municipal by-laws to protect water quality (1.4.7)	DWS, WSAs	2020
Identify and prosecute big polluters across the country (including municipalities), with a national communication campaign to accompany the action inclusive of reviving the Blue Scorpions (1.4.8)	CMAs, NPA, SAPS, DEA, DMR, DWS, Blue Scorpions	2020
Establish a mechanism for applying administrative penalties (1.4.9)	DWS, Dept of Justice	2023
Develop improved regulatory approaches to manage pollution from land-based and in-stream activities (SA1, SA7, SA20 & SA29) (1.4.10)	DWS	2022
Develop and implement an action plan to strengthen water use authorisation processes (SA24, SA25, SA26, SA27 & SA28) (1.4.11)	DWS, CMAs, WRC, CSIR	2022
Implement the Waste Discharge Charge System (WDCS) in priority catchments (SA5, SA41, SA42, SA43 & SA44) (1.5.8)	NT, DWS, CMAs	2030
Ensure fiscal support for IWQM (SA38 & SA39) (1.5.11)	DWS, WSAs	2021
Develop and implement a diffuse pollution source strategy that includes the regulation of land use (1.5.14)	DWS, CMAs	2023
Declare strategic water source areas and critical groundwater recharge areas and aquatic ecosystems recognised as threatened or sensitive as protected areas (1.6.1)	DWS, CMAs, DEA	2021

Action	Responsibility	Completion date
Establish a business case for streamlined institutional arrangements in the waterand sanitation sector (2.1.1)	DWS	2020
Establish financially sustainable CMAs across the country, and transfer staff and budget and delegated functions, including licensing of water use and monitoring and evaluation of water resources (2.1.3)	DWS	2020
Determine the optimal configuration of water boards to manage regional bulk water supply; assist municipalities to perform their primary water and sanitation services mandate where necessary, manage regional water resources infrastructure, manage regional bulk WTWs and WWTWs (2.1.5)	DWS, WBs	2020
Review and develop comprehensive and appropriate Management, Monitoring and Reporting Structures of the DWS data portal (2.2.1)	DWS	Annually
Establish regulations on required qualifications and experience for senior and technical positions in DWS, CMAs, water boards and municipal services institutions (2.3.1)	DWS, CoGTA, SETA	2023
Develop and implement programme for recruiting experienced technical and managerial staff in first South Africa and then internationally (2.3.2)	DWS, CoGTA, DIRCO	2030
Define (and reinstate in some cases) career paths with defined training and on the job experience to build a knowledgeable sector of professionals (2.3.3)	DWS, WSAs, WBs, CMAs	2023
Develop and implement a mandatory, modular hands-on qualification for municipal water managers (technical manager) to be run over 18 months and accredited by EWSETA to include aspects such as asset management, tariffs and revenue management, drought management, stakeholder engagement and customer relations (2.3.4)	DWS, EWSETA, Institutions of Higher Learning	Ongoing
All conditional grants to be dependent on meeting of current payments to the next entity in the value chain, improvements to Blue Drop, Green Drop and No Drop Scores to meeting targets and audit outcome. Allow conditional grants to be used for	NT, AGSA, DWS	2023

Action	Responsibility	Completion date
operational costs (2.4.3)		
Ensure that sufficient revenue is received through tariffs and grants to operate, maintain and improve the water supply and sanitation system. The tariff structure must allow for cross subsidisation for the indigent and building of a reserve for periods of drought (2.4.5)	WSAs, WBs, DWS, NT, AGSA	2024
Review the Municipal Financial Management Act (MFMA) and the Municipal Systems Act (specifically chapter 8) to ensure that they provide an enabling environment for the provision of reliable water and sanitation services (2.5.4)	NT, DWS, CoGTA, SALGA	2020
Develop new policies and strategies on matters not previously addressed, in consultation with all stakeholders, to facilitate the sustainability of various water sector programmes (2.5.5)	DWS	2025
Continue to invest in understanding emerging contaminants (detection and treatment) in order to improve our transition to reuse, reclamation and recycling of water (2.6.15)	DWS, WRC, CSIR, Municipalities	Ongoing
Improving raw water quality: **Invest in Communities of practise that bring together built and ecological infrastructure experts and solutions (2.6.16)**	DWS, DEA, SANBI, WRC, CSIR, DST	Ongoing
Link the Global Environment Fund 6 project on Water Pricing and Ecosystems to Water Master Plan implementation and position DWS to be closely involved in this process (2.6.17)	DWS, DEA, SANBI, WRC, CSIR	2024

7 IMPROVING RAW WATER QUALITY



7.1 PRESENT STATE

Water quality refers to the chemical, physical and biological characteristics of water and is a measure of the condition of water relative to a water quality compliance standard, or relative to the water quality requirements of one or more biotic species or receiving water users.

Although scientific measurements are used to define the *quality of water*, it's not a simple matter to say that *"this water is good"* or *"that water is bad"*. The quality of water that is required for industrial purposes, for instance, is not necessarily the same quality of water that is required for drinking purposes. Therefore, water quality, should be compliant to a set standard, or suitable for its intended use, be it for agricultural, domestic, industrial, recreational or spiritual purposes, or its suitability to maintain a healthy aquatic ecosystem.

South Africa faces a wide range of water quality challenges impacting on both surface water and groundwater, originating from both point source discharges such as industrial processes and municipal waste water treatment works, and from non-point sources due to run-off from land. Approximately 83% of the country's national monitoring sites reflect some form of water quality challenge.

Deteriorating water quality has the potential to significantly limit the economic growth potential of the country. The deterioration of water quality in rivers, streams, dams, wetlands, estuaries and aquifers impacts on the economy, on human health, and on the healthy functioning of aquatic ecosystems. Deteriorating water quality reduces the amount of water available for use as more water must be retained to maintain the dilution capacity in our river systems. It increases the costs of doing business as many enterprises are forced to treat water before using it in their industrial processes.

The deterioration in water quality also impacts on human well-being, with productivity falling as more work days are lost due to water-related illnesses and, finally, it threatens several economic sectors by impacting on crop yields and making crops vulnerable to import restrictions in key trading partner countries. Some of the impacts of water quality deterioration are immediately visible, such as in the case of major fish kills, while others are more insidious and long-term. Combined, however, they have a significant negative impact on socio-economic development in South Africa.

Water quality and water quantity issues are inextricably linked, and the management of water quality cannot be done in isolation from the management of abstraction, storage and use. One of the elements of water quality management is recognising that water resources have a limited capacity to assimilate waste, point above which the water resources becomes unfit for use and lose ecological viability.

Water quality problems are manifested at various scales (see figure below). Salinization, sedimentation, nutrient enrichment and microbial pollution (associated with urban effluent) occur

at a national scale while acid mine drainage, agrochemical pollution and nutrient enrichment (associated with industrial effluent and irrigation return-flows) occur at regional or site-specific scales.

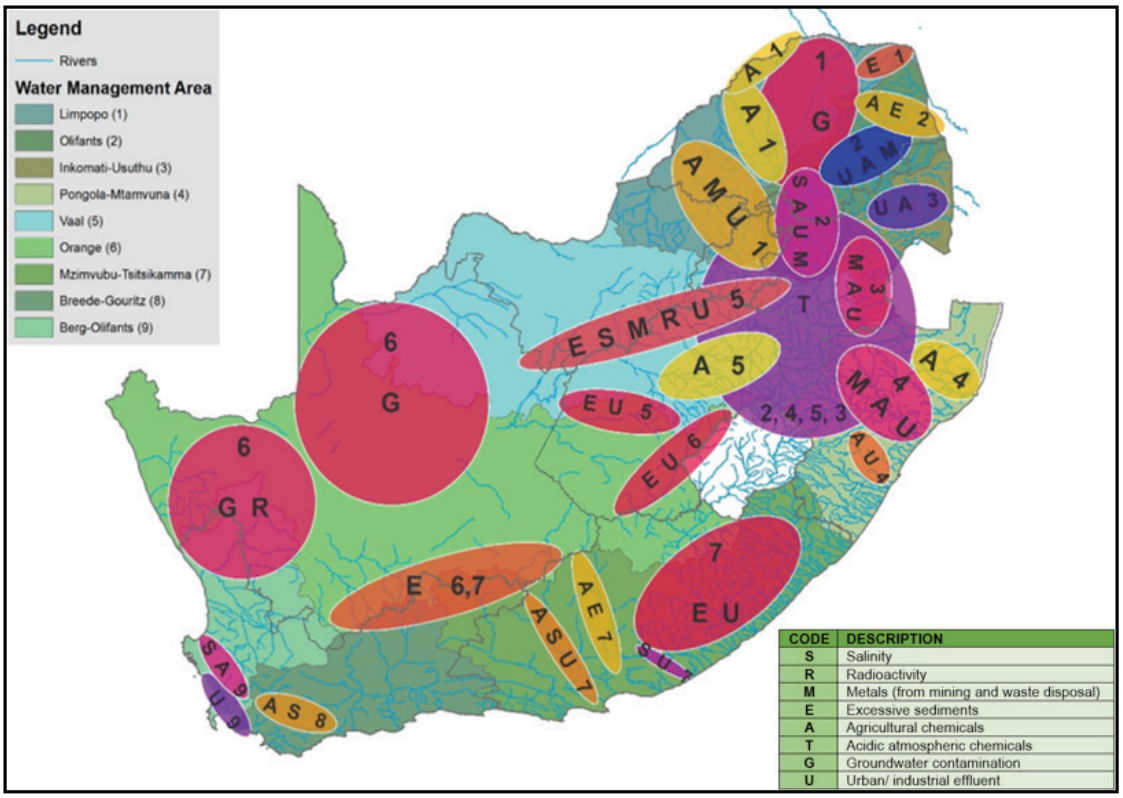


Figure 7-1: Different types of Water Quality problems across South Africa (Ashton, 2012)

Most of the country's water resources are negatively impacted by a combination of wastewater discharges and run-off from land-based activities. Major impacting sources include agricultural drainage and wash-off (irrigation return-flows, fertilisers, pesticides and runoff from feedlots); urban wash-off and effluent return-flows (bacteriological contamination, salts and nutrients); industries (chemical substances); mining (acids, salts, metals and radioactivity); and areas with insufficient sanitation services (microbial contamination). The quality of groundwater is impacted on by mining activities, leachate from landfills, human settlements and intrusion of sea water.

As the economy and technologies develop, the pressures to stay abreast of new forms of pollution increase, and monitoring and /or further investigation to improve our understanding of these pollutants and their impacts will be critical.

There are five priority water quality issues that will be addressed through a strategic, adaptive and action-oriented water quality management programme. These five priority issues are: eutrophication; salinisation; acid mine drainage and acidification; sedimentation; and urban runoff pollution.

These priority water quality challenges all have multi-sectoral characteristics and will need strategic regulatory collaboration and partnerships between DWS and various other state institutions across all three spheres of government (including CMAs, Water Boards, WSAs, DAFF, DMR and the Department of Trade and Industry (DTI), the private sector and organised civil society.

Historically, water quality management has been the sole mandate of DWS. However, there are other government departments whose mandates have a profound impact on water quality, most critically, the Departments of Environmental Affairs (DEA), Mineral Resources (DMR), Agriculture, Forestry and Fisheries (DAFF), Health (DH), Human Settlements (DHS), Education (DoE), Co-operative Government and Traditional Affairs (COGTA), National Treasury (NT), Trade and Industry (DTI), together with provincial counterparts where relevant, and municipalities/WSAs. Water quality management is, therefore, a government-wide task, to be implemented under strong leadership of the DWS, with both the private sector and civil society playing a role.

"Mega trends" potentially affecting water quality

Several "mega-trends" have been identified, which can be expected to unfold in South Africa during the next few decades and which could lead to new or accelerated water quality challenges in many locations across the country. These include: climate change; hydraulic fracturing; rural-urban migration and growth of inadequately serviced densely populated settlements; the adoption of new manufacturing and industrial processes, and water re-use. These trends will require new and adaptive management approaches, increased levels of cooperative governance between sectors, and ongoing monitoring and evaluation.

7.2 PRIORITIES FOR THE FUTURE

7.2.1 High-level Water Quality Management Master Plan Targets

The national *Integrated Water Quality Management Plan*[43] contains three high-level outcome-based targets to be progressively realised by 2030. These targets also support those components of SDG 6 that have direct water quality relevance. Each of these targets is only realisable through the implementation of multiple preceding strategic actions. These three high-level targets pertain to resource water quality management; source control; and integrated water quality management, as follows:

[43] Department of Water and Sanitation (DWS). 2017. Integrated Water Quality Management Plan

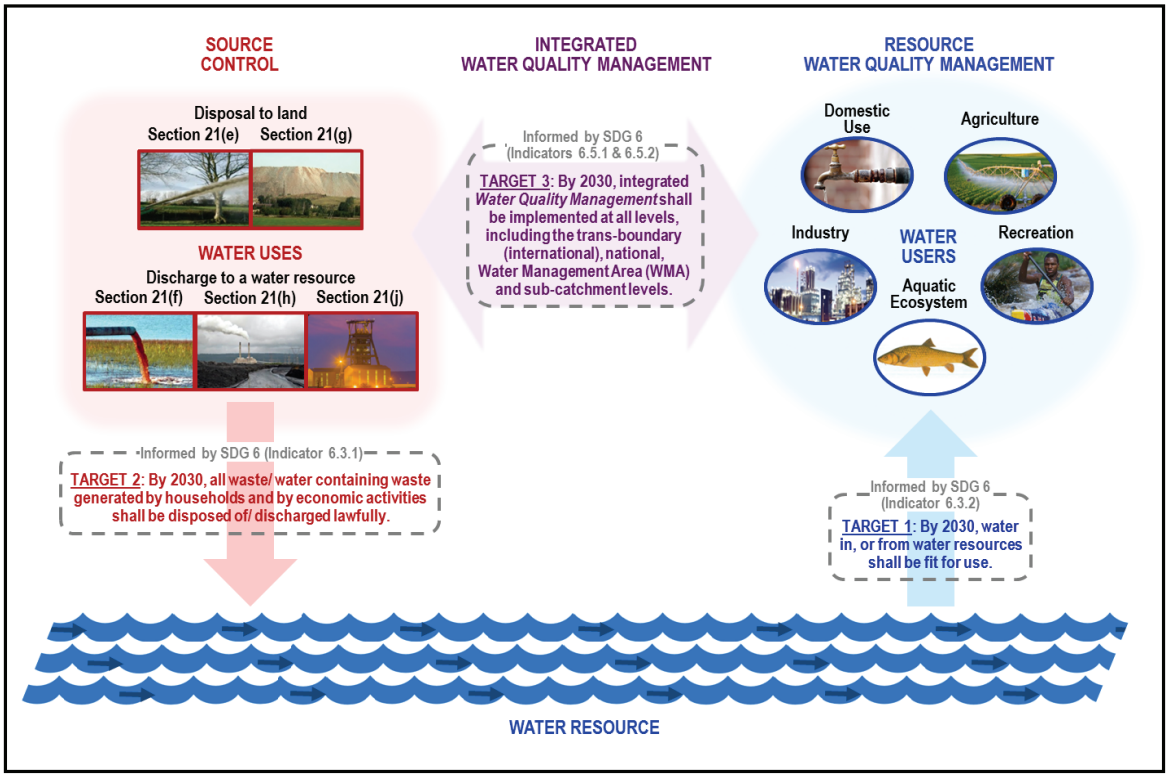


Figure 7-2: High-level Water Quality Management Master Plan Targets

TARGET 1: By 2030,water in, or from water resources shall be fit for use[44]

For water resources to be able to continuously sustain economic growth and social development, the quality (or "resource quality") of such water resources needs to be maintained within pre-determined parameters.

These resource parameters, or Resource Directed Measures (RDMs), are represented by the Resource Management Class, Resource Quality Objectives (RQOs) and the Reserve. Collectively the RDMs, and more specifically the resource water quality objective (RWQO) components of RQOs, provide performance indicators to benchmark the fitness-for-use of water resources; and to measure the effectiveness of water quality management measures being applied. It is, thus, essential that RWQOs must be determined for all significant water resources and that they are given effect through appropriate source controls, such as through water use

[44] National Planning Commission.2012. National Development Plan.

licensing (as per Section below). Suitable water quality monitoring must also be carried out to gauge performance as a potential precursor to possible corrective action.

The purpose of Target 1 is to progressively ensure that all water resources are fit for use. It is further unpacked in the table below.

Table 7-1: High-level Water Quality Management Master Plan Target 1

Target text	Normative interpretation
"By 2030…	Implies the progressive realisation of the set target over time by the specified year.
…water in, or from water resources…	Implies custodianship over all surface water, groundwater and estuaries.
…shall be fit for use."	Implies compliance to the fitness-for-use criteria, as determined for receiving water resources. Such fitness-for-use criteria are represented by Resource Quality Objectives (RQOs), determined in terms of Section 13(1)(b) of the National Water Act, 1998 (Act No. 36 of 1998), or in the absence thereof, by in-stream water quality objectives that are set, based on the South African Water Quality Guidelines. Fitness-for-use may relate to the water quality requirements of the aquatic ecosystem, or the domestic-, agricultural-, industrial- and/ or recreational water user sectors. **Note:** Source control measures to ensure fitness-for-use of receiving water resources may relate to the management of point- and diffuse source impacts. Target 2 focuses on the control of point-sources of potential pollution.

TARGET 2: By 2030, all waste/ water containing waste generated by households and by economic activities shall be disposed of/ discharged lawfully and safely[45]

The control and management of sources of water pollution is guided by the National Environmental Management Act, 1998 (Act No. 107 of 1998) as well as the Resource Directed Measures (RDMs) determined for affected water resources.

The precautionary approach is always applicable and will be balanced against socio-economic needs. Preventing pollution in the first place will always be encouraged while pursuing the best practicable environmental option. Should some water quality degradation be inevitable, waste minimisation will be encouraged.

[45] National Planning Commission.2012. National Development Plan.

All water uses that may affect the water quality of a water resource, *i.e.* the disposal of waste or the discharges of water containing waste to a water resource, are regulated under the National Water Act, 1998 (Act No. 36 of 1998) and must be compliant with the conditions of the relevant water use authorisation. Discharges of water containing waste to municipal waste water treatment works must be compliant with the relevant bylaws of such municipalities. Compliance monitoring is essential, and strong action will be taken against unlawful and/or non-compliant water uses.

The effective regulation of water use and the effective control of potential sources of water pollution are prerequisites to maintaining and improving the water quality of the country's water resources. Target 2 is focused on improving the water quality regulatory environment. The table below provides an interpretation of this target.

Table 7-2: High-level Water Quality Management Master Plan Target 2

Target text	Normative interpretation
"By 2030…	Implies the progressive realisation of the set target over time by the specified year.
…all waste/…	Implies disposed waste that may potentially detrimentally affect (a) water resource(s).
…water containing waste…	Implies discarded effluent that is no longer required by the owner or user. Such effluent includes effluent discharged to a municipal waste water treatment works or to a water resource or reused by another user without further treatment.
…generated by households…	Implies sewage and faecal sludge emanating from the domestic sector.
…and by economic activities…	Implies industrial effluent and waste emanating from activities identified in the Standard Industrial Classification of all Economic Activities (1993), as amended and supplemented.
…shall be disposed of/ discharged lawfully…	Implies (1) the implementation of the Water Quality Management Hierarchy of pollution prevention, waste minimisation, and the differentiated utilisation of the capacity of receiving water resources to assimilate waste, as per Section 2(4)(ii) and (iv) of the National Environmental Management Act, 1998 (Act No. 107 of 1998); (2) where relevant, that such water use is permissible in terms of the National Water Act, 1998 (Act No. 36 of 1998); (3) where relevant, such water use is compliant with the conditions contained in the applicable authorisation; and (4) where relevant, that such water use is compliant with the stipulations of the applicable bylaws.
…and safely."	Implies that the conditions that are attached to such lawful water use should link to the resource quality requirements of receiving water resources. See Target 1 (Table 7-1.

TARGET 3: By 2030, integrated Water Quality Management shall be implemented at all levels, including the transboundary, national, water management area (WMA) and sub-catchment levels

Integrated water quality management (IWQM) aims to achieve specific objectives in a particular management unit, taking into consideration the defining principles and background conditions

relevant to that specific management unit, whether the management unit in question is at the level of an internationally shared river basin, at the level of an individual water user, or somewhere in between. See the figure below.

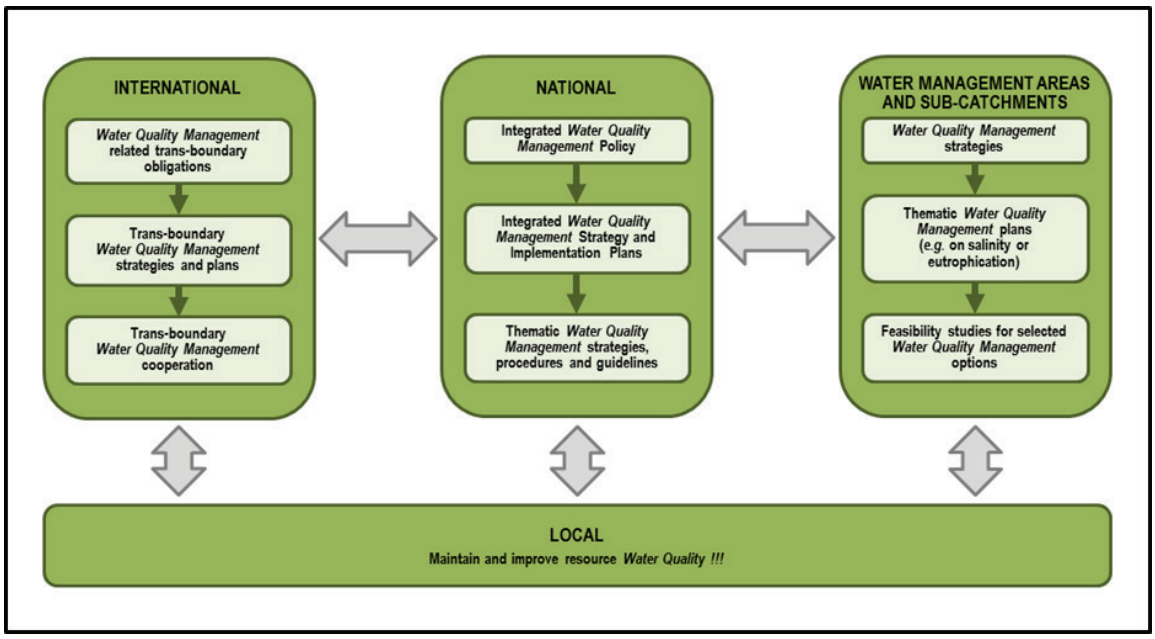


Figure 7-3: International, national and catchment Water Quality Planning (adapted from DWS, 2015)

Operationally, IWQM involves applying knowledge from various disciplines, as well as the insights from diverse stakeholders, to devise and implement efficient, equitable and sustainable solutions to water quality and development challenges. Coherent and integrated water quality management is only achievable when water quality challenges are addressed holistically within catchments through a process of water quality planning to attain desired water quality outcomes.

The establishment and implementation of water quality management strategies at WMA and/ or sub-catchment level is central to the integration of management efforts. These strategies will also provide input to the development and implementation of catchment management strategies and future revisions of the National Water and Sanitation Resources and Services Strategy.

Target 3 aims to establish structure towards the integrated management of Water Quality and stands in support of the aims of Targets 1 and 2. The table below provides an interpretation Target 3.

Table 7-3: High-level Water Quality Management Master Plan Target 3

Target text	Normative interpretation
"By 2030…	Implies the progressive realisation of the set target over time by the specified year.
…integrated Water Quality Management…	Is that distinct component of Integrated Water Resource Management that promotes the coordinated and holistic management of *Water Quality* to achieve specific objectives within a particular management unit, taking into consideration the defining principles and background conditions relevant to that specific management unit, in order to maximize the resultant economic and social benefit in an equitable manner without compromising ecologically sustainable development.
…shall be implemented…	Refers to the Johannesburg Plan of Implementation (2002) objective, *i.e.* to develop Integrated Water Resource Management and Water Efficiency plans. The aforementioned include *Water Quality Management* and considering Targets 1 (Table 7-1**)** and 2 (Table 7-2).
…at all levels,…	Refers primarily to vertical levels of governance, from transboundary cooperation between basin states to national Government to CMAs to local government, including water users and stakeholder participation.
…including the trans-boundary (international),...	Implies the development and implementation of cooperation agreements to address water quality matters of mutual interest in respect of surface water and/ or groundwater basins (aquifers) that cross international borders or are shared among two or more co-basin states.
…national,…	Implies the development and implementation of water quality management approaches that apply uniformly across South Africa, including national policy and strategy.
…Water Management Area (WMA) and sub-catchment levels.	Implies the development and implementation of water quality management approaches that address catchment specific challenges and concerns, including the development and implementation of catchment water quality management strategies and thematic plans.

7.2.2 Prioritised focus for maintaining or improving water quality

There are several areas that are priority for implementation under the NW&SMP. Firstly, there is a need to develop a diffuse source pollution strategy that will include improved regulation of land use in order to reduce diffuse source pollution.

The implementation of the waste discharge charges strategy is of critical importance in order to increase the funding available for the management and rehabilitation of polluted catchments, but also in order to incentivise the reduction of pollution. In line with this, the waste discharge charge will be implemented in three priority catchments initially, the upper Crocodile, the upper Vaal and the upper Olifants catchments. This will be followed by programmes to rehabilitate and manage the water quality in these catchments.

At the municipal level, there is a need to restructure the grant funding mechanisms for water supply and sanitation to ensure that existing infrastructure is effectively maintained, including waste water treatment works. This also requires standardised O&M budgeting and expenditure.

A national programme is also needed to turn around dysfunctional WWTW and to ensure that they are effectively maintained once they have been rehabilitated.

Pollution in the Vaal River system will be improved by the construction of a desalination plant to treat AMD from the Wits mining basins.

Strong enforcement of licence conditions is necessary to prevent pollution and to improve water quality across the country. While the introduction of a system of administrative penalties will assist in this regard, in the interim, the more conventional route of prosecution through the courts will be required.

To support this, it will be important to build the necessary skills and expertise in government through clear definition of career paths, and on the job training and experience.

7.2.3 List of priority actions

The following table as summarised in Volume 1 of the NW&SMP provides a list of priority actions to be implemented:

Table 7-4: Priority Actions

Action	Responsibility	Completion date
Development of strategic water resources infrastructure (Volume 3, Action 1.1.10)	DWS, LHDA, WSAs, WBs, TCTA	2025
A National water and wastewater treatment performance turnaround plan to be developed and implemented. Turn around the functionality of five, currently dysfunctional, large water and wastewater treatment works with an accompanying publicity campaign, followed by a programme addressing the rest (1.3.12)	DWS, WSAs, NT, WBs, CoGTA	2030
Develop and implement municipal bylaws to protect water quality (1.4.7)	DWS, WSAs	2020
Identify and prosecute big polluters across the country (including municipalities), with a national communication campaign to accompany the action (1.4.8)	CMAs, NPA, SAPS, DEA, DMR, DWS, Blue Scorpions	2020
Establish a mechanism for applying administrative penalties (1.4.9)	DWS, Dept of Justice	2023
Implement measures to ensure that water users use and discharge water responsibly and adhere to regulatory requirements (1.5.1)	DWS, CMAs, WSAs	2022

Action	Responsibility	Completion date
Determine in-stream Resource Water Quality Objectives (RWQOs), based on the SA Water Quality Guidelines (SA36), in support of RQO's (1.5.1)	DWS, CMAs	2020
Routinely monitor resource water quality (SA46, SA47 SA48) (1.5.2)	DWS, CMAs	2030
Establish and maintain appropriate and accessible information management system(s) for resource water quality (SA49, SA51 & SA60) (1.5.3)	DWS, CMAs	2030
Assess resource water quality information (SA52 & SA59) (1.5.4)	DWS, CMAs	2030
Implement adaptive source control-based water quality management interventions, in accordance with relevant catchment plans and strategies (SA34 & SA35) (1.5.5)	Chamber of Mines, DWS, CMAs, DMR	2030
Develop and implement a strategic action plan for the rehabilitation and upgrade of prioritized WWTWs (SA17) (1.5.6)	DWS, WSAs, NT, SALGA, CoGTA	2023
Adopt an integrated planning approach at trans-boundary (international), national, Water Management Area and sub-catchment levels (SA16, SA17, SA18, SA21, SA22, SA23 & SA33) (1.5.7)	DWS	2030
Implement the Waste Discharge Charge System (WDCS) in priority catchments (SA5, SA41, SA42, SA43 & SA44) (1.5.8)	NT, DWS, CMAs	2030
Ensure IWQM is supported by effective departmental arrangements (SA8 & SA9) (1.5.9)	DWS	2020
Formalise governance frameworks to support engagements on water quality management (SA10, SA11, SA12, SA13, SA14, SA15, SA54 & SA61) (1.5.10)	DWS, CMAs, WSAs	2030
Ensure fiscal support for IWQM (SA38 & SA39) (1.5.11)	DWS, WSAs	2021
Build water quality management capacity through recruitment, education and training (SA53, SA54, SA55 & SA56) (1.5.12)	DWS, CMAs, NT, WRC, CSIR, SETA	2030
Create an informed, supportive and responsible public (SA62) (1.5.13)	DWS, CMAs, WSAs	2030

Action	Responsibility	Completion date
(1.5.14) Develop and implement a diffuse pollution source strategy that includes the regulation of land use	DWS, CMAs	2023
Implement programmes to rehabilitate catchments through development of Catchment business plans (1.5.15)	DWS, NT, CMAs	2025
Secure funds for restoration and ongoing maintenance of ecological infrastructure through operationalising the water pricing strategy (1.6.4)	DWS, CMAs, DEA, SANBI	Annually
Establish a business case for streamlined institutional arrangements in the water and sanitation sector (2.1.1)	DWS	2020
Establish financially sustainable CMAs across the country, and transfer staff and budget and delegated functions, including licensing of water use and monitoring and evaluation of water resources (2.1.3)	DWS	2020
Establish the National Water Resources and Services Authority (2.1.4)	DWS, NT	2020
Review and develop comprehensive and appropriate Management, Monitoring and Reporting Structures of the DWS data portal (2.2.1))	DWS	Annually
Review and develop a comprehensive DWS information management strategy **to include among other:** **• Amended authorisation conditions to provide for self-reporting** **• Harmonization of monitoring actions by all responsible institutions** **• Perform information V&V audit (2.2.2) s**	DWS	Annually
Alignment of monitoring institutions to support National and International reporting programmes, e.g. SDGs, Agenda 63 and AMCO (2.2.3)	DWS	2021
Establish regulations on required qualifications and experience for senior and technical positions in DWS, CMAs, water boards and municipal services institutions (2.3.1)	DWS, CoGTA, SETA	2023

Action	Responsibility	Completion date
Develop and implement programme for recruiting experienced technical and managerial staff first in South Africa and then internationally (2.3.2)	DWS, CoGTA, DIRCO	2030
Define (and reinstate in some cases) career paths with defined training and on the job experience to build a knowledgeable sector of professionals (2.3.3)	DWS, WSAs, WBs, CMAs	2023
Develop and implement institutional arrangement that recognise the diversity of circumstances across South Africa, the legacy of Apartheid and allow for regional cross subsidisation (2.4.1)	NT, DWS	2021
Develop new policies and strategies on matters not previously addressed, in consultation with all stakeholders, to facilitate the sustainability of various water sector programmes (2.5.5)	DWS	2025
Improving raw water quality: **Invest in Communities of practise that bring together built and ecological infrastructure experts and solutions (2.6.16)**	DWS, DEA, SANBI, WRC, CSIR, DST	Ongoing
Continue to do research on land use impact on water linked ecosystems (2.6.18)	WRC, CSIR, DEA, DWS, DAFF, ARC	Ongoing
Ongoing research, modelling and planning around climate change and its impacts on water security and water infrastructure needs to be conducted (2.6.19)	DWS, DEA, DST WRC, CSIR	Ongoing

7.2.4 Provincial priorities

When implementing the priority actions cognizance to be given to specific water quality priorities per province[46]. These are summarised in **Table 7-5.**

Table 7-5: Provincial Priorities

Province	Meeting backlog	Addressing wastewater treatment works	O&M priorities
Eastern Cape	Additional resources* for rural programme and urban informal settlements, as well as other backlogs.	Upgrade failing WWTW, extend capacity of under-capacity works	Moderate Green Drop risk profile: Strengthen O&M capacity and resources in all areas
Free State	Additional resources* for rural & urban programmes as well as other backlogs. Replace all bucket toilets in formal areas	Upgrade failing WWTWs, improve maintenance of WWTWs, extend capacity of under-capacity works	Moderate Green Drop risk profile: Strengthen O&M capacity and resources in all areas
Gauteng	Additional resources* for urban informal settlements as well as other backlogs.	Extend good performance to all areas	Moderate Green Drop risk profile: Strengthen O&M capacity and resources in all areas
Kwa-Zulu Natal	Additional resources* for rural programme and urban informal settlements as well as other backlogs.	Extend good performance to all areas	Moderate Green Drop risk profile: Strengthen O&M capacity and resources in all areas
Limpopo	Additional resources* for rural programme as well as other backlogs.	Upgrade failing WWTWs, improve maintenance of WWTWs, extend capacity of under-capacity works	High Green Drop risk profile: Strengthen O&M capacity and resources in all areas
Mpumalanga	Additional resources* for rural and small town programmes as well as other backlogs.	Upgrade failing WWTWs, improve maintenance of WWTWs, extend capacity of under-capacity works	High Green Drop risk profile: Strengthen O&M capacity and resources in all areas
North West	Additional resources* for rural and small town programmes as well as other backlogs.	Upgrade failing WWTWs, improve maintenance of WWTWs, extend capacity of under-capacity works	High Green Drop risk profile: Strengthen O&M capacity and resources in all areas

[46] Department of Water and Sanitation.2017. Integrated Water Quality Management Policy.

Province	Meeting backlog	Addressing wastewater treatment works	O&M priorities
Northern Cape	Additional resources* for small town programmes as well as other backlogs. Replace all bucket sanitation in formal areas.	Upgrade failing WWTWs, improve maintenance of WWTWs, extend capacity of under-capacity works	High Green Drop risk profile: Strengthen O&M capacity and resources in all areas
Western Cape	Additional resources* for urban informal settlements as well as other backlogs.	Extend good performance to all areas	Moderate Green Drop risk profile: Strengthen O&M capacity and resources in all areas

** Resource needs include financial, skilled human resources and dedicated institutional units*

8 PROTECTING AND RESTORING ECOLOGICAL INFRASTRUCTURE

About 50% of South Africa's water resources originate from 8% of our land. These strategic water sources ('water factories') must be protected and maintained through appropriate regulation.

The capacity of catchment-based institutions to harness the value of ecological infrastructure in the water value chain needs urgent attention.

South Africa is known for its rich biodiversity boasting one of the world's six floral kingdoms and a wide variety of aquatic ecosystems, including seven of the world's freshwater eco-regions. These eco-regions are characterised by a wide range of river ecosystems, wetlands and estuarine types.

The protection of the ecological infrastructure of our natural aquatic ecosystems is crucial for economic development, water and food security and the assurance of healthy and functional water resources that will support future sustainable development.

The Millennium Ecosystem Assessment categorised four types of ecosystem services: *provisioning, regulating, cultural* and *supportive* as described below:

- **Provisioning:** Products that are obtained from ecosystems such as food, wood, and water;
- **Regulating:** Benefits that are accrued from the regulation of ecosystem services such as water purification, and water regulation (wetlands) disease regulation and climate regulation;
- **Cultural:** Non-material benefits that are obtained from ecosystems and includes spiritual and religious, aesthetic, sense of place and recreational; and
- **Supportive:** Services that are necessary to support all other services and includes soil formation and retention (i.e. riparian vegetation, wetlands) water cycling, nutrient cycling and primary production (migratory routes and connectivity of water resources from source to sea).

The continuous over utilisation and inadequate protection of ecological systems and infrastructure has led to changed characteristics of rivers from perennial to more seasonal, from ephemeral to perennial and in many cases, has pushed the rivers and/or other water resources beyond the point where they can be restored to their original ecological condition. In these worst-case scenarios, the ecological services and functions of the water resource have been lost to such an extent that rehabilitation of these systems is not possible without significant investment.

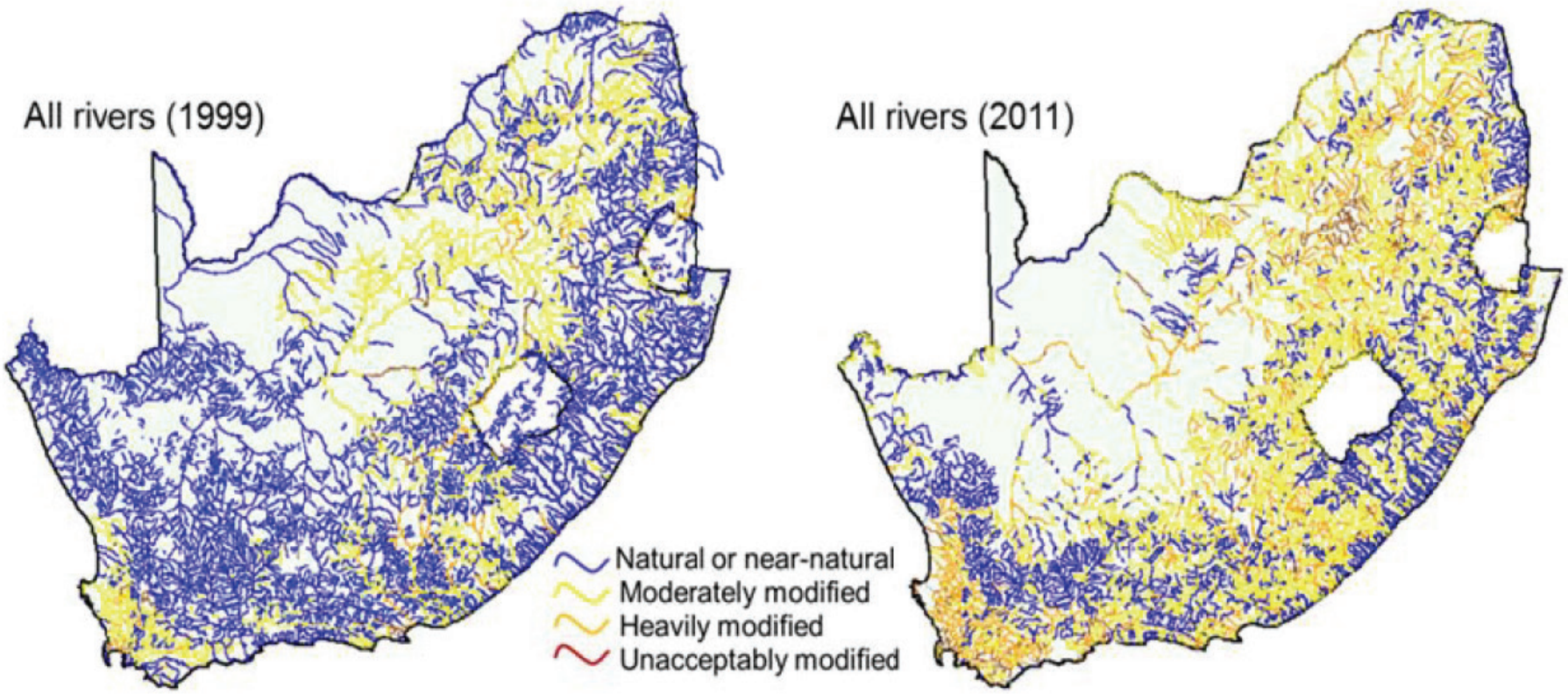


Figure 8-1: Deterioration of ecological condition of South African rivers, 1999 – 2011
(Source: Nel, J.L. & Driver, A. 2015. National River Ecosystem Accounts for South Africa)

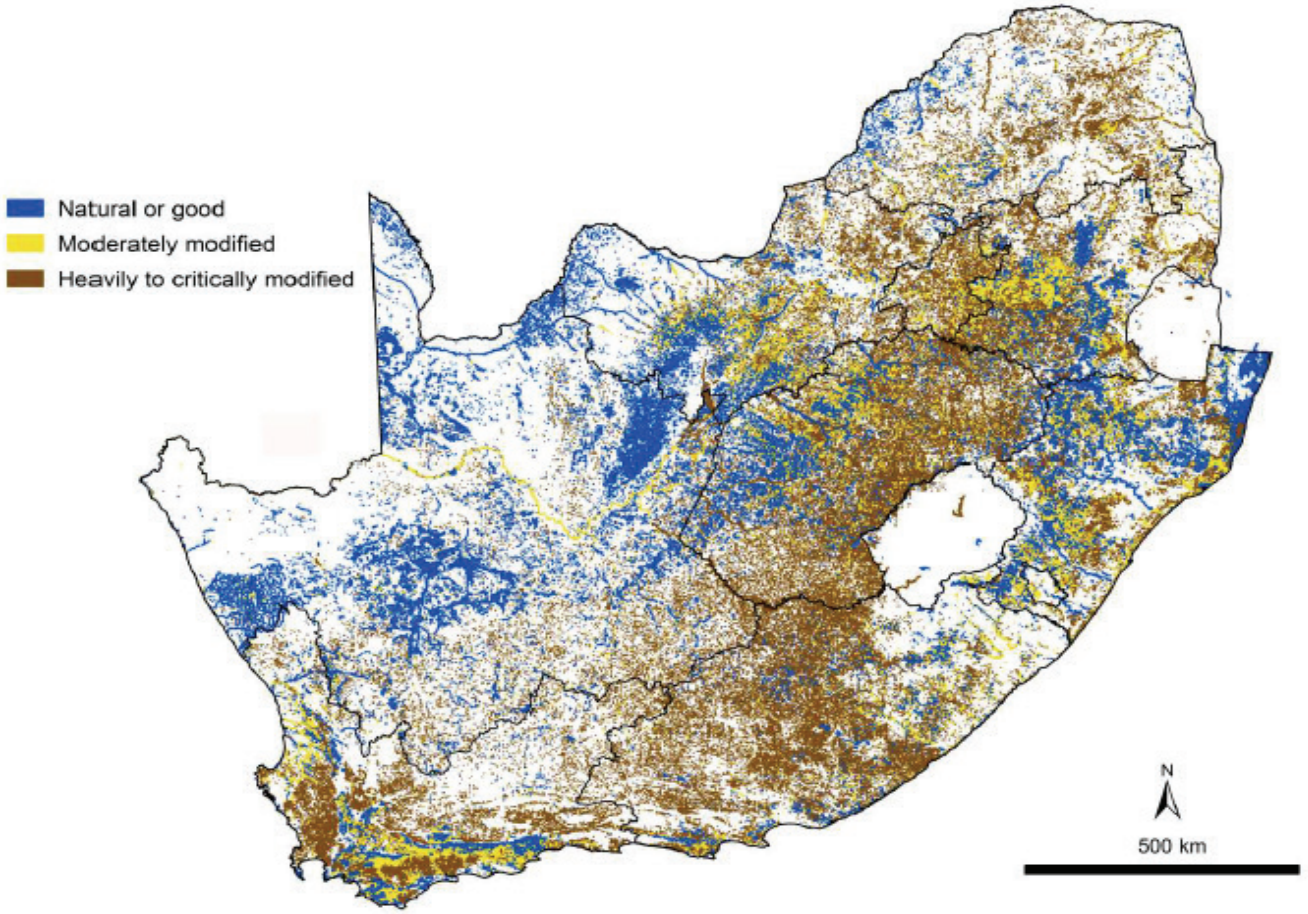


Figure 8-2: Ecological condition of South African wetlands, 2011 (Source: Nel J.L. and Driver A. 2012. South African National Biodiversity Assessment 2011: Technical Report. Volume 2: Freshwater)

8.1 PRESENT STATE

Water ecosystems comprise river ecosystems, wetland ecosystems, estuarine ecosystems, as well as the contribution from aquifers.

8.1.1 River Ecosystems

River ecosystems are vital for supplying fresh water: they store and transport water and, combined with constructed storage and transfer schemes, bring water to urban and rural areas, irrigate croplands, take away waste and provide cultural and aesthetic services. Healthy tributaries help to maintain natural flow pulses and flush pollutants from hard- working larger rivers, contributing to the quantity and quality of water supplies.

Contrary to popular perception, fresh water flowing from rivers out to sea is not wasted but is essential for maintaining healthy ecological systems in estuaries as well as coastal and marine ecosystems, and the social and economic benefits received from them.

Fifty-seven percent of river ecosystem types are threatened (25% critically endangered, 19% endangered and 13% vulnerable). Tributaries tend to be in better ecological condition than main rivers, so the proportion of threatened river ecosystem types is higher if only main rivers are assessed, with 65% of main rivers threatened (including 46% critically endangered)[47].

Mountain streams are the best protected while lowland rivers have the highest proportion of ecosystem types with no protection.

High water yield areas are defined as sub-quaternary catchments in which mean annual runoff is at least three times the average for the related primary catchment. These areas constitute only 4% of South Africa's surface area and are the 'water factories' of the country. Currently only 18% of them have any form of formal protection. Given their strategic importance for water security, options for formal protection of high water yield areas should be explored, for example declaring them as Protected Environments in terms of the Protected Areas Act.

Rivers are linear ecosystems and are impacted on by land uses and activities throughout their catchments. Protected areas alone will seldom do the full job of protecting river ecosystems, particularly in the lower reaches. This highlights the importance of using the integrated water resource management tools provided by the National Water Act and other pieces of legislation, including the ecological reserve, the classification of water resources and the determination and implementation of resource quality objectives. For all rivers, good land-use practices such as

[47] Department of Environmental Affairs. 2011. National Biodiversity Assessment 2011: An Assessment of South Africa's biodiversity and ecosystems.

keeping natural vegetation intact along river banks can make a vital difference to their ecological integrity.

8.1.2 Wetland Ecosystems

Wetland ecosystems are vital for purifying water and regulating water flows, acting as sponges that store water and release it slowly, filtering pollutants and easing the impact of droughts and floods in the process. They also support a rich diversity of species, which have both intrinsic and economic value.

According to the *National Biodiversity Assessment* (2011), 65% of wetland ecosystem types are threatened (48% critically endangered, 12% endangered and 5% vulnerable), making wetlands the most threatened of all ecosystems. Only 11% of wetland ecosystem types are well protected, with 71% not being protected at all, reflecting the fact that wetland ecosystems have not been systematically considered in establishing and expanding land-based protected areas. There is clearly scope for the protected area network to play a bigger role in protecting South Africa's wetlands.

Wetlands are exceptionally high-value ecosystems that make up only a small fraction of the surface area of the country. Given their strategic importance as ecological infrastructure for ensuring water quality and regulating water supplies, investments in conserving, managing and restoring wetlands are likely to generate disproportionately large returns.

8.1.3 Estuarine Ecosystems

Estuaries are formed where fresh water from rivers meets the sea, although the mouths of some estuaries periodically close off from the sea. They are often focal points for coastal development and recreation, including water sports, fishing and holiday-making.

Estuaries provide nursery areas for many commercially important fish species and pass through sediments that form and maintain beaches and provide nutrients for marine food webs.

Estuaries face multiple pressures from human activities, often resulting from development too close to the estuary as well as the cumulative impacts of land uses throughout the catchment. Reductions in the quantity and quality of fresh water that reaches an estuary, because, for example, of dams higher up in the catchment, or activities such as sand mining, can impact severely on its ecological condition and ability to provide ecosystem services.

Of estuary ecosystem types, 43% are threatened (39% critically endangered, 2% endangered and 2% vulnerable). The proportion of threatened types is highest in the cool temperate region (the west coast, which has relatively few estuaries) and lowest in the warm temperate region

(south and southeast coast, including the many small estuaries along the Wild Coast, most of which are in good ecological condition). Only 33% of estuary ecosystem types are well protected and 59% have no protection at all[48].

8.1.4 Groundwater

An aquifer is both a reservoir and a transport channel. Groundwater flow in an aquifer is governed by the aquifer's intrinsic characteristics (shape, size, permeability etc.) but also by its recharge, largely produced by infiltration of precipitation.

Most of the groundwater flow eventually ends up in springs and streams. Groundwater recharge and discharge are thus the links between groundwater and other components of the water cycle.

Wherever groundwater flows or discharges to the surface, aquifer-dependent ecosystems (ADEs) can occur. Their identification is often difficult, but a type-setting and identification study has been undertaken to guide groundwater management and allocation.

8.2 DRIVERS

8.2.1 River Ecosystems

Rivers are the lowest points in any given topography, and often the receivers of cumulative impacts from across the landscape.

Abstraction of water and changes to the timing and quantity of flows, because of dams or transfer schemes between catchments, exert pressure on aquatic ecosystems in rivers. Pollution is a serious and growing problem, as is the destruction of natural vegetation along river banks which results in irreversible damage to rivers and their ability to provide ecosystem services. Sand mining and other structural alterations in rivers also impacts negatively on riverine ecosystems. Invasive alien species in rivers and along the banks are also impacting negatively on ecosystem functioning.

Land management throughout catchments influences the health of river ecosystems. Water resources cannot be managed in isolation from the land-based activities that surround them.

[48] Department of Environmental Affairs. 2011. National Biodiversity Assessment 2011: An Assessment of South Africa's biodiversity and ecosystems.

8.2.2 Wetland Ecosystems

Several pressures contribute to the loss and degradation of wetlands, some of them occurring at the wetland site and others related to land management in the wider catchment. The most prevalent on-site causes of wetland loss and degradation are: mining, cultivation, urban development, dam construction and poor grazing management causing erosion.

The most prevalent off-site causes of wetland degradation are:

- Disruption of the flow regime (changes to the amount and timing of flows of freshwater to the wetland, for example as a result of water abstraction, effluent discharge, and dams in the catchment)
- Deterioration of water quality in associated rivers as a result of polluting activities in the surrounding catchment *and*
- Poor grazing management or poor crop production practices in the catchment that result in an increased sediment load being deposited in the wetland.

The health of rivers and wetlands is linked. A river in poor condition is likely to affect the condition of associated wetlands. Similarly, destruction of wetlands has an impact on river condition because the wetlands are no longer able to filter pollutants from surrounding land uses to prevent them ending up in the river. Buffers of natural vegetation around wetlands can play a major role in keeping wetlands healthy and well-functioning, even if land uses in the surrounding catchment are not wetland-friendly.

8.2.3 Estuarine Ecosystems

The threats to estuarine health and biodiversity can ultimately be grouped as follows:

- Flow modification
- Pollution (e.g. from agriculture, waste water treatment works (WWTW), industry, mining, and sediment)
- Over-exploitation of living resources (fish and invertebrates)
- Habitat destruction (within the estuarine functional zone)
- Invasive alien species *and*
- Climate change.

A general trend is that estuaries fed by larger catchments tend to be in poorer health than estuaries in neighbouring smaller catchments. This is partly because larger catchments have larger rivers which are generally more heavily utilised and attract more coastal development and other economic activity.

Smaller estuaries (and their related smaller catchments) generally tend to be subjected to fewer pressures. If there are no direct development pressures such as urban development on these smaller estuaries, they tend to be healthy.

8.2.4 Groundwater

Land-use exerts major contaminating impacts on groundwater from a wide range of activities and through impacting groundwater recharge processes. The negative impacts are enhanced by ignorance and by the unseen nature of groundwater - it takes a long time to notice that it has become polluted and it is difficult to clean a contaminated aquifer.

Knowledge of groundwater pollution is limited because monitoring information is only available at a national or regional level, while pollution impacts are generally localized. Groundwater compliance monitoring is not yet sufficiently operational. A major concern, picked up through national monitoring[49], is increasing nitrate levels in boreholes in parts of the Limpopo, North West and Free State provinces.

8.3 PRIORITIES FOR THE FUTURE

The desired state of a water resource is the state that ensures that it functions sustainably i.e. a state that supports ecological functioning as well as socio-economic requirements (which include basic human needs) without compromising the ability of the resource to provide appropriate goods and services.

Ecosystems that are in a state consistent with its Recommended Ecological Category (REC) are referred to as being in a desired state. However, practically this cannot be achieved for some water resources due to irreversible actions such as dam building. Therefore, in these instances the desired state may be not be the REC but maintaining the Present Ecological State (PES) and not allowing any further degradation. The RECs and PESs have been determined for a most of the water resources in South Africa through RDM studies (i.e. Reserve, Classes and Resource Quality Objectives).

8.3.1 Rivers and Wetlands

A free-flowing river is a long stretch of river that has not been dammed. There are very few large rivers that are dam-free, or 'free-flowing' in South Africa. The flagship free-flowing rivers identified in the National Freshwater Ecosystem Priority Areas (NFEPA) initiative should receive top priority for maintaining their dam-free status, while carefully weighed against the plans to increase supply through a number of planned dams as discussed in section 3.7.1.

[49] Water Research Commission. 2017. National Groundwater Strategy.

Managing these areas in a good condition is not just about conserving freshwater plants and animals – but should also be regarded as a comprehensive approach to sustainable and equitable development of water resources. The PES and/or REC for all river Freshwater Ecosystem Priority Areas (FEPAs) needs to be maintained or improved.

Healthy tributaries can improve water quality by 'flushing' pollutants when they join their main stem rivers, and they also replenish water supply in the main stem. Wetlands filter pollutants and sediments from the surrounding landscape thus preventing them from entering the river. They also regulate the flow of water from the surrounding landscape which helps to reduce the effects of flood (by slowing down run-off) and droughts (by reducing evaporation).

8.3.2 Estuaries

Freshwater running out to sea should not be considered wasted. Fresh water flowing to estuaries and the sea provide important inputs such as nutrients, sediments and carbon, which in turn maintain important ecological processes that keep marine resources healthy. Healthy marine and coastal ecosystems sustain commercial and recreational fish stocks and provide a source of food to poor coastal communities that depend directly on marine resources for food.

A certain amount of water is also required to scour the mouth of most estuaries – without this scouring effect, sediments build up at the mouth and the risk of back-flooding during storms increases. Artificial breaching of an estuary mouth to minimise this risk is expensive and damages estuarine ecosystems.

Important estuaries must be classified, have RQOs and reserves determined and be monitored for compliance with the class, RQOs and reserve requirements.

8.3.3 High water yield areas play a critical role in securing South Africa's water supplies

High water yield areas and high groundwater areas generally occur in mountain catchment areas. These are the 'water factories' of the catchment and generate a large proportion of the water for human and ecological use. Maintaining these areas in a healthy state will allow for the use of clean water downstream that can also maintain ecosystem functioning and biodiversity.

The CSIR, in association with DWS and the WRC, identified and delineated key water source areas in the country that need protection, as per the map below.

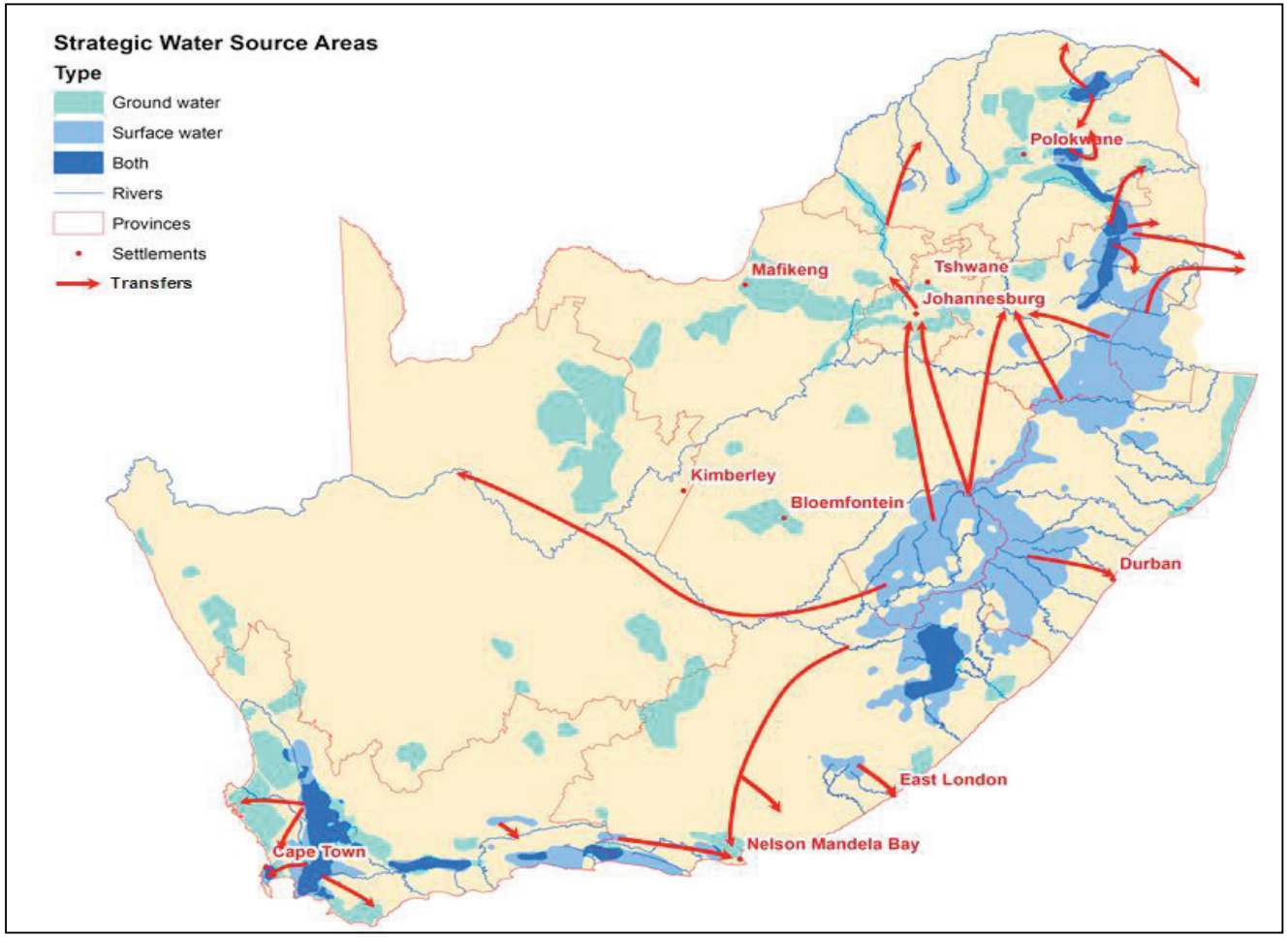


Figure 8-3: Key water source areas

(Source: Enhancement of the method to identify and delineate South Africa's Water Source Areas (K5/2431). Deliverable 7. Draft Integrated Report. June 20 Le Maitre, D..C., Seyler, H., Holland, M., Smith-Adao, L.B., Maherry, A., Nel, J.L. and Witthüser, K. 2017).

8.3.4 Groundwater

Groundwater resources and aquifer-dependent ecosystems are protected to secure a sustainable supply of water for human survival and socio-economic development, while maintaining essential groundwater environmental services

Key groundwater resources and aquifer-dependent ecosystems must be classified, have RQOs and reserves determined and be monitored for compliance with the class, RQOs and reserve requirements

Groundwater abstracted from river beds, close to streams, and from shallow alluvial aquifers has a very direct influence on river flow and plays an important role in sustaining wetlands and river flows ('base flows') and supporting refuge pools in the dry season. Apart from the human benefits of maintaining river flows in the dry season, refuge pools in seasonal rivers support water dependent animals that would otherwise not survive when the rivers dry up. It is only when groundwater has very weak links to surface water (such as in deep, confined aquifers) that it may be possible to abstract it without significantly impacting on river flow. However, the long-term impacts are not well understood.

8.3.5 List of Priority Actions

The following table as summarised in Volume 1 of the NW&SMP provides a list of priority actions to be implemented:

Table 8-1: Priority Actions

Action	Responsibility	Completion date
Declare strategic water source areas and critical groundwater recharge areas and aquatic ecosystems recognised as threatened or sensitive as protected areas (Volume 3, Action 1.6.1)	DWS, CMAs, DEA	2021
Review and promulgate aggressive restrictions within the legislation to restore and protect ecological infrastructure (1.6.2)	DEA, DWS, CMAs, SANBI, CSIR	2020
Implementation of the Reserve: **(The classification, RQO's and the Reserve (collectively known as Resource Directed Measures (RDM)) for main stem rivers starting with the Berg, Breede and Gouritz, Middle and upper Vaal WMA's) (1.6.3)**	DWS, CMAs	2022
Secure funds for restoration and ongoing maintenance of ecological infrastructure through operationalising the water pricing strategy (1.6.4)	DWS, CMAs, DEA, SANBI	Annually
Develop and implement a diffuse pollution source strategy that includes the regulation of land use (1.5.14)	DWS, CMAs	2023
Implement programmes to rehabilitate catchments through development of Catchment business plans (1.5.15)	DWS, NT, CMAs	2025
Develop new policies and strategies on matters not previously addressed, in consultation with all stakeholders, to facilitate the sustainability of various water sector programmes (2.5.5)	DWS	2025
Link the Global Environment Fund 6 project on Water Pricing and Ecosystems to Water Master Plan implementation and position DWS to be closely involved in this process (2.6.17)	DWS, DEA, SANBI, WRC, CSIR	2024
Ongoing research, modelling and planning around climate change and its impacts on water security and water infrastructure needs to be conducted (2.6.19)	DWS, DEA, DST, WRC, CSIR	Ongoing

SECTION 2: ENABLING ENVIRONMENT

9 CREATING EFFECTIVE WATER SECTOR INSTITUTIONS

9.1 PRESENT STATE

The Minister of Water and Sanitation is the Executive Authority for public institutions in the water sector and is accountable to Parliament for the performance of these institutions. These institutions are currently thirteen water boards, two catchment management agencies, the Water Research Commission (WRC), the Trans-Caledon Tunnel Authority (TCTA), and a large number of water user associations.

The mandates for the water sector institutions are set out in three pieces of legislation, the National Water Act (Act 36 of 1998), the Water Services Act (Act 108 of 1997) and the Water Research Act, 1971 (Act No 34 of 1971), and Government Notice 277 in Government Gazette No 21017 dated 24 March 2000 for the TCTA.

Two special purpose entities were established for the development, financing and operations of water projects across the borders of SA namely the Komati Basin Water Authority (established in terms of the Treaty on the Development and Utilization of the Water Resources of the Komati River Basin (1992) and the Lesotho Highlands Development Authority (LHDA). The latter is responsible for the implementation of phases 1 and 2 of the Lesotho Highlands Water Project

The CMAs and the WRC are Schedule 3A public entities in terms of the PFMA, while water boards are listed under Schedule 3B. The TCTA is a Schedule 2 entity. The Minister is also responsible for overseeing water user associations and irrigation boards, however, these institutions are not listed under the Public Finance Management Act (PFMA).

The international river basins are managed via river basin commissions. These basins have international river basin commissions operating in them, namely the Orange-Senqu River Commission (ORASECOM) for the Orange-Senqu River basin, the LIMCOM for the Limpopo River basin, and the TPTC (SA, Mozambique and Swaziland). The Inkomati and Maputo basins does not yet have such a commission established. These commissions play an advisory role in relation to the management of shared water courses, under the framework provided by the *Southern African Development Community (SADC) Protocol on Shared Watercourses*.

Local government has the constitutional responsibility for providing potable water supply and domestic sanitation services, as designated water services authorities (WSAs) and using a water services provider to deliver the services, as per the Water Services Act.

Water Boards are established under the Water Services Act.

Water sector institutions have a critical contribution to make towards achieving government's transformation and development objectives outlined in the National Development Plan. They have an essential role in the achievement of sustainable water and sanitation provision to give effect to the fundamental right of every individual to have access to water and to human dignity, as well as socio-economic objectives.

9.2 DRIVERS

Government recognises that institutional inadequacies within the water sector carry heavy socio-economic costs for the country. Management of a scarce resource such as water requires constant review of institutional mechanisms to ensure effectiveness and efficiency.

In addition, increasing concerns regarding water availability and water quality create a basis for review of how institutional performance and misalignment of institutions contributes to high public discontent.

The 2011 Diagnosis Report compiled by the National Planning Commission[50] highlighted several challenges in the institutional framework for the water and sanitation sector, which remain relevant. These include a lack of shared vision; differing interpretation of obligations; capacity and coverage of water institutions; regulation of institutions by national government (DWS); poor performance of some institutions; transformation, restructuring and realignment of water institutions; and the number of institutions reporting to the Minister.

Other institutional challenges included slow institutional establishment, varying institutional capacity, viability and sustainability challenges, duplication of effort and resources, even within the same region, lack of regulation and compliance, as well as a low skills base.

9.2.1 Specific Challenges

9.2.1.1 National Water Resource Infrastructure

- It is acknowledged that the performance of DWS with respect to the management of national and regional water resource infrastructure has been poor. Functions between DWS and TCTA are duplicated; and financing arrangements across the sector are sub-optimal with the result that assets are funded out of the government budget where these could be financed through water use charges. Poor collection of water use charges means that maintenance of water resources infrastructure is considerably under-funded.

[50] National Planning Commission. 2011. Diagnostic Report

- In addition, the requirement of off-take agreements prior to the construction of large infrastructure projects has led to delays in implementation that have increased water vulnerability, particularly in Cape Town, Durban and Gauteng.

9.2.1.2 Managing Water Resources at Catchment Management Level

The National Water Act provides for the establishment of catchment management agencies to manage one or more water management area (WMAs). The number of WMAs was reduced from nineteen (19) to nine (9) in 2013. The establishment of CMAs has been slow. By end of 2016, only two of the nine CMAs were established and functional. A number of process and institutional challenges have delayed the process, leading to a review of the initial plan to establish nine CMAs.

9.2.1.3 The management of regional water infrastructure and the future role of Water Boards

While most water boards have been established for pragmatic reasons and several have had a history of good performance by both local and international standards, there are three primary drivers for change:

- The weak performance in the management of water supply and sanitation services by many municipalities compromises the extension of services to those without, and results in (or threatens to result in) unreliable and unsafe services;
- There are some important gaps in the existing institutional and financial framework – responsibilities for water resources development at the local and regional level, and for regional bulk services outside of the existing water board service areas are not clear; and
- There have been, and currently still are, governance and performance-related problems for some of the water boards.

9.2.1.4 Managing local water resource infrastructure

Water User Associations (WUAs) are local-level institutions with voluntary membership intended to support the management of local water resources in the common interest. Most, but not all WUAs, serve the irrigation community. They are intended to include all users of a resource, both consumptive and non-consumptive. This is an institutional space that is too localised for DWS to manage and the department relies on these institutions to manage local resources and infrastructure (both state owned and private) themselves. Legislation provides that WUAs can be delegated additional functions to perform on behalf of the DWS or CMAs if it is more effective for them to do so.

The development and transformation of WUAs, either through the transformation of irrigation boards through broader representivity, or through the establishment of new WUAs comprising resource poor farmers, has been very slow. This has been due to a combination of difficulties in meeting representivity targets, unresolved concerns regarding the transfer of private assets and liabilities to a wider grouping, and bureaucratic delays by the DWS.

The creation of WUAs to manage government water schemes has been stalled by staff not wishing to be transferred from government to what are essentially private bodies.

There is a lack of financial and technical resources to support new 'developmental' WUAs. DWS does not have the capacity (human and financial) to provide support on a large scale.

9.2.2 Drivers

Water sector institutions should be consolidated to achieve, among others, the following outcomes:

- Economies of scale in terms of capacity and service delivery
- Sufficient institutional capacity to attain sustainability and capability to execute service delivery mandates of affected institution
- Integrated planning for water sector development
- Sufficient delegation and decentralisation of water services delivery mandates
- Economic and financial viability of institutions
- Elimination of inefficiencies and duplication *and*
- Enhancement of regulatory compliance.

Table 9-1: Key Drivers

Issue	Rationale
Transformation and rationalisation of the number of institutions	More effective use of limited state resources
Governance, accountability and transparency	Improved governance and accountability in water sector institutions
Financial sustainability	Responding to cost containment measures Adopting a sustainable funding model
Performance	Respond to poor performance of institutions
Ownership of water and sanitation infrastructure	Transfer of infrastructure to appropriate organ of state

9.3 PRIORITIES FOR THE FUTURE

The vision is to create sustainable water sector institutions that will facilitate effective service delivery while supporting government's transformational objectives. This will be achieved by the separation of policy making, shareholding and regulation to ensure that there will be effective governance in the sector. Institutional integration is also required to ensure that functions are allocated to institutions that are best placed to undertake them, to optimize sector capacity and, to facilitate economies of scope and scale.

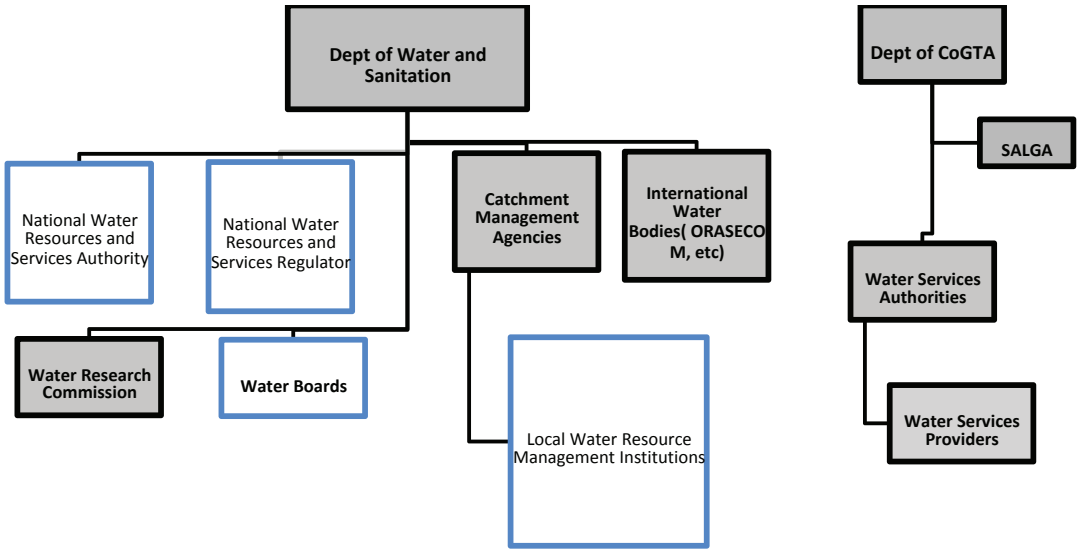


Figure 9-1: Possible future institutional arrangements

The desired institutional state (set out in the figure above) is envisioned as follows:

- The overall trusteeship and regulation of the water value chain lies with the Minister of Water and Sanitation who is responsible for ensuring that efficient and effective water institutions give effect to his/her public trusteeship of the water and sanitation business value chain.
- A considerably smaller DWS will set policy and the regulatory framework for water resources, water supply and sanitation management and will monitor the overall performance of the sector.
- A National Water Resources and Services Authority (NWRSA) will be established to finance, develop, manage and operate national water resource infrastructure and sanitation. New capability around bulk sanitation provision will be developed.
- A National Water Resources and Services Regulator (NWRSR) will be established which will be responsible for ensuring the development, implementation, monitoring and review of regulations across the water and sanitation value chain in accordance with the provisions of the National Water Act (1998), the Water Services Act (1997) and related water and sanitation policies. The possibility of an independent economic regulator to regulate tariffs, standards and performance in the water services sector has been proposed.
- The establishment of CMAs has progressed slowly with only two of nine planned CMAs established and functional. While the establishment of a single Catchment Management Agency for the country was raised during the initial development of the NW&SMP, this proposal has not carried and the implementation of a total of nine CMAs is envisaged.

- The water boards are of different sizes and capabilities, with only a few technically and financially strong, each serving one or more major cities, while the smaller boards are technically and financially stretched and are serving economically weaker and less dense areas. Rand Water and Umgeni Water together make up 75% of national water board capacity. A process is underway to amalgamate some of the boards to reduce the overall number to nine with an expanded mandate, including for regional bulk infrastructure.
- The development, financing, management, operation and maintenance of regional bulk water and wastewater services will be the responsibility of water boards.
- All irrigation boards should have been transformed into WUAs by 1999. A policy position that all WUAs and IBs will cease to exist in future was approved by Cabinet in 2013. A roadmap has been developed to transform all IBs and WUAs into local water resource management institutions.
- The transboundary water management bodies will be responsible for co-ordinated and overseeing development and management of transboundary water resources.
- The challenges faced by WSAs are addressed under the section on water services and sanitation.

9.3.1 Priority Actions

DWS, as the leader of the water and sanitation sector, will lead a process, with other sector partners, to simplify and streamline the currently complex institutional arrangements in the sector. In addition, it will drive increased functionality and efficiency in institutional arrangements. Institutional Rationalisation and Organisational Alignment is urgently required and is supported by the Presidential review on State Owned Enterprises (SOEs). However, implementation of changes must not impact negatively on the implementation of other aspects of this plan.

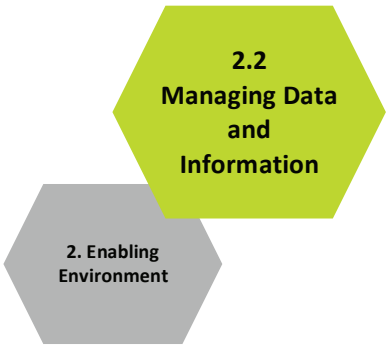
The following table as summarised in Volume 1 of the NW&SMP provides a list of priority actions to be implemented:

Table 9-2: Priority Actions

Action	Responsibility	Completion date
Develop and implement a long-term plan for the turn-around of water supply and sanitation services in the country based on a sector-wide approach, that recognises DWS as regulator of W&S provision that includes the development of centralised programmes to obtain economies of scale and to ensure impact (e.g. driving municipal non-revenue-water improvements, and assessing the cost-effectiveness and appropriate systems for desalination) (Volume 3, Action 1.3.1)	DWS, CoGTA, NT, SALGA	Annually
Develop and implement Provincial Water Services Delivery Master Plans to provide reliable and sustainable water supply and sanitation to all households within South Africa: **• Provincial Bulk Services Master Plans** **• Reliable Services Delivery Action Plans that includes a backlog analysis and infrastructure asset management plans (1.3.6)**	DWS, WSAs, CoGTA, SALGA, NT, WBs	2030
Establish a business case for streamlined institutional arrangements in the water and sanitation sector (2.1.1)	DWS	2020
Establish a Municipal Intervention Unit for Water and Sanitation in DWS, staffed with highly competent experts to drive a national programme of intervention at the municipal level (2.1.2)	DWS	2022
Transform all WUAs into Local water resources management institutions as per the developed roadmap (2.1.7)	DWS, WBs, WRMI, CMAs	2021
Establish financially sustainable CMAs across the country, and transfer staff and budget and delegated functions, including licensing of water use and monitoring and evaluation of water resources (2.1.3)	DWS	2020
Establish the National Water Resources and Services Authority (2.1.4)	DWS, NT	2020

Action	Responsibility	Completion date
Determine the optimal configuration of water boards to manage regional bulk water supply; assist municipalities to perform their primary water and sanitation services mandate where necessary, manage regional water resources infrastructure, manage regional bulk WTWs and WWTWs (2.1.5)	DWS, WBs	2020
Establish the National Water Resources and Services Regulator (NWRSR) (2.1.6)	DWS, NT	2020
Implement accurate billing and effective revenue management systems in all entities in the water value chain with a strict *"No payment = no water"* approach to agriculture/industrial/commercial users and restricted supply to domestic users (2.4.2)	WSAs, WBs, DWS, AGSA	2024
Ensure that sufficient revenue is received through tariffs and grants to operate, maintain and improve the water supply and sanitation system. The tariff structure must allow for cross subsidisation for the indigent and building of a reserve for periods of drought (2.4.5)	WSAs, WBs, DWS, NT, AGSA	2024

10 MANAGING DATA AND INFORMATION



10.1 PRESENT STATE

Reliable data, information and knowledge on the status of the country's water resources, water supply and sanitation is required to understand and enable spatial and non-spatial analysis and presentation of water use and water demand including the manner in which various economic, social and environmental activities in catchments affect (consume, pollute, increase) or constrain (limit, degrade) water quality, quantity and ecosystems. DWS has developed a systematic knowledge base and associated knowledge products of their water services and resources business with the aim to share the knowledge in the public domain. Information is available in a Geographic Information System (GIS) format as well as various separate and supporting formats that are of non-spatial nature.

Water resources data includes regular measurements of rainfall, streamflow, dam levels, and of chemical and biological determinants based on a well-established network of monitoring points. It further includes information on the ecological properties of water resources, both surface and groundwater. The coverage of rainfall and runoff gauging in the country has, however, been allowed to deteriorate and many rainfall measurement stations and gauging weirs are no longer functional. The South African Weather Service and HydroNET joined forces to provide reliable weather information. HydroNET is a web-based decision support system which transfers weather and water data into sophisticated applications and dashboards to make well-informed and transparent decisions.

DWS runs a number of monitoring programmes on a national level to provide:

- Information required for performing its regulation and custodian role e.g. information to CMAs, the public, NGOs, WUAs, tertiary & research institutions including on the status of, and trends in water resources quantity and quality
- Information to national, provincial and local government e.g. other national departments, provincial and local government, *and*
- Information in terms of international/regional/trans-boundary agreements and national level water resources strategic and development planning e.g. UNEP GEMS/Water, ORASECOM, LIMCOM, KOBWA.

The monitoring programmes run by DWS include:

- The National Chemical Monitoring Programme, which assesses the status and trends of water resources' chemistry
- The National Microbial Monitoring Programme, which assesses trends of faecal pollution and associated health risks *and*
- The National Eutrophication Monitoring Programme which assesses trophic status, risks and trends of single impoundments, river reaches or canals.

The National Toxicity Monitoring Programme is currently being designed and is intended to assess the status and trends of toxicity and toxicants in water resources. A National Radioactivity Programme is currently in the testing phase.

DWS also runs a National Ecosystem Health Monitoring Programme (NAEHMP), which has three components:

- River Ecosystem Monitoring Programme (REMP) /formerly River Health Programme (RHP)
- National Wetlands Monitoring Programme (NWMP) *and*
- National Estuaries Monitoring Programme (NESMP).

DWS also monitors the state of dams and river flow in the country, through the Hydrological Information System. Flood monitoring is also conducted in the Orange-Vaal system through a near real-time monitoring system.

DWS is also responsible for the assessment of groundwater resources, data acquisition and data management, and the development and maintenance of information systems in this regard. This is done to ensure the sustainable development and use of groundwater countrywide through the establishment of monitoring network infrastructure and management.

Water use data (according to the water use as defined by the National Water Act, Section 21) is captured by DWS through the Water Authorisations and Registration Management System (WARMS). It is however a challenge to ensure the system is kept up-to-date to allow for new developments or uses of water by registered and new users.

Rainfall is monitored by the South African Weather Service (SAWS) which is also responsible for weather forecasting and seasonal rainfall predictions.

DEA monitors the status of wetlands and estuaries across the country.

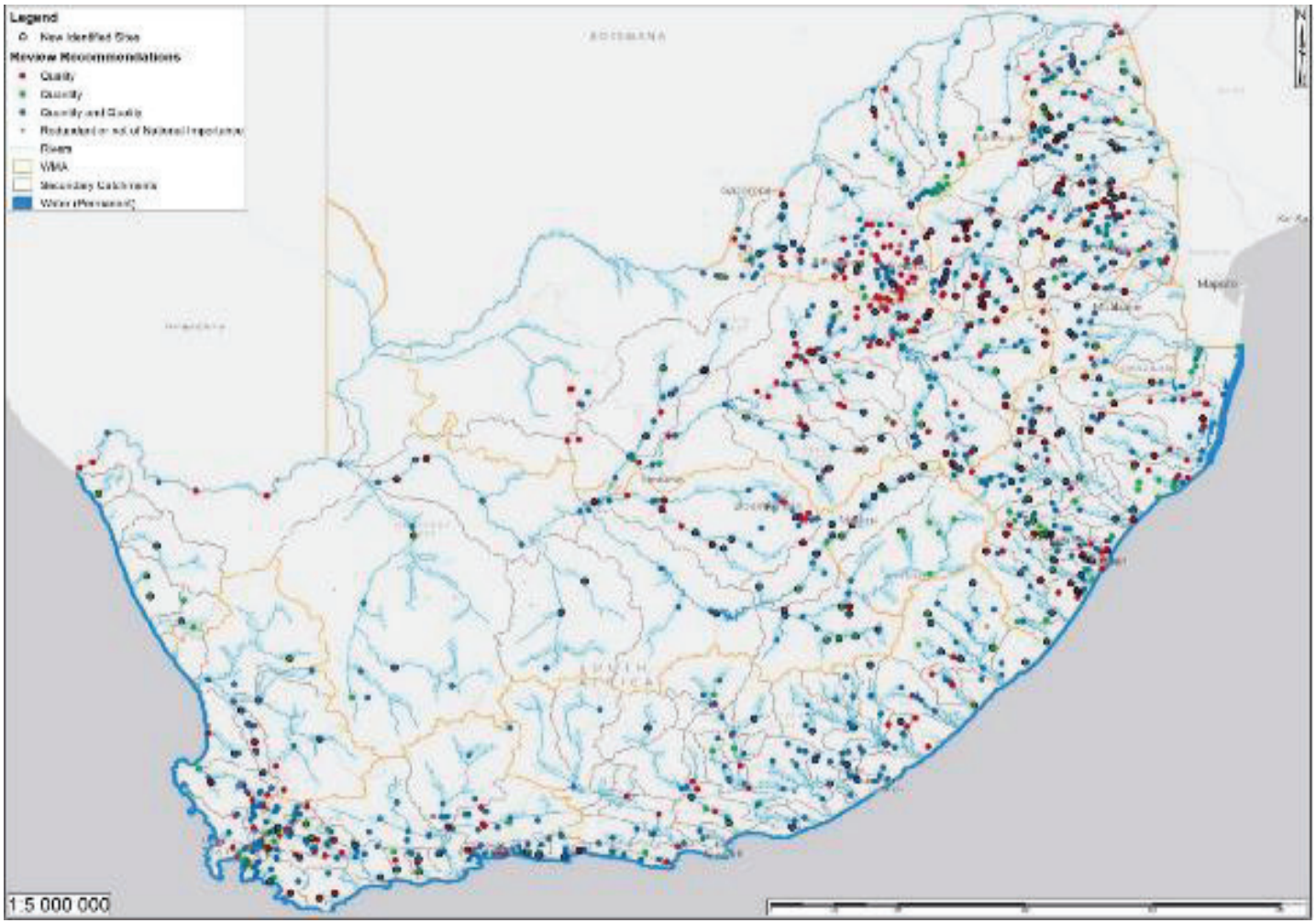


Figure 10-1: Monitoring Network Design: Surface Water Quantity and Quality

Water services institutions, water supply and sanitation information and monitoring

DWS maintains a geodatabase of water services provision by all WSAs[51] which includes spatial footprints and supporting attribute data of water supply and sanitation infrastructure and settlements. This is further extended by the Water Services / Regulation Systems Menu. StatsSA collects data on water services and sanitation provision through the national census, and the regular household and community surveys.

Important tools for monitoring the status of water supply and sanitation delivery were the Blue Drop, Green Drop and No Drop assessments and progress reports. The Municipal Services Self-Assessment (MuSSA) programme, together with its supporting databases is also an important tool to assess the capacities and constraints of water services institutions. Water Services Authorities (WSAs) report on water supply and sanitation through their Water Services Development Plans, as required by the WSAct, section 12.

Section 155(7) of the Constitution, as well as Section 62(1) of the WSAct, mandate national government to monitor the performance of the water sector and specifically grant DWS the mandate to monitor the performance of all water services institutions. Reliable data is required on the performance of water services institutions, on the delivery of sustainable and reliable water and sanitation services, and on the state of water and sanitation assets in order to monitor progress towards the goals of universal and reliable coverage of services. WSAs are responsible for water supply and sanitation provision, including monitoring of potable water quality and the quality of effluent discharged from WWTWs, and for monitoring the performance of WSPs.

Currently the most reliable information on municipal financial performance is maintained in the National Treasury databases, but unfortunately water and sanitation financial information is still not clearly ring-fenced.

The Municipal Systems Act makes provision for the Member of the Executive Committee for Local Government in a province to: establish mechanisms, processes and procedures to monitor the performance of municipalities of their powers functions; monitor the development of local government capacity in the province; and assess the support needed by municipalities to strengthen their capacity to deliver.

[51] Department of Water & Sanitation Water Services Geodatabase

It is also a hinderance that there are insufficient, accessible and up-to-date information available within the DWS on supporting datasets such as agricultural activities, energy generation, water requirements for all sectors – various scales, socio-economic data or scenario planning, to assist in water management and governance activities.

10.2 DRIVERS

Effective information management, monitoring and evaluation is crucial for the successful management and regulation of water resources or water services as it creates the platform to initiate interventions / actions, understand trends, adapt management plans appropriately or plan effectively for the future. This is particularly critical in an environment facing significant change. The lack of data and information resulting from weak monitoring systems, information systems that are outdated or not maintained, pose a high risk to the achievement of the goals set out in the NWRS2 and the NW&SMP.

Monitoring and reporting has also been compromised by the high staff turnover in DWS, resulting in the lack of technically qualified staff. There are also budget constraints with increasing costs for running the programmes. There is ongoing pressure to expand and maintain the networks due to an increase in demand for more reliable information, but there are insufficient funds to achieve this.

While DWS has worked alongside sector partners in the development of other ambitious regulatory and/or benchmarking databases, such as the National Benchmarking Initiative undertaken by SALGA, the WRC, and the South African Association of Water Utilities (SAAWU), these exercises have unfortunately never achieved full coverage and most have been allowed to lapse. It requires a tremendous amount of human resources, technical skills and coordination to ensure information exchange between the DWS and water services institutions to ensure continued update and maintenance of information on water services infrastructure and provision. The highly successful Blue, Green and No Drop programme have also been allowed to lapse in 2014.

Ensuring that data and information are shared, accessible in suitable formats and gender disaggregated in order to support the aims of government and in empowering women, remain a challenge.

10.3 PRIORITIES FOR THE FUTURE

Improved and modernised information systems must be developed in support of the implementation of the NW&SMP and continue to build and expand on the suite of knowledge products and communication channels that are and should be utilised to share knowledge in a customized manner. Spatial and non-spatial datasets should be packaged as time-series knowledge products such as atlases, interactive dataset exploration and visualization toolkits (appropriate charts, maps and schematic). Online mapping and interfacing with modelling tools inclusive of systematic metadata and factsheets on the knowledge base should also be included. In addition, there will be a need to include other non-spatial data and information such as existing information, maps reports, data on policies, programs, and projects, institutional information to name a few.

A comprehensive knowledge and information management strategy should be developed and implemented that outlines the development of a variety of interactive knowledge products These products could include among other:

- An interactive atlas of key water resources, water and sanitation management related topics that are visualised as maps, supporting text, graphs, schematics, photographs, and other graphics;
- A repository of relevant existing reports key reports, documents, journal articles, web links, etc. relevant to the water sector; and
- Metadata of the associated database/GIS data developed. This should include information on the sources, coverage, date, and spatial processing related to each of the datasets and enable systematic documentation of the data.

The knowledge products must be derived from reputable national water monitoring networks and information systems that are extensive and aligned with the country's strategic, governance and management requirements to meet current and future requirements. In order to give sufficient weight to this, the following existing projects and programmes should be developed / revitalised to enforce the credibility and relevance of current and future interventions:

- the formalisation of a national hydrological and geohydrological monitoring centre should be considered amongst other actions. This could be achieved by ensuring hydrological monitoring is 'back up to standard' through the recruitment and training of suitable personnel and the allocation of adequate funds for the installation, refurbishment and maintenance of rainfall and river flow gauging stations;
- WARMS[52] is a critical tool in the management of water resources in the country and in being able to track transformation of equitable access to water. As such, it is important that it functions effectively and information is updated and maintained;
- The Blue, Green and No Drop programme have played a critical role in the collection, provision and dissemination of information, and as such should be revitalised and results published annually as a matter of urgency; and
- The DWS Water Services / Regulation Systems Menu consists of a suite of programs and tools to report on water supply, sanitation, water services institutions and programmes. The information should continue to be updated through information exchange between DWS, water services and water resource institutions, and other departments or organisations such as StatsSA.

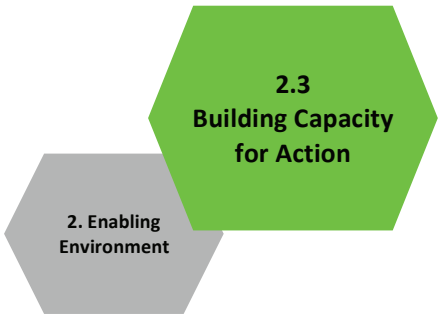
[52] http://www.dwa.gov.za/Projects/WARMS

The following table as summarised in Volume 1 of the NW&SMP provides a list of priority actions to be implemented:

Table 10-1: Priority Actions

Action	Responsibility	Completion date
Revitalise the Green, Blue and No Drop programmes and publish results. Revise and establish norms and standards to be applied in the Green, Blue and No Drop programmes (Volume 3, Action 1.4.1)	DWS, WSAs	Annually
Review and develop and implement comprehensive and appropriate Management, Monitoring and Reporting Structures of the DWS data portal (2.2.1)	DWS	Annually
Review, develop and implement a comprehensive DWS information and knowledge management strategy **to include among other:** **• Amended authorisation conditions to provide for self-reporting** **• Harmonization of monitoring actions by all responsible institutions** **• Perform information V&V audits (2.2.2)**	DWS	Annually
Alignment of monitoring institutions to support National and International reporting requirements and programmes, e.g. SDGs, Agenda 63 and AMCO (2.2.3)	DWS	2021
Monitor, review, evaluate, report on and update NW&SMP (2.7.4)	DPME, DWS	Annual report to Parliament

11 BUILDING CAPACITY FOR ACTION



The water sector is inter-sectoral and multi-disciplinary in nature.

At an inter-sectoral level, it links with agriculture, health, education, local government, mining, forestry, industry and environment.

Its multi-disciplinary nature covers a range of responsibilities, including policy and regulation, planning and management, capital works design, construction, operation and maintenance, ecological, water quality and social analysis, financial management, all across both urban and rural environments.

These responsibilities are allocated to a number of water sector institutions, mostly within the public sector such as water services authorities, water services providers, water boards, catchment management agencies and water user associations, but the private sector and civil society also play a role.

An effective water sector requires human resources capacity for different functions at different institutions – both in terms of numbers to meet demand for specific skills; and competencies in terms of skills, qualifications and experience.

11.1.1 Approach to Skills Development and Capacity Building

Skills and capacity building should be defined beyond individual capacity, as the institutional capacity and the enabling environmental have aspects of capacity that should be taken into consideration. This chapter has adopted the Department of Cooperative and Traditional Affairs' (COGTA) definition of capacity building as espoused in the *National Capacity Building Framework* (NCBF).

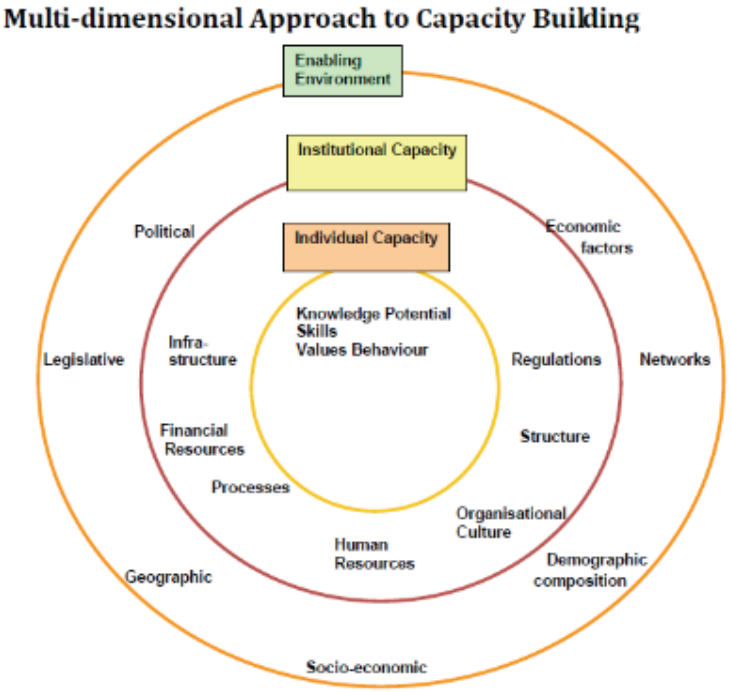


Figure 11-1: Multi-dimensional Approach to Capacity Building

It is recognized that skills are produced over many years through an education and training system (the Pipeline Approach). The system begins at pre-primary level, through the general education and training (GET), further education and training (FET) as well as higher education and training (HET) bands and covers the occupational learning sphere.

The approach proposes a strategic intervention in each of the blocks that constitute the education and training pipeline with the understanding that the effective functioning of the system will produce sufficient numbers of work-ready graduates required by the sector. The figure below illustrates the pipeline approach to education and training.

A leading example of the utilisation of the pipeline approach is the 2020 Vision for Water and Sanitation Education Programme[53] (VfWSEP) which seeks to address water conservation, demand management and skills shortages in the sector.

[53] Possible link to DWS website?

Figure 11-2: Pipeline Approach

11.1.2 Institutional Capacity

Institutional capacity refers to the capacity of sector institutions and entities to plan and manage the execution of sector mandates efficiently and effectively, and includes:

- Powers and functions of various institutions;
- Institutional service delivery models;
- Institutionalised arrangements for planning and delivery of services;
- Regulations and bylaws;
- Financial resources;
- Leadership and governance; and
- Awareness and constituency engagement.

Capacity building includes all physical and non-physical resources necessary for institutions to undertake their functions and a seamless relationship amongst institutions with a clear division of functions, liabilities, obligations and powers.

11.1.3 Environmental Capacity

Environmental capacity refers to external enablers for effective and efficient functioning of water sector institutions. These include sector policies, legislation, strategies, plans, funding and institutional arrangements for effective regulation and seamless accountability. Other issues include the political and socio-economic environments and how water sector institutions are enabled to operate optimally and navigate through challenges such as skills deficit, limited government fiscus, high levels of poverty, demographic trends such as high rural to urban migration, high rate of informal settlements, low levels of cost recovery, and public unrests.

11.2 PRESENT STATE

The NW&SMP sets out the challenges that must be addressed to ensure a secure water future. These will not be achieved without addressing the issue of capacity – human resources with the necessary qualifications, knowledge, attitudes, competencies and capabilities to improve the water sector planning and management processes; and an enabling environment with appropriate policy and legal frameworks; institutional tools, systems and processes including public participation, partnerships and intergovernmental relations. Environmental and

institutional capacity constraints are addressed elsewhere in the Master Plan and the focus is on human resources capacity both in terms of numbers and skills.

Three key challenges impact on the human resources capacity – number of vacancies in critical areas especially engineering; development of new skills for a changing environment; and development of functional skills for incumbents in water sector institutions.

A skills gap analysis conducted by the WRC in 2015, looking at numbers of staff and their skills relative to required skills, showed significant skills gaps in all water sector institutions, including DWS, CMAs, water boards and Water Services Authorities[54]. Recent reports (2017) by National Treasury identified over 800 vacancies within DWS[55]. StatsSA's Non-Financial Census of Municipalities 2016[56] reported a 13,7% vacancy rate in the water and sanitation departments across all municipalities.

11.2.1 The Skills Development Mandate in the Water Sector

The responsibility for the coordination of education, training and skills development across various sectors is vested in the Department of Higher Education through the various Sector Education and Training Authorities (SETAs). The Skills Development Act (No. 97 of 1998, as amended) conferred the primary legislative responsibilities of facilitation of learning programmes (linked to occupations), disbursement of workplace training funds (mandatory and discretionary grants) and skills planning functions to Sector Education and Training Authorities (SETAs).

For the water sector, the Energy and Water Sector Education and Training Authority (EWSETA) is charged with the responsibility of coordinating and facilitating skills development and capacity building in accordance with the Skills Development Strategy, Human Resource Development Strategy II (2010-2030) and the New Growth Path, National Skills Accord (NSA) between government, business and labour. Through its Sector Skills Plan, the EWSETA focuses on determining skills development priorities after thorough analysis.

11.2.2 Skills Development

The water and sanitation sector is dependent on high levels of professionals and technicians; however, there is a serious shortage of specific critical skills within various water sector institutions across the water and sanitation business value chain. Achieving sustainable water

[54] Integrated Water Sector Skills Intervention Map based on a sector skills gap analysis report to the Water Research Commission by A Vienings (Water Concepts) & M Lima (Onyxx Human Capital) (co-project leaders) WRC 2015
[55] Parliamentary Monitoring Group www.pmg.org.za.
[56] Statistics South Africa; 2016 Non-Financial Census of Municipalities

resources management requires a multi-dimensional approach to how skills and capacity is addressed across the value chain from regulation through to provision, usage, treatment and re-use of water, in both rural and urban areas and across the gender divide.

The EWSETA 2017-2022 Sector Skills Plan highlights challenges such as:

- limited number of people studying in engineering
- graduates not having the required practical skills
- the quality of Technical Vocational Education and Training (TVET) colleges not being adequate
- many current personnel nearing retirement and the shortage of experienced people in the pipeline that can fill these positions *and*
- inadequacy of the sets of qualifications for emerging occupations.

As a result of this serious shortage of technical skills, even the Department of Water and Sanitation continues to over-rely on consultants in key strategic areas including planning and programme management.

The skills and capacity required by the Water Services Authorities (WSAs) to deliver and maintain water and sanitation services sustainably also remain inadequate. This is compounded by the difficulties in attracting qualified professionals to rural municipalities in particular.

The publication entitled *Numbers and Needs in Local Government* (Lawless 2005) highlighted that municipalities were short of civil engineers, technologists and technicians, with some 28% of municipalities having no in-house civil engineering capacity at all at that time. The updated *Numbers and Needs* (Lawless, 2007) further highlights the fact that civil engineering levels in municipalities is too low to adequately plan, deliver, operate and maintain local government infrastructure in a sustainable manner.

To determine progress made, The South African Institute of Civil Engineers' (SAICE) Professional Development and Project has undertaken a comparison between the 2005 results and the status quo in 2015. As indicated in the table below, the number of municipalities with no civil engineers on their staff has increased from 126 to 202. Twenty-eight have no civil engineering staff at all, while 81 have only technicians.

Table 11-1: Civil Engineering Metrics – 2005 compared with 2015

Totals	2005	2015		Number of municipalities with	2005	2015
Civil engineering staff	1 875	2 387		No civil engineering staff	82	28
Civil in metros	1 059*	1 201		No civil engineers	126	202
Civil in districts	240	260		One civil engineering staff member	60	41
Civil in locals	576	926		Only civil engineering technicians	95	81
Population	47.640m	54.432m		Female civil engineering staff	56	153
Households	11.754m	16.122m		Registered civil engineering staff	85	56

The Municipal Demarcation Board's *State of Municipal Capacity Report* (2012) also highlighted the uneven distribution of registered Engineers, which is an essential capacity to manage water and sanitation services. As indicated in the figure below, particularly small and rural municipalities are struggling to attract and retain engineers.

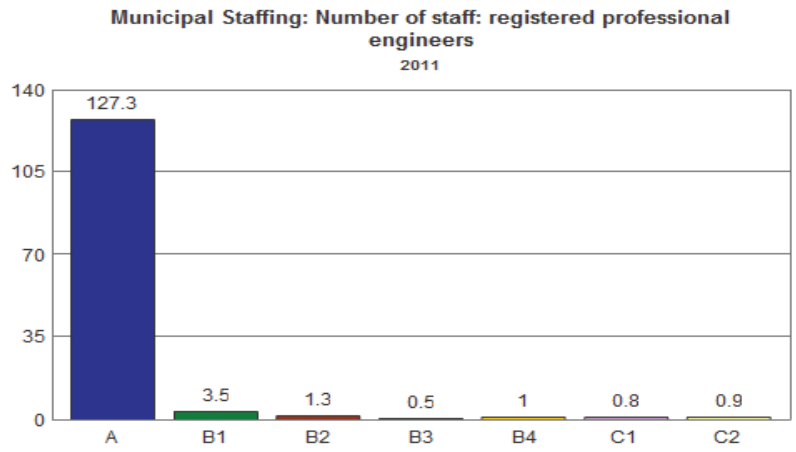


Figure 11-3: Number of Registered Engineers per Municipal Category

11.2.3 Current Supply Trends

Records from the Council for Higher Education show that the number of Civil Engineering graduates doubled between 2010 and 2015 from approximately 1 000 to 2 000 graduates per year. It is not clear how many of these graduates seek work in the water sector. Other graduate numbers with qualifications that apply to the water sector also increased dramatically in this period, leading to no shortage of science graduates applying to work in the sector. However, the challenge of appointing qualified and experienced staff remains, especially in municipalities and the Department of Water and Sanitation. Key constraints include the availability of competitive salaries and suitable working environments to attract and retain the required skills, as well as the lack of experienced engineers and scientists to provide mentorship and training to graduates to enable them to register as professionals.

11.3 PROBLEMS, CHALLENGES & DRIVERS FOR CHANGE

The South African water sector has experienced major sectoral, regulatory and institutional reform since 1994. These have had significant impact on the governance, operations and management of water sector institutions and engagement with water users, and on the capabilities and expertise required. The capacity gaps are present at various levels – environmental, institutional and human skills. Environmental and institutional capacity gaps are a result of a multiple factors beyond the control of the water sector.

11.3.1 Human Skills

The following human skills capacity gaps are noted:

- Experienced professionals are leaving public institutions to work in the private sector and in foreign countries due partly to the inability of public sector institutions to attract and retain such staff.
- Mentoring of new entrants into the water sector has become a major challenge due to shortage of experienced personnel in the public sector.
- Impact assessments are hardly ever conducted, allowing little evidence of the actual impact of capacity building and skills development interventions in the sector.
- Primary planning data, which under ideal circumstance should be generated through the workplace skills planning process, is poor.
- Limited water and sanitation sector occupations are listed in the Organising Framework for Occupation (OFO), as these workplace skills plans from employers are not standardised and reflective of the actual needs/gaps. This contributes to inaccurate prioritisation and allocation of funding for interventions.
- The ongoing retirement of a large cohort of older, experienced workers is leaving significant gaps in skills and experience in the sector.
- There are new capability requirements to meet the emerging demands of climate change, environmental management, new technologies, and the multi-disciplinary nature of sustainable water management.
- Resource constraints and the low capacity to engage with the water sector, hampers the updating of materials, and the generation of new courses relevant to emerging needs and to deliver industry-relevant education and training.
- There are low levels of entrants and completions in education and training programmes relevant to the water sector, including sciences and engineering.

Other trends which influence skills availability and retention within the water sector include the following:

- Extensive corporatisation and the contracting out of many functions of water utilities in the 80s and 90s, and a resulting reduction in the level of inhouse training provided by the state

- The overall shortages of technical skills in the South African economy, the strong competition for human resources within the infrastructure/ mining sectors in particular and an extended period of low investment in curriculum development
- Demand from the mining and construction industries for a limited pool of scientists and engineers
- Changing/evolving job roles, definitions and qualifications make it difficult to choose a specific career path in the water industry
- Changing expectations from younger members of workforce who expect greater flexibility in working hours, the opportunity to achieve a work/life balance and better optimised career paths than is offered by industry *and*
- Variable connectivity of universities with industry resulting in less employment-relevant curriculum.

11.4 PRIORITIES FOR THE FUTURE

The future is envisaged as follows:

- A well-skilled and adaptable water sector work force
- An attractive sector that competes with other sectors for skills and can retain skilled staff in the water sector
- Accountable and strong governance structures focused primarily on monitoring and evaluation of new and existing training/skills development programmes *and*
- Funding available for scarce skills throughout the skills development pipeline.

While the present needs are urgent, and solutions are required in a corresponding short-term framework, the solution will take time. Both the water sector and the education sector operate in long timeframes, with gestation periods of years and decades. Addressing skills needs across these sectors requires a long-term perspective, balanced with the need for urgent action. There are significant current commitments to education and training places, and recent further commitments announced. Some of the actions identified by *EWSETA Sector Skills Plan 2017-2022* are as follows:

- Develop new skills and leadership for Hydrologists, Hydrogeologists and Ecologists, to drive groundwater use at local level and improve artificial recharge of aquifers
- Build human and institutional capacity to better manage water databases, create communication and awareness and project the cost implications of utilizing alternative sources of water and the development of green processes and technologies
- Expand high-level knowledge and quality research in areas such as groundwater use, desalination, water treatment, and the role of women in water in rural areas and informal settlements
- Facilitate the War on Leaks training programme
- Align skills development interventions to support green jobs and initiatives

- Mainstream issues of sustainability and environmental ethics into education and training programmes
- Develop high level of technical and research skills that underpin technological advancement and innovation
- Up-skill and retain the existing labour force that participate in varying capacities within the sector to address changing skills needs linked to technological advancement
- Develop industry-research / skills development partnerships with research institutions, science councils and universities of technology in areas identified for innovation *and*
- Train women involved in accessing and distributing water in rural areas and informal settlements in the safe and efficient usage of water and sanitation.

Skills development (planning to implementation) happens within the National Qualification Framework (NQF), and its sub-framework of quality councils and structured pipeline bands. This form of capacity is exclusive to individual capability and knowledge to fill a particular occupation.

It is important to develop and implement a mandatory, modular hands-on qualification for municipal water managers to be run over 18 months and accredited by EWSETA to include aspects such as asset management, tariffs and revenue management, drought management, stakeholder engagement and customer relations

In addition, regulations should be developed regarding the required qualifications and experience for senior and technical positions in DWS, CMAs, water boards and municipal water services, accompanied by a programme for recruiting and retaining experienced technical and managerial staff with technical qualifications in South Africa and internationally. The definition of career paths with defined training and on-the-job experience will help to build a cadre of sector professionals.

A detailed assessment of sector skills and capacity building needs will be concluded after approval of this plan. The following ten-point plan incorporates this thinking:

- Undertake water and sanitation sector skills capacity needs analysis. The study will investigate current state of skills and map stakeholders throughout the water value chain in terms of mandate, current capacity and required capacity for optimal performance. It will indicate the skills gaps in terms of numbers per occupation, and skills levels within each of the water sector institutions.
- Develop a skills and institutional capacity development strategy for the sector aligned to the 2030 National Water and Sanitation Master Plan by indicating what skills (competencies and numbers) are needed by the different water sector institutions to achieve the sector goals and priorities identified in the National Water and Sanitation Master Plan, the NDP, the SDGs and the NWRS2. The focus of skills will be at all levels – artisans, administrative, supervisory, management, technical, legal, scientific and financial.

- Assess and develop appropriate institutional arrangements required to achieve sector goals and priorities. This will take into consideration work done through the institutional reform and realignment project. Focus will be on effective division of powers and functions for potable water supply and sanitation.
- Undertake a study to identify constraints and capacity gaps in water sector institutions that prevent water sector institutions from achieving sector goals and priorities identified in the National Water and Sanitation Master Plan and the SDGs. Identify interventions to address the constraints and institutional capacity per sector. The sectors referred to are: domestic use (local government), mining, industry and agriculture. The intervention required will be comprehensive to include amongst others, human capital, technical, social, institutional, environmental, financial management and legislative issues.
- Evaluate various alternative interventions and institutional arrangements to meet current and future water and sanitation capacity demands considering the benefits and challenges of every alternative mechanism or solution. Develop support models and institutional mechanisms to address the identified constraints and capacity per sector.
- Resource, expand and continue to implement the 2020 Vision of Water and Sanitation Schools Education Programme. Review the programme and focus on the 2030 Vision.
- Resource, expand and continue to implement the Community Water Education Programme incorporating climate change.
- Resource and implement the Water Councillor Leadership Programme.
- Establish partnerships with private sector and international development partners for skills development and institutional capacity building. Assess opportunities for private public partnerships throughout the water and sanitation business value chain.
- Establish partnership with Non-Governmental Organisations for institutional capacity development.

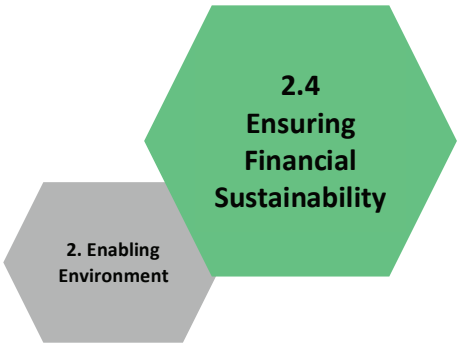
The following table as summarised in Volume 1 of the NW&SMP provides a list of priority actions to be implemented:

Table 11-2: Priority Actions

Action	Responsibility	Completion date
Establish regulations on required qualifications and experience for senior and technical positions in DWS, CMAs, water boards and municipal services institutions (Volume 3, Action 2.3.1)	DWS, CoGTA, SETA	2023
Develop and implement programme for recruiting experienced technical and managerial staff in first South Africa and then internationally (2.3.2)	DWS, CoGTA, DIRCO	2030
Define (and reinstate in some cases) career paths with defined training and on the job experience to build a knowledgeable sector of professionals (2.3.3)	DWS, WSAs, WBs, CMAs	2023
Develop and implement a mandatory, modular hands-on qualification for municipal water managers (technical manager) to be run over 18 months and accredited by EWSETA to include aspects such as asset management, tariffs and revenue management, drought management, stakeholder engagement and customer relations (2.3.4)	DWS, EWSETA, Institutions of Higher Learning	Ongoing
Partner with institutions to fund training of water sector practitioners in the curation, management and use of data as well as the associated technologies (2.3.5)	DWS, EWSETA	Ongoing
Initiate a focused research capability initiative in water sector economics to address this existing skills gap (2.3.6)	DWS, WRC, CSIR, DST	Ongoing
Continue to develop high end skills (post graduate) to ensure a future science, technology and innovation capability in South Africa (2.3.7)	DWS, DST, NRF, WRC, CSIR, the dti (THRIP)	Ongoing
Continue to support programmes that enable development of critical skills and exposure to emerging innovations (e.g. Young Engineers Programme) (2.3.8)	SALGA, DST, WRC, CSIR, DWS, CoGTA, MISA	Ongoing

12 ENSURING FINANCIAL SUSTAINABILITY

Sustainable financial water management involves the full spectrum of financial management and governance activities required to develop and sustain effective water and sanitation services to the people, environment and the economy of the country. The focus of the country must be on sustainable management and not only on infrastructure investment.



To stay in business, income (funding) and expenditure must remain positive or in balance. The following sections present the current financial situation, future investment needs, funding sources, financing mechanisms and financial governance to achieve and maintain financial sustainability in the water sector.

12.1 FINANCIAL HEALTH OF THE SECTOR

The water and sanitation sector is currently not financially sustainable. Funding needs are on the increase and available funding is limited due to the economic recession, reduced revenues and accumulating debt. In general, this Master Plan indicates the need for an immediate “turn-around” and mind-shift change with regards to the sector, which is also the case from a financial sustainability perspective.

The following diagram illustrates the current situation and depicts three financial health scenarios for the future:

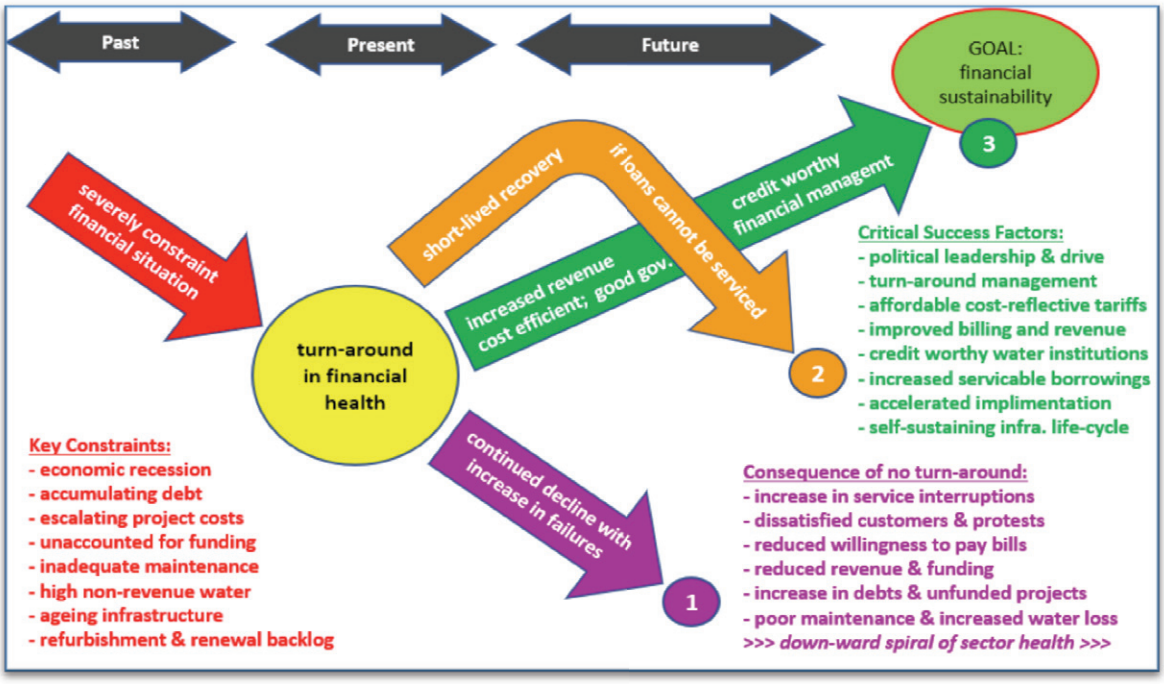


Figure 12-1: Three Scenarios for the Future

As illustrated in the above diagram, the following scenarios apply:

- Scenario 1: "Business as usual" with continued decline of financial health and large-scale failures
- Scenario 2: "*Ad-hoc*" approach with short-lived illusory recovery resulting in borrowings that cannot be serviced resulting in continued dysfunctionalities in sector *and*
- Scenario 3: "Turn-around" based on sustainable financing of economic and social projects.

***Scenario 1:* Business as usual** is not an option. The risk of not spending what is required will result in further infrastructure degradation over time (a "reverse gear" situation); water investment not providing an enabling environment for economic growth; socio-economic targets and objectives not being attained and a sector that is not able to provide a level of service acceptable to users.

***Scenario 2:* "Ad-hoc" approach** can result in large expenditure and raising of long-term loans to provide quick relief but does not support financial sustainability in the long term. In terms of this scenario, a non-integrated or selective approach to finding solutions for the sector can result in scarce financial resources being utilised on the wrong solutions. Loans can tie future revenue streams to committed funding structures for the next two to three decades, hampering

recovery of the sector as a whole and putting undue pressure on the fiscus and user tariffs in the future. This approach would typically respond through "cherry-picking" where the best revenue streams are isolated for purposes of a transaction, but where this does not form part of the holistic solution required. It can be a case of "low-hanging fruit" where short-term impacts are the focus through emergency schemes providing only symptomatic relief.

Scenario 3: **The "Turn-around" approach** is the only viable option to ensure financial sustainability of the South African water sector in the long-term. A well-planned and executed turn-around is required and decisions have to be based on solid information to evaluate the challenges at hand and assess the most appropriate solutions. A turn-around will inevitably require change where strong (and sometimes unfavourable) decisions would have to be taken. There is no time to be wasted and immediate action is required on an integrated and balanced approach.

A turn-around towards financial sustainability is not optional and requires dedicated, purposeful intervention and a serious mind-shift by all stakeholders.

Although financial sustainability is outlined in this chapter as a separate focus area and an enabler to the success of the sector, it is equally inter-dependant on the successful implementation of the other enabling pillars such as enforcement, regulation and having value attached to water security. This integrated approach can, together with fundamental financial management, mobilise sustainable financing for the sector.

12.2 KEY CHALLENGES TO FINANCIAL HEALTH IN WATER AND SANITATION

The sector is currently not financially sustainable and challenged with *inter alia* the following factors that impacts on the financial health of the sector:

- Lack of understanding of the strategic value of water (particularly the importance of water security);
- Degradation of existing asset value (backlogs in operations, maintenance and refurbishment);
- Funding gap (expectations exceeding current capacity);
- Water use not optimised (lack of demand management, water allocations insufficient);
- High non-revenue water (non-paying users, insufficient revenue management system, growing debt);

- Backlogs on Free Basic Water supply and sanitation provision (still catching up);
- Inefficient sector institutions (complex structure and governed under different legislation);
- Fiscal constraints (limited capacity by fiscus to provide funding or guarantees);
- Tariffs not cost-reflective (under-recovery, agricultural subsidies);
- Capacity constraints (lack of skills and integrated, practical support programmes);
- Non-alignment on priorities and strategic value of water;
- Institutions not creditworthy (financially constrained municipalities - especially in rural areas);
- Private sector participation not optimized;
- Reducing water quality (increasing costs and environmental risks); and
- Value for money procurement not optimal.

The South African water sector is in decline with highly vulnerable municipalities characterised by declining levels of service, a continued increase in customer dissatisfaction, rising levels of unpaid bills and aging infrastructure. In terms of the Vulnerability Assessment report[57], 78% of municipalities rate are between 'high' and 'extreme' in terms of vulnerability. The dire situation is confirmed by No-Drop and Green Drop Reports which shows high levels of non-revenue water and large numbers of wastewater treatment works not meeting the discharge standards.

[57]Department of Water and Sanitation (DWS). 2015. Municipal Strategic Self-Assessment (MuSSA)

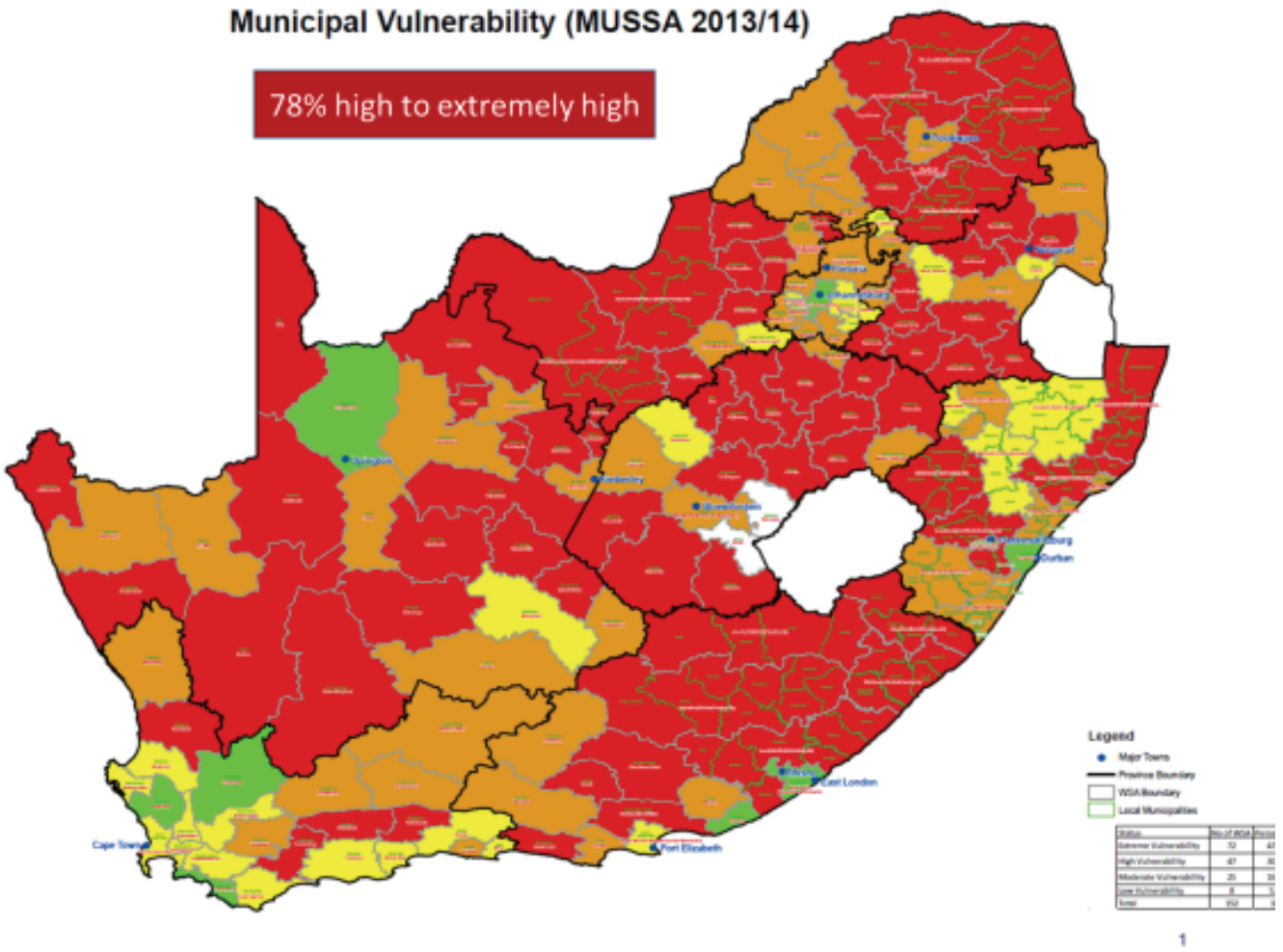


Figure 12-2: MuSSA Vulnerability Assessment (MuSSA 2013/14)

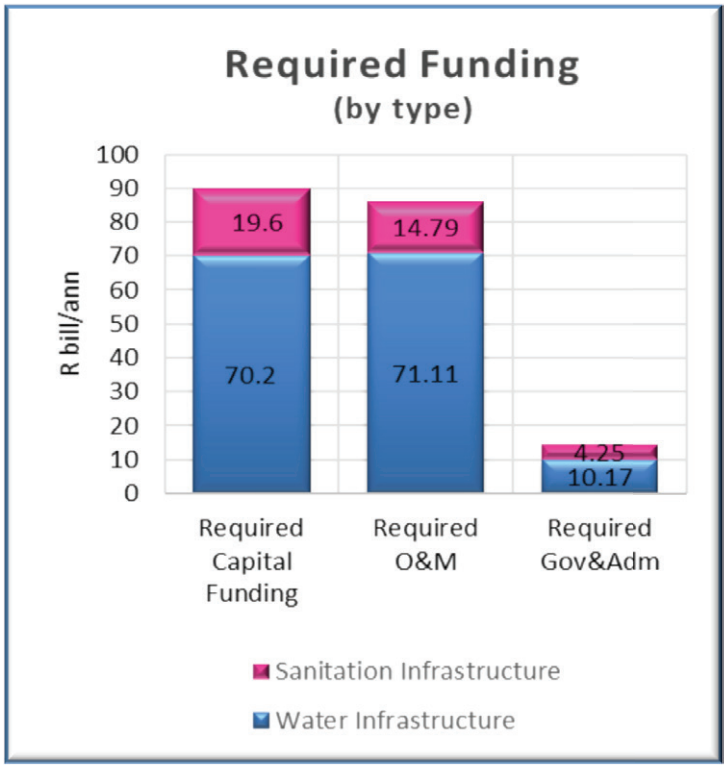
Although these challenges are substantial and should by no means be underestimated, an immediate and focused implementation of the Master Plan could save the sector if the identified corrective measures are implemented and maintained to protect this strategic, yet vulnerable sector, to the benefit of all. The turn-around will require a mind-shift change and commitment from each and every citizen to be mobilized successfully.

12.3 PRESENT STATE

12.3.1 Strategic Overview of Financial Position

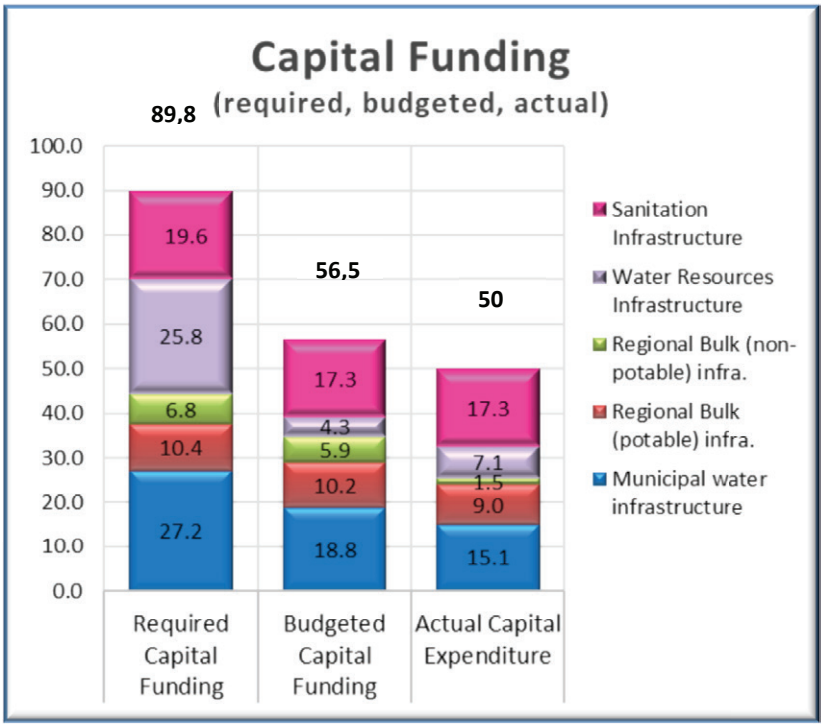
Funding of the water sector comprises capital for infrastructure development, operation and maintenance (O&M) along the water supply chain, as well as funding for governance (plan, organize, lead and control) and effective management of water and sanitation services provisioning.

The adjacent graph shows the extent of required funding in all three funding streams[58]. The capital requirement of the sector totals approximately R90 billion per annum, comprising about R70 billion for water supply infrastructure from source to end-user and about R20 billion for sanitation and wastewater collection and treatment.



The Capital Funding bar-graph compares the required capital funding of R89,8 billion to the current capital budgets, totalling R56,5 billion, and the actual capital expenditure of R50 billion (88% of budget). This is a 12% under-expenditure caused by limited implementation capacity and ineffective project management.

[58] Department of Water and Sanitation (DWS). 2017. National Water Investment Framework



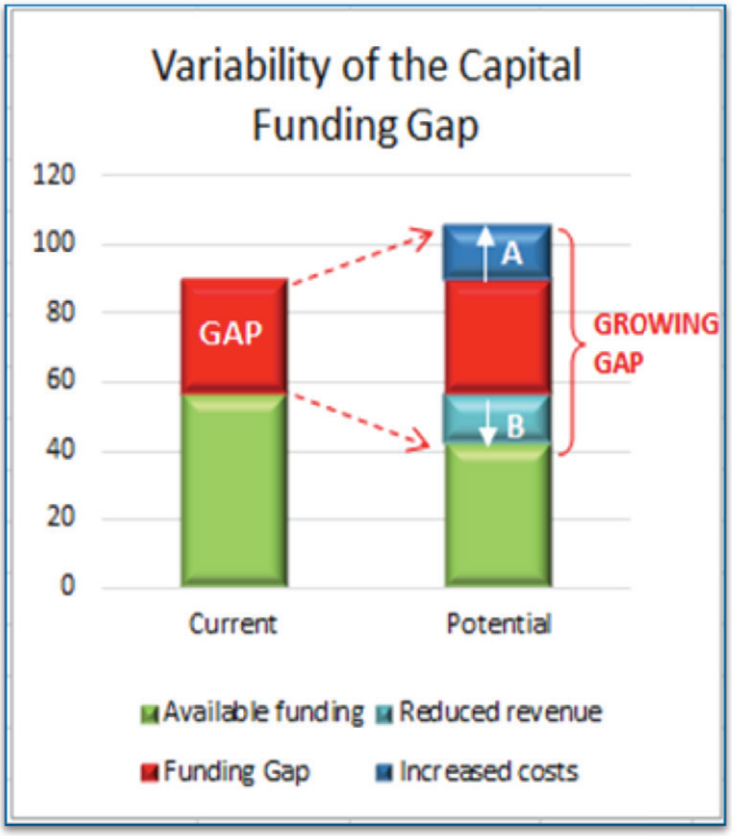
The colours in the graph indicate the breakdown of capital funding along the water supply chain with the biggest funding need at municipal level followed by water resource infrastructure development.

A funding gap of R 333 billion is anticipated over the next 10-years between funding required (R 898 billion) and available funding (R 565 billion). **This funding gap of R33,3 billion per annum must be reduced through purposeful interventions.**

Estimated Funding Gap over the next decade

Figure 12-3: Funding Gap

This funding gap can either increase or decrease, depending on how it is managed. The funding gap is therefore not firm!



Potential increase in the funding gap: As illustrated in the adjacent graph, the funding gap can increase as a result of increased costs (see **A**) due to poor project planning, unsolicited bidding, construction delays, vandalism, delays in implementation of Master Plan actions, poor contract and financial management, unrealistic expectation of users and unexpected risk events such as natural disasters, vandalism and theft of infrastructure.

It can also increase as a result of declining funding availability (see **B**) from reduced revenue (affordability and willingness-to-pay), budget reallocations, fiscal shortfalls, misappropriation of available funds, etc.

Potential decrease in the funding gap: The funding gap can equally be reduced through various interventions, policy reviews, enhanced regulation, implementation of cost efficiency measures and proper management of user expectation and demands.

Interventions to **reduce costs** and **increase revenue** in the sector have to feature as a strategic priority for the country.

The following sections provide more detail on above capital requirement and summarize the status of key financial indicators.

12.3.2 Asset value of existing infrastructure

The value of existing infrastructure is an asset, representing the sum of past capital investments.

The capital replacement value of the existing water and sanitation infrastructure is a key indicator of the size (financial extent) of the sector. South Africa has a substantial existing water and sanitation network valued at an estimated R 1 362 billion in 2017 at capital replacement value. The existing assets are however also depreciating, resulting in a current book value of the infrastructure of about R 584 billion, or 43% of capital replacement cost[59].

**** Infrastructure is ageing (57% depreciated) and needs urgent refurbishment and renewal.***

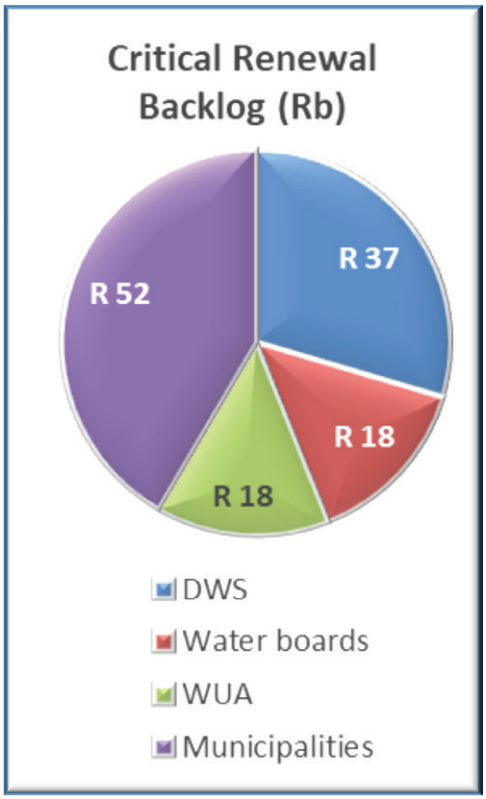
**** Refurbishment backlog of R59 billion needs about R12 billion per annum over 5 years to recover.***

**** Renewal backlog total R332 billion with R125 billion a priority need***

"Asset value" is measured by its assured revenue streams. While this fixed asset value is significant, it can seldom be used as collateral for loan funding since it is mostly a permanent installation and common good which cannot be sold. Instead loans are primarily secured through the assured income streams that can be generated by the infrastructure.

The focus of the past twenty years in South Africa was on new water and sanitation services to address historic backlogs and rapid urbanisation. The operational reality is that existing infrastructure was "stretched" because of significant underinvestment in infrastructure maintenance and delays in renewal of aged infrastructure.

A lack of maintenance has resulted in an accumulated refurbishment backlog of about R 59 billion. The majority (R 25 billion) of this is with municipal infrastructure, while refurbishment of irrigation canals totals about R 18 billion. The municipal budget reform process increased municipal maintenance budgets from R 9 billion to R 24 billion, targeting 8% of asset replacement value or 11% of operational expenses.



[59] Department of Water and Sanitation (DWS). 2018. National Water Investment Framework

Municipal expenditure on repairs and maintenance is however lagging due to shortages in skills and capacity.

Ageing infrastructure has led to a significant backlog in infrastructure renewals, estimated at R 332 billion of which about R 125 billion is critical. Proper life-cycle asset management is required to address the backlog and to reinstate sustainable financing of renewals from depreciation charges deposited into Capital Renewal Reserves. However, most institutions have depleted these reserves and currently only about R12 billion per annum is allocated to renewal of infrastructure, which is about 1% of the capital invested.

A large renewal backlog exists of which the largest component is municipal infrastructure such as treatment works, pump stations and reticulation networks. If sustainable financing of renewal is not implemented, existing infrastructure will deteriorate further resulting in regular service interruptions and a downward spiral of customer dissatisfaction, non-payments, protest and vandalism.

Large scale irrigation infrastructure refurbishment is required. The DWS conducted a detailed condition assessment of its irrigation infrastructure in 2016/2017 to establish a detailed list of required refurbishments amounting to an estimated R 21 billion[60]. With the addition of government owned irrigation infrastructure of the Department of Agriculture Forestry and Fisheries, a total refurbishment need of R 28 billion is estimated.

- Additional capital investment of R33 billion is needed per annum
- Water resource development successfully mobilised R 50 billion capital loans and municipalities about R 11 billion
- The ability to take up more loans is limited by the poor revenue streams and a decline in creditworthiness
- About R3 billion per annum is raised from the market through bonds.
- Bond market requires skilled issuers and public confidence in capacity
- Private sector participation options are not optimised
- Skilled technical, financial and legal capacity is required to manage contracts effectively and ensure that infrastructure meets or exceeds its expected useful life
- Projects normally depend on revenue from the bigger system and may not be bankable on their own

12.3.3 Capital investment need and funding

Investment in infrastructure includes refurbishment, renewal and upgrades to existing infrastructure, as

[60] Department of Water and Sanitation (DWS). 2016.Condition Assessment Audit of Irrigation Scheme Infrastructure.

well as new green-field infrastructure and extensions.

Available capital investment in water infrastructure is in the order of R 40 to R 42 billion per annum, while investment in sanitation is approximately R 13 to R 15 billion per annum, totalling R 55 billion for the sector[61]. This can vary by more than 10% from year to year, subject to infrastructure investment needs, priorities in the national budget allocations, the socio-economic factors affecting the revenue streams and the ability to raise additional financing.

However, capital investment over the next 10 years of at least R90 billion per annum is required, is based on the following priority needs:

- remaining backlog in basic water and sanitation services (at current street tap service levels);
- critical refurbishment backlogs (caused by poor maintenance);
- critical renewals of aged infrastructure;
- provision for water resource developments identified in DWS planning studies; and
- provision of new bulk, connector and reticulation infrastructure to meet the demands of population growth and agreed water use extensions aimed at promoting economic growth.

The capital funding gap is the difference between the “expectation” or development target, and the available funding. Based on above estimates, the current funding gap over the next 10 years is estimated at R333 billion.

The cost of abnormal climate and water related disasters is not included in the current shortfall. If Government cannot provide disaster relief funding, a dedicated fund will be needed which could extend the funding gap.

The reality of the sector is that funding options are limited. There are essentially only two means to pay for capital and operation of infrastructure, being either taxes (national) and/or tariffs (users). However, loan funding is not “new funding”, but is used to address immediate funding needs to be repaid over a longer-term with interest from future tariffs.

In addition, fiscal funding and government guarantees are constrained. The water and sanitation sector is currently heavily reliant on fiscal allocations to survive. Citizens are paying taxes and fiscal allocations are made to the sector to fund agreed social services and the conservation of the natural environment via budget allocations, grants, equitable share etc. The economic

[61] Department of Water and Sanitation (DWS). 2017. National Water Investment Framework. National Treasury. 2017. Division of Revenue Act

component of infrastructure is normally funded through tariffs from the economic users. In some cases, certain subsidies or incentives to achieve development targets or to bridge unforeseen disasters is made available from the fiscus. Off-budget funding often requires government support in the form of explicit or implicit guarantees which increases reliance on the fiscus. Availability of further guarantees or government support is limited, and the sector has to compete with other sectors for such support.

Capital loans are used effectively in the sector totalling about R 61 billion[62]. The majority (78%) of the loans are for water resource development projects undertaken by the DWS and the TCTA.

The TCTA as a special purpose vehicle to the DWS, borrows from financial markets in its own capacity and manages project implementation of bulk raw water infrastructure. Once the infrastructure is built, the DWS operates and maintains the infrastructure on an integrated systems basis, while the TCTA services the debt with payments from the DWS emanating from water tariffs charged to users.

Municipal budgets indicate total annual borrowings of about R 11 billion by creditworthy metropolitan and large municipalities, while maximum municipal borrowing capacity is estimated at about R 18 billion to R 20 billion per annum for all municipal services of which only a small portion (about R 3 billion to R 5 billion) would typically be available for water and sanitation services[63]. Municipal borrowings have declined over the past 3 years from about 24% to 15% of capital expenditure, primarily due to a deterioration in their financial health and creditworthiness. The DBSA is the primary lender with a gradual involvement from other large commercial banks.

The ability to raise capital funding from the open market is constrained due to limited capacity in the water and sanitation sector to access funding. The capacity constraint is underpinned by lack of resources, low credit ratings, non-ringfencing of revenues at municipal level and current structures which generally does not create an enabling environment to mobilise private sector funding.

Grant/donor funding is available but limited in quantity and South Africa often does not qualify for substantial concessional funding. “Tied” export credit funding has successfully been applied but conditions are not necessarily supportive of South Africa’s socio-economic goals to create local job opportunities and procure goods and services from South African suppliers where feasible. Not all projects have clear and sizable foreign content to justify export credit funding.

[62] DWS and National Treasury. 2017. National Water Investment Framework & Municipal Budget Data Base
[63] National Treasury.2017. Municipal Borrowing Bulletin & Municipal Budget Data Base

However, treatment plants and Acid Mine Drainage technology could pose more future opportunities if revenue streams are bankable.

Capital market bonds are used effectively at national level and currently totalling about R 23 billion within water institutions. The TCTA has raised about R19 billion through its bond programme to date from local and international markets, Rand Water about R 2,8 billion and Umgeni Water around R 1,5 billion[64]. Increased utilisation of the capital market bond funding is envisaged by these institutions depending on funding requirements and borrowing limits granted through PFMA and the financial sector's risk view of state owned entities in general.

Municipalities are also issuing bonds as part of their funding portfolio although it is not specific to water and sanitation projects and therefore not easy to determine how much relates to the sector's specific needs. It is mostly the large water boards and metros with reputable management capacity and creditworthiness that are able to make use of this instrument.

Bond funding requires public confidence in the institution's capacity to manage the investor's money over the life of the bond and to honour the scheduled payments. In some cases, it requires an explicit government guarantee to be a viable instrument. Bond funding is often cheaper than long-term loan funding but not necessarily the most suitable, or cost-effective funding instrument for smaller entities.

The bond market is generally hesitant to cover construction risk and ring-fenced project bonds are still in a developing phase, although it should not be overlooked as a potential funding mechanism. In the water and sanitation sector, the implementation of projects can be ring-fenced, but the cash-flow to repay the debt is normally from a system and not the project in isolation as required by pure ring-fenced instruments.

Other funding structures are successfully applied in the sector. The concept of private sector participation (PSP) is largely applied in the sector e.g. where private funding is mobilised to fund public infrastructure, private contractors are appointed to implement public infrastructure or operate and maintain infrastructure on behalf of Government etc. However, limited cases of formal Public Private-Partnerships (PPP'S) have been implemented in the sector where the private sector assumes more risk and payment is performance based. PPP's have proven to provide successful funding and implementation structures, but expensive and overly cumbersome to set-up and in certain cases, the public sector lacks the expertise to structure PPP's.

[64] TCTA. 2017. TCTA Annual Report

To date, two large water concessions have been implemented successfully, one at Nelspruit (the Mbombela Concession) and one at Ballito (the Dolphin Coast Concession). Private sector indicates clear appetite for large scale investment in the sector, but bankable projects are not clearly identifiable for increased participation. Lack of ring-fencing at municipal level reduces bankability and the sector's institutional structure review needs to consider funders' needs to identify bankable projects.

Blended funding structures are also successfully applied in the sector but underutilised to date. It consists of a mix of funding solutions to fund a defined project and has various permutations such as a mix of fiscal funding, off-budget funding, equity, concessionary loans, credit enhancements, grants, subordinated loans, guaranteed components etc.

With most projects having to provide for economic and social use collectively, this funding structure has capacity to be developed and further expanded under skilled capacitated entities such as TCTA, MISA and DBSA where capacity exists in project implementation, funding and contract management resulting in more effective procurement, cost efficiencies, clearly defined risk allocation and management.

The challenges experienced with blended funding structures are the extensive time required to obtain approval for each of the funding components. These approvals are generally progressive and approval processes are not necessarily aligned.

A systems approach to infrastructure development is applied. Projects are often added to an existing system and the revenue from the collective user base is used to create bankable revenue streams. Blended funding lends itself well to this scenario where water projects are intended to increase assurance of supply (i.e. provide storage capacity) and therefore would not necessarily have predictable and continuous use, but the benefit and cost is being shared over multiple users.

12.3.4 Operating cost and funding

Operating costs include the direct costs for bulk purchases of water and electricity, the employee costs for operators and maintenance staff, operator expenditure (e.g. travel, spare parts and disbursements), the financing costs of infrastructure, and provisions for asset depreciation and impairment.

Annual operating expenditure in the water and sanitation sector is estimated at R 100 to R 120 billion per annum[65].

Operating costs are estimated at R10 billion per month.

[65] DWS and National Treasury. 2017. National Water Investment Framework & Municipal Budget Data Base

This is a first-order estimate as water services are currently not ring-fenced in municipal accounting.

A typical cost split between the different municipal services, has been applied to establish a representative estimate.

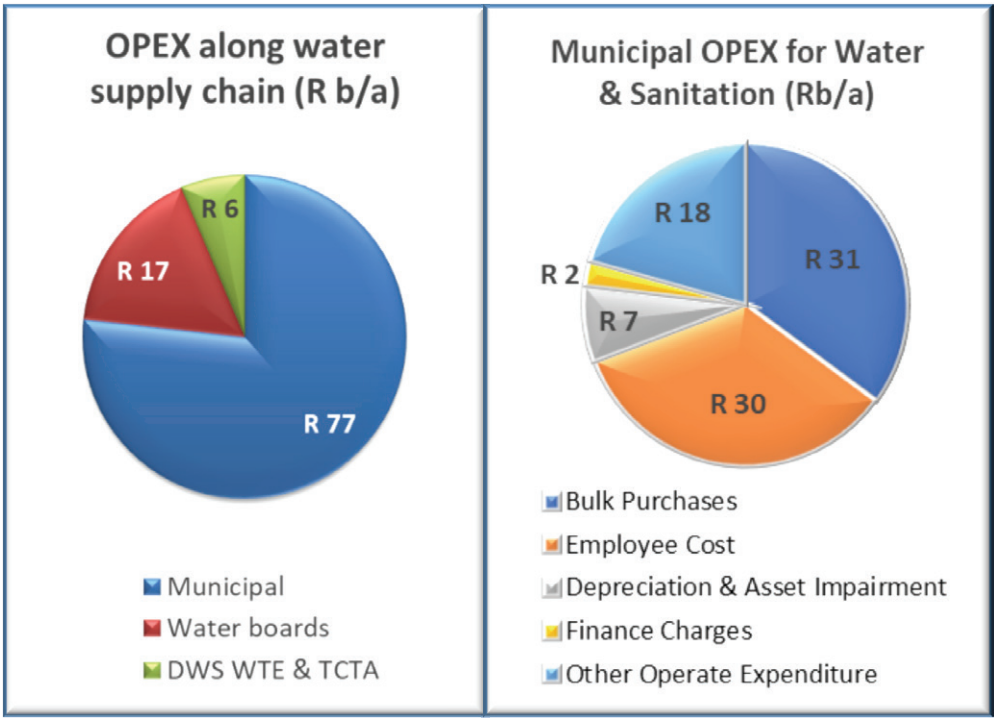


Figure 12-4: Cost Split between Municipal Services & Water Supply Chain

The costs increase along the water supply chain from about R 9 billion per annum (7%) at water resource level to about R 87 billion (70% of total OPEX) at municipal level[66].

Municipal operating costs typically comprise 30% for employee costs and 30% for bulk purchases (water purchases from water boards and DWS, and electricity for pumping and

[66] DWS and National Treasury,2017. National Water Investment Framework & Municipal Budget Data Base

treatment of water) with the balance for depreciation and financing charges (see right-hand graph).

Operating costs differ between rural and urban schemes, primarily due to type of water source, logistics and available skills. Rural schemes do not benefit from economies of scale, increasing the operating cost per unit of water.

Available funding for operations of water and sanitation services is difficult to determine as municipal accounting is not ring-fenced per service. The current revenue from water and sanitation services amounts to R 72 billion per annum along the full water and wastewater supply chain. Operating grants are primarily from the Equitable Share and total an additional R29 billion per annum, based on the DoRA allocation guidelines. The Equitable Share is however unconditional, and municipalities can use it at own discretion. The total funding for water & sanitation operations is estimated at **R 98 billion**, if the full revenue is allocated to operation and maintenance. Revenue is however, also needed to finance capital, which decreases the available funding for operations proportionally.

A funding gap for good operations, albeit difficult to determine, is estimated at **R 5 billion per annum** if all water services revenue is allocated to operations or **up to R 10 billion per annum**, if revenue is committed to new capital financing. These shortfalls must either be cross-subsidized from other revenue streams, such as property taxes, or will result in sub-standard operations, a lack of infrastructure maintenance and/or an accumulation of bulk purchases debts.

O&M funding gap is R5 to R10 billion per annum

12.3.5 Governance and Financial Management Cost and Funding

The elements of Water Governance and Water Management are described in detail under chapters 3 to 11. Actions identified in these chapters include management and governance actions that must be funded from administrative budgets.

Institutional arrangements for sector management and financial governance

Governance of the water sector involves various institutions at national, provincial and local spheres of government. It is constitutionally a shared responsibility which must be coordinated and managed to achieve the required outcome for social and economic development.

Sanitation is mostly a local government function.

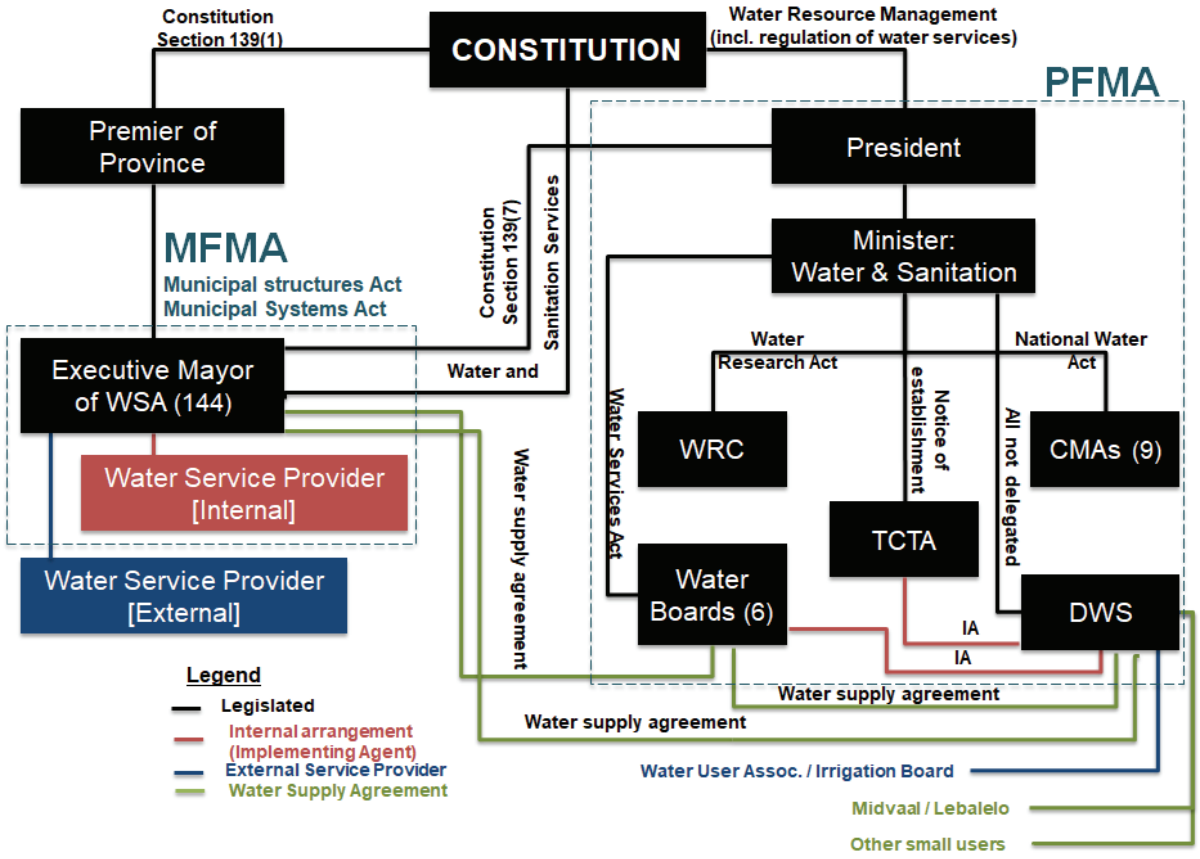


Figure 12-5: Governance of Water

An additional challenge is that the governance of the water sector is fragmented between different Acts (legislation) and different institutions, which makes it very difficult to resolve the financial challenges confronting the sector, particularly at municipal level. With an integrated revenue stream but partly governed by the PFMA and partly by the MFMA, Municipal Structures Act and the Municipal System Act, the true integration of the sector and the revenue management, is challenged. The above diagram provides a high-level overview of governance of financial management of entities that currently exist in the water supply chain.

The DWS is the sector leader responsible for sector-specific policies and legislation, strategic planning, water resource management, water quality management, programme coordination and regulation. It also owns and operates strategic water resource infrastructure through its internal branch, the DWS Water Trading Entity, and institutions such as water boards and water user associations. Financially, it funds and implements new bulk water resource infrastructure from the fiscus or through the TCTA and collects revenue from its raw water provisioning. Water boards fund their operations and capital programmes from bulk water provision (potable and raw) to municipalities and industries.

National Treasury (NT) leads financial governance comprising financial policy development and legislation, financial management (budgeting and expenditure) of national, provincial and local government institutions. The NT plays a critical role in overseeing and enabling good budgeting and financial accounting of water and sanitation services development and delivery as part of the total financial management of each institution. This includes dedicated grant funding programmes (RBIG, MIG, WSIG, ACIP and others) to finance the social component of infrastructure development. It also manages the allocation of the equitable share to enable effective management, operation and maintenance of water and sanitation services delivery to the indigent population.

COGTA oversees provincial and local government and plays a key role in building the necessary skills and capacities for effective municipal services delivery. They manage the integrated basic services programme (MIG) and perform institutional governance functions to create capable water services authorities.

Financial management and governance is inadequate to achieve and sustain financial health of the water sector

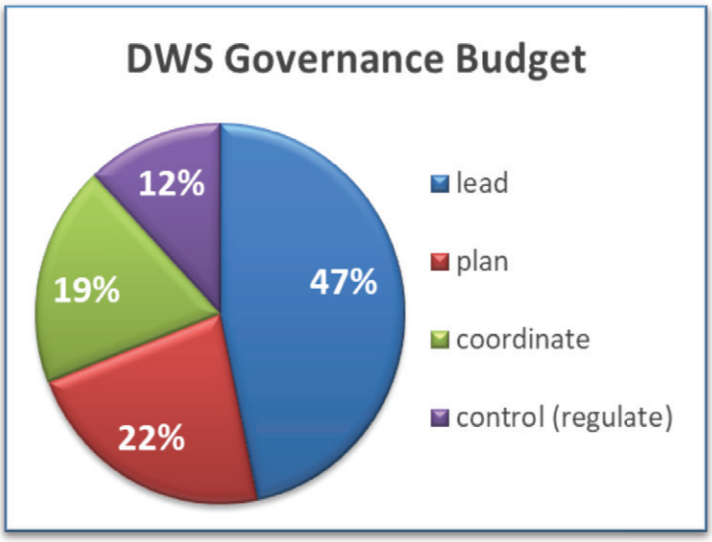
Additional funding is required to enhance governance. While there are dedicated budgets for administration and management of government departments, it still needs to be assessed to what extent it would be adequate to address the implementation of the "turn-around" plan. Existing budgets provide for planning, sector coordination, regulation and oversight. They also provide for information systems and specialist support to enable good governance. Where additional programme management is needed to implement the Master Plan, this will be motivated from the programme budgets as is the case for RBIG, WSIG and MIG. National Treasury has already recognised this need and set aside initial funding.

Determination of a required governance budget is difficult, considering the broad range of functions involved. Provisional estimates, show that about R10 billion per annum is needed for good water governance while about R 4 billion per annum is needed for good sanitation management, including all aspects of institutional capital and operational costs.

Funding requirement for good water governance across all sector institutions is in the order of R 14 billion per annum. (detailed budgeting is required)

The current **budget of the DWS** provides **R 3,3 billion** for the core governance functions.

Leadership includes administration of the Department, the political office and strategic sector coordination such as international affairs. There are substantial shortfalls if Catchment Management Agencies and the National Water Resources and Services Regulator are to be fully implemented and operationalized.



Planning also has specific shortfalls with many projects not having proper feasibility and bankability studies. This is a high priority in the financial "turn-around" plan and should form part of the managed life-cycle of all projects.

Coordination of integrated water management is insufficient and ineffective. Additional funding would be needed to establish catchment management agencies and improve regional bulk water management.

Regulation is under-capacitated to do effective monitoring and regulatory interventions on unlawful water use and non-compliant wastewater discharges. The extent of uncontrolled water uses and the level of water pollution are evidence of this deficiency.

While there is a need for more funding, it needs to **achieve targeted outcome**. Considering the high salary component of expenses, there are significant inefficiencies within the various water institutions that need to be addressed in line with the above strategic governance enhancements.

Need to address inefficiencies in the water governance across water institutions.

12.4 DRIVERS

A multi-faceted approach is required to make the "turn-around" in financial health

An inclusive approach between all spheres of the public sector and private sector is pivotal to address the funding gap. It requires disciplined and intentional action from the entire water supply chain, individual end-users and role-players such as funders, contractors and service providers. The funding gap does not indicate the shortfall in funding but quantifies the extent to which expectations exceed current financial capacity. The following areas need to be addressed collectively to address the funding gap and financial sustainability of the sector and are the key drivers to bring about change in the current financial health of the sector:

Figure 12-6: Addressing the Funding Gap

The table below provides an overview of focus areas for the key drivers or "game changers" to support the turn-around:

Table 12-1: Focus Areas for the Key Drivers

- *Enhance **financial governance** and **financial management** to increase cost efficiencies – PFMA, MFMA compliance*
- *Delay replacement of existing assets through proper **operations, maintenance**, **refurbishment** (sweat the assets – extend economic life)*
- *Reduce physical **water losses** as a wasted expense and reduce availability of water*
- *Reduce demand to delay **future augmentation** by getting more from every drop of water – re-use of water, fit for purpose design, water efficient technologies etc.*
- *Enforce **water quality** measures to reduce cost of purification*
- *Review **institutional structure** for viable water and sanitation functions – consolidate where required*
- *Improve contract management in DWS and other water institutions*

- *Improve financial management and control in DWS*
- *Reduce **user expectations** – "cut your coat according to your cloth: to operate within funding constrained environment*
- *Address lack of **understanding of the usage and value of water** to reduce water use and address non-payment culture*
- *Poor consumers entitled to a basic volume of water but understand that **excessive use must be paid for***
- *Enhance **revenue management** – address non-revenue water through enhanced collection based on accurate metering and billing – quick and fair resolution of disputes with customers*

- *Review **water pricing** – radical revision to ensure cost reflective charges based on life-cycle costing*
- *Address **agricultural sector** benefiting from a large subsidy on the price of water, as a result of a capping of increases and the exemption from the Return on Assets charge*
- ***Ring-fence water revenue** to limit subsidisation of other functions*
- ***Reallocate water allocations** – turn "sterilised water" into "economic water" where appropriate– "use it or lose it"*
- ***Integrated political support** and alignment (non-politicised approach to addressing the sectors challenges)*
- *Enhance **regulatory enforcement** e.g. revive Blue Scorpions – currently no real consequences for non-payment*
- *Increase **reliability** – users more willing to pay for good services*

Further fiscal transfers would be unlocked if cost efficiencies and revenue challenges are addressed

- *Increase **capacity** through enhanced institutional capability*
- *Demonstrate ability to spend wisely and provide clear budget submissions*
- *Appropriate spending – solid planning, combat misappropriation of funds*
- ***Prioritisation** - articulate priorities in line with major targets – solicit political agreement on project prioritisation*
- ***Manage expectation of fiscal contribution -** use fiscal*

allocations for basic supply and kick-start of economic development where bankability requires fiscal support

- ***Incentivise** responsible water management through benchmarking as a regulation measurement – in line with Blue drop, Green Drop and No Drop compliance*

Further loan funding would be unlocked if cost efficiencies and revenue challenges are addressed - Creditworthy entities within the sector will increase

- *Create enabling environment and investment friendly sector for **private sector participation***
- *ensure **regulatory compliance** especially PFMA and MFMA – provides a safe platform for funders to enter into agreements*
- ***central access** point to identify projects*
- *secured **procurement** processes*
- ***ring-fence** water revenue and grants intended for loan repayment*
- ***provide capacity** - facilitated programme to achieve bankability, strong project management capacity to implement and operate projects, assessment of appropriate funding model per project, strong contract management skills etc.*
- *Build on **existing funding models** known to funders – quick mobilisation*
- *Assess most appropriate funding model on case-by-case basis*
- *combine implementation, service provision, management contract, O&M etc. with funding to enhance bankability*
- ***Simplify PPP structure** to create simplified and sector specific guidelines and rules*

Below are some pointers to support the key drivers:

Establish integrated long-term cash flow plan:

It is critical to establish an integrated long-term cash flow plan to map the full capital and operating costs along the full infrastructure life-cycle. It will provide tools to re-prioritize and re-align projects to fit available revenue streams and loan repayments and facilitate the “cash flow” management of actual projects, supply systems and revenue streams into the future.

The graph below illustrates a phased management approach to address the estimated average funding gap over a 5-year period. The first two years are below the average investment requirement, implying that non-critical investments must be delayed until such time that adequate revenue is available to cover the cost or secured funding is raised, if needed.

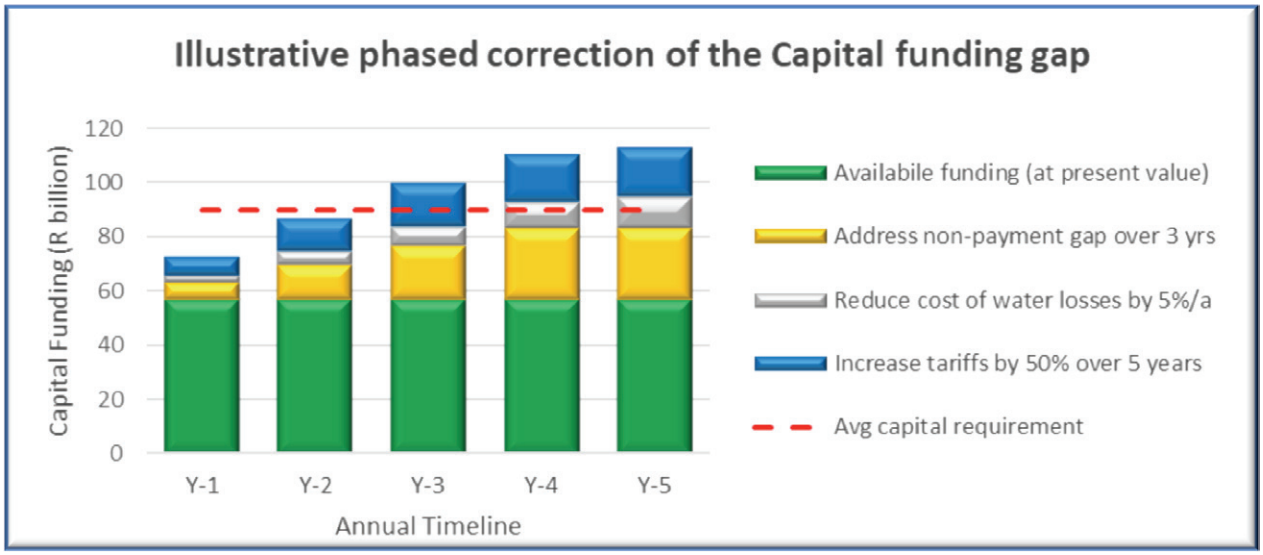


Figure 12-7: Phased Management Approach to address the Funding Gap

Determine funding required to implement the turn-around:

Volume 3 of the NW&SMP intends to provide a first-order indication of the funding required to implement the NW&SMP Action List. However, the Actions must still be thoroughly designed to give effect to the Master Plan and costed and such review will typically include:

- Diagnostic analysis of system need, feasibility and bankability;
- Financial planning and securing of funding;
- Procurement and contractual management;
- Implementation management;
- Operational arrangements and contract management;
- Performance monitoring and regulation of outcome; and

This will be refined as part of the on-going process of engagement with sector stakeholders.

Implement dedicated programme and governance:

Systematic “turn-around” requires inclusive political support, institutional mandate, leadership, a formal programme and dedicated funding. The National Water and Sanitation Master Plan is soliciting this through stakeholder consultation, sector engagement and partnerships prior to presenting the proposed solution to politicians and Cabinet for formal adoption. Critical success factors are the elevation of water as a critical resource and the ability to implement the Master

Plan actions. A formal management programme will be established by the DWS and processes put in place to tightly coordinate the turn-around – management of implementation of the Master Plan is pivotal.

Assess appropriate funding options:

Funding options are limited to basically three categories as follows:

Transfers refer to any cash contributions without a requirement to be repaid or compensated for	*Revenue is generated from tariffs/charges to the water sector users as allowed for in the NWA and other legislation*	*Loan funding options include any form of borrowing with a requirement to be repaid or compensated for*
• *Fiscal allocations (funded from taxes on national level and/or government borrowings)* • *Grants* • *Untied donations* • *Etc.*	• *Tariffs* • *Levies* • *Statutory charges* • *Punitive charges* • *Etc.*	• *Capital market bonds* • *Project Finance loans* • *Private sector participation structures* • *Public Private Partnerships* • *Structured finance* • *Development funding* • *Tied funding* • *Etc.*

Transfers – Public Sector Focus: There is a substantial role for the public sector to contribute to the sustainability of the sector. The water and sanitation sector will always have a social impact and without water, no economic development can take place.

Revenue – User Focus: The water and sanitation sector is already reliant on user tariffs and regular income from providing services such as the sale of potable water and charging for waste treatment, provides a revenue stream to the provider of services. In addition, there may be an indirect income from, for example, property taxes. Revenue that can be generated by the sector has to be optimised and fully explored in addition to transfers from the fiscus. This will require enhanced enforcement and regulation to mobilise and provide support structures to municipalities to enforce the "user-pays" principle for sanitation services and use of water in excess of FBW. Punitive charges are intended to influence behaviour and should not be

considered a funding source. However, such tariffs can assist in alleviating the pressure on the system. A holistic review of water pricing is required to ensure cost recovery and optimization of revenue as a funding source.

Loans – Private Sector Focus: The reference to "Loans" is used to describe any form of a borrowing with an obligation to be repaid or be compensated for. It can be in the form of loans, bonds, structured finance, export credit facilities, concessions or any other structure combining implementation, O&M, management contracts, etc. with funding.

Combined approach / Blended funding refers to any combination of the above three categories of funding options which could be applied. Crowding-in of financiers can be well mobilised with blended funding models whereby funders with different risk appetites, different portfolio structures and so on, could collectively address the funding needs of a project or management intervention.

12.4.1 Reduce Costs

The first key driver of turnaround is a reduction in costs. Various measures and actions are outlined throughout the NW&SMP to increase cost efficiency in the sector and will not be repeated in this Chapter. However, for purposes of financial health, some additional focus is given below on financial governance and financial management.

Financial governance is critical to achieve financial health. This involves strategic financial planning and the application of financial policy and regulations (PFMA and MFMA) to achieve financial sustainability and viability to all stakeholders in the sector. Strategic financial planning is a multi-stakeholder policy dialogue to establish a national consensus on a phased action plan to achieve and maintain affordable levels and quality of water supply and sanitation services for all people in the country. Financially, this boils down to doing the right thing within the financial means of the sector (reduce expectations to close the gap; "cut your coat to fit the cloth").

Financial management: This involves appropriate budgeting for the capital and operational expenditure within the available funding and implementation capacity of the organisations. Subsequently, it requires cost-effective procurement of services, material and equipment, contract management and progress monitoring to implement the budget in accordance with the agreed milestones and outcome. Finally, all financial transactions must be accounted for within the policy and regulations of the PFMA and MFMA to prove that the expenditure was "fruitful" and in accordance with the budget.

Improved financial management must start at the sector leader, DWS. Reports of meetings in Parliament of the Standing Committee on Public Accounts (SCOPA) have reflected badly on the current state of affairs and it is essential that his is addressed.

National Treasury has repeatedly highlighted the financial management challenges in provinces and municipalities, noting that there is poor financial planning, alarming under spending on capital budgets, cost overruns and very poor revenue collection. Seven of the nine provinces under spent their capital budgets by 20% to 23% in 2017, totalling a sum of over R50 billion.
A large portion of this under-spending is in municipalities with large service delivery backlogs

and ailing service provision quality. Spending on the water and sanitation grant programmes (RBIG, WSIG, MIG) has been slightly better than the rest, but continues to rely heavily on municipal capacity to implement projects in accordance with industry standards.

A quick conclusion is normally that a funding gap exist which needs to be funded from loans. However, often availability of funding is not the constraint, but the capacity to spend. Alternatively, sufficient revenue can be available from water and sanitation services, but the revenue is applied to cross-subsidise other services and not spent on much-needed investment in the sector. Therefore, if financial governance and financial management are addressed through the regulatory environment, the sector could already look much different (although not perfect), without even having to increase water and sanitation tariffs or obtaining additional loans. Users will most probably not allow increases in tariffs if simultaneous better control over spending is not clearly demonstrated.

12.4.2 Increase Revenue

The second key driver is to increase revenue. Increase in revenue collectively considers the cost of water (pricing) as well as revenue management (metering, billing and collection).

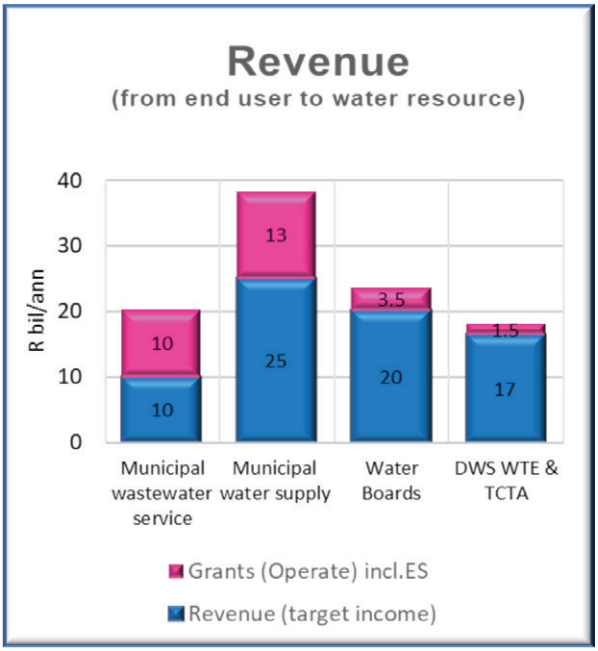
The Value of Water is not only its financial value (i.e. tariff) it also has a social value, environmental value, strategic value, scarcity value and political value.

Valuing water: A mindset-shift is required by users and water utilities with regards to the **value of water**. Users have to acknowledge that water security is worth more than the price of a unit of water and financial pricing is not the only criteria to be considered. There are other strategic values with indirect social and/or economic impact that should also inform the cost of water, distribution of water and allocated water uses.

Water is under-priced – and will become more expensive

Scarcity of water should increase the value of water and enforce water demand and conservation measures for sustainable water use between competing uses. This will differ spatially with some areas having high competition between multiple users while other remote areas have less competition and hence a lesser impact on water pricing.

Water pricing: With water being under-priced, increases in excess of inflation over the next few years to achieve economically sustainable cost-reflective water pricing, are inevitable.



The water and sanitation sector is large and annual revenue totals about R 98 billion per annum[67]. The adjacent graph shows the revenue throughout the water supply chain.

Revenue is primarily collected at the end-user/municipal level, from where it feeds up the supply chain via water boards or water user associations to the raw water supply by the DWS. It is the same revenue stream that supports the entire water supply chain and the cost of water to the end-user has to be sufficient to sustain the various layers within the water supply chain, including cross-subsidisation of Free Basic Water (FBW) supply.

A review of water pricing is required to ensure the financial sustainability of the sector; however, revenue should not be considered in isolation as reduction in cost and increase in revenues should be balanced and optimised.

To provide some context to the relativity of water cost compared to other services, the adjacent graph[68] indicates that electricity and equitable share are the main contributors to municipal revenue and water is the third largest. Water only represents about 13% of total budgeted revenue.

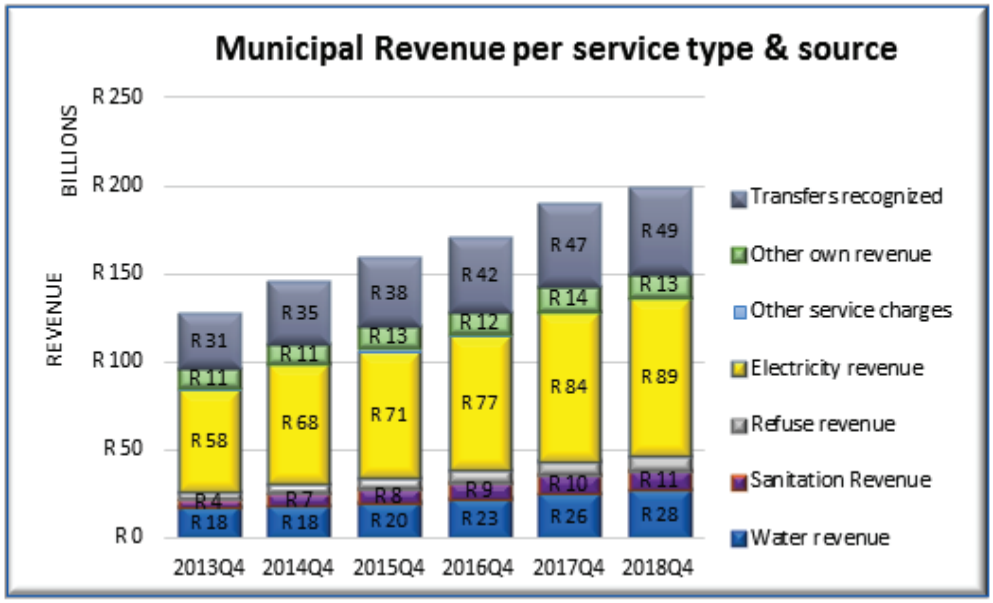


Figure 12-8: Municipal Revenue per Service Type & Source

[67] DWS and National Treasury. 2017.National Water Investment Framework & Municipal Budget Data Base

[68] National Treasury.2017. Municipal Budget Data Base (MSCoA),
National Treasury, 2017. Division of Revenue Act, 2017

Increases have been above the Consumer Price Index (CPI), varying between 8% and 11% per annum over the past 5-years.

Enhance revenue collection: The price of water and sanitation does not have an impact if it is not charged or paid for. It would therefore be equally important to consider the price of water and ensure that users pay. Poor revenue collection is currently a major contributor to the funding gap.

Financial management involves cost efficient service delivery but also enhanced revenue collection to meet ongoing financial commitments. Without serious improvement of revenue collection at the end-user level (municipality, WUA and CMAs) systems will not become bankable and this will inhibit the entire water and sanitation supply chain from recovering.

The following sub-sections describe the tariffs and status of revenue collection for raw water and potable water:

Raw water tariffs and revenue collection:

Raw water is provided by the DWS which manages the water resources nationally and operates the national water infrastructure to ensure regional distribution. DWS also sets the raw water tariffs and collects the revenue.

Raw water tariffs are determined by the "National Pricing Strategy for Water Use Charges", which is currently under revision. These tariffs are currently not regulated with the result that DWS is both "player" and "referee". The current strategy provides for the following types of raw water charges:

- water resources management charges (to fund the protection, allocation, conservation and control of water resources in South Africa)
- water resources infrastructure charges (which provide for operation and maintenance, and asset depreciation charges, capital use charges, assurance of supply charges and non-consumptive use charges such as hydropower)
- waste discharge mitigation charges (to ensure that the polluter pays) and
- water research charge (to fund the Water Research Commission).

Raw Water tariffs are mostly system specific with little to no provision for cross-subsidisation between systems. Some systems benefit from existing infrastructure (mostly historically funded by the fiscus) and have a large established user base, lowering the unit cost of water to those users through economies of scale.

Water tariffs are system specific and not equalized nationally or across regions, as is the case with electricity with a national electricity grid.

Rural areas lack the economies of scale and seldom share in the lower cost of larger urban schemes. In addition, most rural schemes have recently been developed, at current development costs, while urban areas benefit from lower unit costs of older schemes.

Raw water tariffs are formula driven with the intention of cost recovery, but in certain cases it is calculated on the delivery capacity of the system (yield) but charged on actual use, resulting in under recovery when the full yield of the system is not utilised.

Irrigation tariffs are very low, benefitting from historical under-pricing and a cap on annual increases. This places an increased responsibility on other sectors and the fiscus to cover the cost of water provision to irrigators. When determining the price of irrigation water cognisance must be taken of the fact that irrigation water often originates from return flows and discharges from WWTWs and is often of a poor quality.

Raw water tariffs are an input cost to the entire sector and users tend to challenge annual increases in excess of inflation, even if new projects have to transport water over longer distances resulted in a financially unsustainable sector where operations, maintenance, betterments, refurbishments and renewals have been sub-optimal done.

Raw water billing is substantial, but revenue collection is failing. Water pricing is based on the "user-pays" principle and tariffs from users provide a significant cash inflow to the sector with billing of raw water of about R 16 billion per annum to more than 85,000 users[69]. Billing and collection is a major administrative and operating challenge with such a large user base. Consideration must be given to whether a branch in a government department, such as the Trading Entity is the most efficient body to collect revenue. A dedicated infrastructure agency is necessary therefore the DWS will establish a National Water Resources and Services Authority to finance, develop, manage and operate national water resource infrastructure and sanitation.

The billing is typically split between users as illustrated in the left-hand pie diagram below. However, only about R14 billion is collected annually leaving a shortfall of R1,5 billion to R2 billion per annum. This has accumulated to a total debt of R10,5 billion in 2017, presented in the right-hand pie diagram.

[69] Department of Water and Sanitation (DWS). 2017.Debt Collection Performance Report, 2017

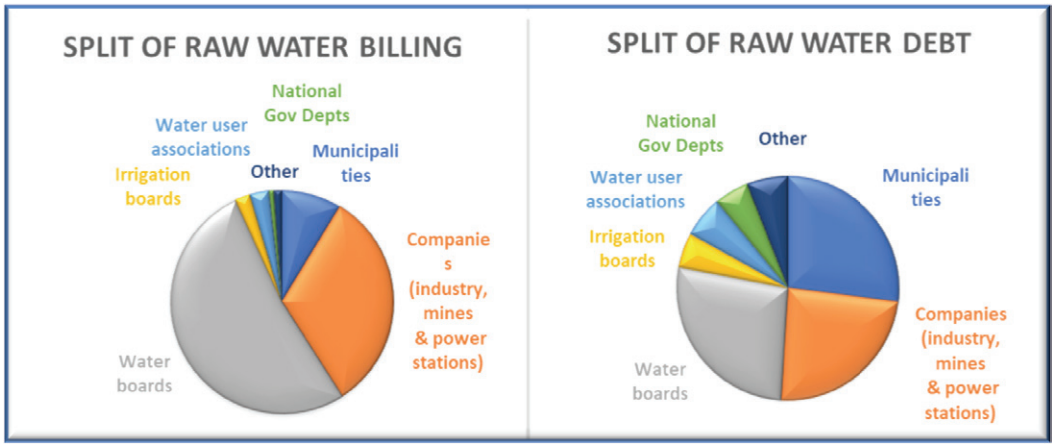


Figure 12-9: Raw Water Billing & Raw Water Debts

Revenue management within the DWS is not optimal and not properly structured/geared to address the billing and collection challenges that exist.

Accumulated debt of raw water supply by the DWS is R10,5 billion with municipalities accounting for 50% directly and a further 20% via water boards

Bulk raw water supply to domestic and industrial users (including mines and power stations) is often metered by the bulk user and DWS is not always directly involved, making meter reading problematic and erratic, impacting on billing and revenue collection. Accumulated debt of the DWS has almost doubled from R5,9 billion in 2013 to R10.5 billion in 2017, which represents an average increase of R1,15 billion per annum[70].

Municipal accounts represent about 50% of the accumulated raw water debt at DWS, while water boards add another R1,7 billion, which is mostly also due to non-payment by local municipalities. Municipalities are thus responsible for more than 80% of the accumulated debt. No resolution is imminent despite intergovernmental intervention, with municipalities not honouring the signed payment agreements. Looking at

Revenue feeds up from municipal level via bulk water service providers to the DWS.

Without municipal revenue collection the entire water supply chain is AT RISK

[70] Department of Water and Sanitation (DWS). 2017.Debt Collection Performance Report, 2017

the debtors of municipalities (currently more than R143 billion[71] for all services), the origin of the revenue problem is primarily with the end-user not paying, municipalities not collecting and financial management not being efficient. There is little consequence (if any) at the moment for users not paying for water and the user-pay principle is under threat.

Irrigation water revenue is at 46%[72] of billable amount. Irrigation water is poorly metered, and billing is at best described as "ad-hoc". The large irrigation schemes have established water user associations (WUAs) and irrigation boards (IRBs), who assist the DWS with operation and maintenance of water distribution to irrigable farm areas and selected towns and industries located along the canals. Currently, 47 of the 240 WUAs are also assisting the DWS with revenue collection through signed "billing agent agreements". The balance represents many small irrigation schemes, which are not efficiently metered and billed, partly due to the small-scale farming and low economic base that they represent. Currently, irrigation revenue is about R1,2 billion per annum representing about 46% of the billable amount of R2,6 billion at current subsidized irrigation tariffs. The WUAs collect the tariffs based on the list of irrigated areas (hectares) and the volume of water allocated per hectare during the growing season. The Water Accounting Software (WAS) was developed by the WRC to improve water distribution efficiency through the canal networks in accordance with scheduled water requests from farmers. It improves the monitoring of irrigation water use and can support the DWS accounting, billing and revenue collection of the irrigated water use.

The waste discharge charge system (WDCS) was developed by the DWS to promote waste reduction and support water conservation. While it is legislated in the National Water Act (NWA) and Raw Water Pricing Strategy, its implementation depends on the setting of resource quality objectives (RQOs), which have not been determined for most receiving water bodies. If users are discharging effluent that is not in accordance with the licence they can already be held responsible for costs. However, most water users are discharging waste water without being monitored, charged or penalized, resulting in extensive contamination of water resources. Reduced water quality increases the cost of purification to down-stream users which unfairly subsidises the polluters who should have purified the waste to acceptable levels before discharging. Revenue is not collected and even if the WDCS would be implemented, there is no indication how such revenue will be applied. Users indicated that such revenue should be diverted to those entities that are incurring the additional cost of purification.

[71] National Treasury. 2016. The state of local government finances and financial management.
[72] Department of Water and Sanitation (DWS). 2017. Debt Collection Performance Report, 2017

Key challenges on raw water revenue management for DWS include:

- extensive customer base of over 85,000 accounts
- only 836 marked as metered customers (albeit the large users)
- most meters are not owned by the DWS
- poorly maintained bulk meters
- large volumes of irrigation water are estimated based on water license allocations
- estimated water use has a high risk on revenue loss as the water users might consume more than their allocation, decreasing the assurance of supply to other users *and*
- installation of additional bulk meters at strategic bulk users has been slow.

Potable water tariffs and revenue collection:

Municipal tariffs are not effectively regulated. Potable water is normally provided by municipalities to domestic and industrial users. The setting of municipal tariffs for water and sanitation is governed by the MFMA, while the Water Services Act also provides tariff regulations. Regulation is thus a split responsibility which leads to poor implementation. While both legislations state the importance of setting cost-reflective tariffs, it is not implemented accordingly. Regulatory procedures should be improved to assess the cost-reflectiveness of tariffs on a regular basis and engage with water services authorities on how to address this.

Integration of the water sector is not visible w.r.t. water pricing. The water sector is integrated with the same water flowing from water resources, via the water supply chain to end-users and back into the system, but the pricing of water is de-linked between raw and potable water. Equally waterborne sanitation is almost completely dependent and inter-linked with water, but sanitation tariffs are set in isolation of water implications. Sanitation decisions in general are not considered within the context of water availability and the cost of water provision and alternative technologies have not been fully explored and implemented. Such alternative technologies for sanitation can have a substantial saving on water provision and water can be redistributed for other uses and potentially create a better return on water investments.

Municipal water and sanitation tariffs are not cost reflective. These tariffs vary significantly with many municipalities not pursuing the setting of cost-reflective tariffs as required by Water Services Act regulations. Annual review of municipal tariffs by the DWS, shows that many municipalities do not have cost-reflective tariffs and proposes urgent consultative intervention to raise tariffs to affordable and sustainable levels. It would be beneficial if the basic water supply and sanitation allocations from the equitable share would also be cost-reflective, but this is currently seen to be too complex to implement.

Cross-subsidisation in tariffs exists at municipal and raw water level. Municipalities effectively use block-tariffs to charge high end users more per unit of water to enable them to subsidise the indigent users. Raw water is often also cross-subsidized within schemes (e.g. Vaal River System and Mooi-Mgeni System) or within bulk water supplier institutions (e.g. Rand Water cross-subsidizes within their distribution system).

User-pay principle not enforced. Although the "user-pay" principle is generally applied to water and sanitation services, there are a large number of users who do not pay. The payment profile per province is outlined in the graphs below and based on the "Living Conditions Survey" of StatsSA undertaken in 2014/2015[73]. This is aligned with similar data from the StatsSA GHS of 2016 and should be monitored closely to track changes over time. The "green" portions indicate those who are paying, and "blue" portions represent the population stating that they receive Free Basic Water (FBW) or have permission from the municipality not to pay, which implies that their payment should come from the equitable share allocation or other cross-subsidization. The balance (in red) represents people that should pay, but do not pay, which is the priority area for revenue enhancement. They represent 30% of the national population or 43% of the population that should pay. If this can be addressed, revenues could increase by up to R26 billion per annum at current tariffs. With the funding gap at R 33 billion per annum, a significant portion of it can be funded from increased revenue management if such revenues are applied to the water and sanitation sector.

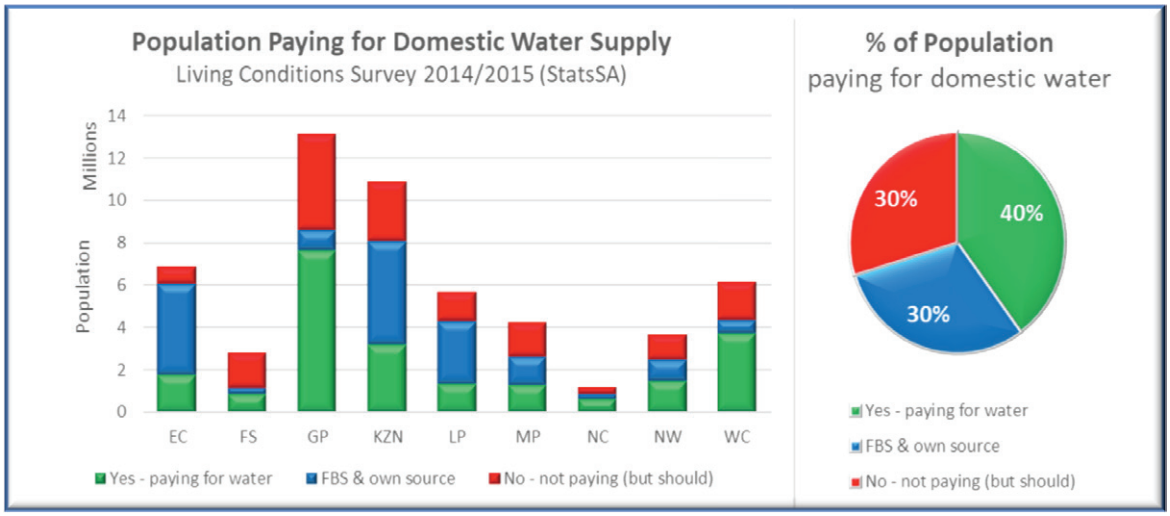


Figure 12-10: Population Paying for Domestic Water Supply

The reason for non-payment is further analysed in the graphs below. It excludes valid reasons for non-payment, such as the indigent population qualifying for Free Basic Water (FBW) and the population using own water sources.

[73] Statistics South Africa. 2015. Living Conditions Survey 2014/2015.P

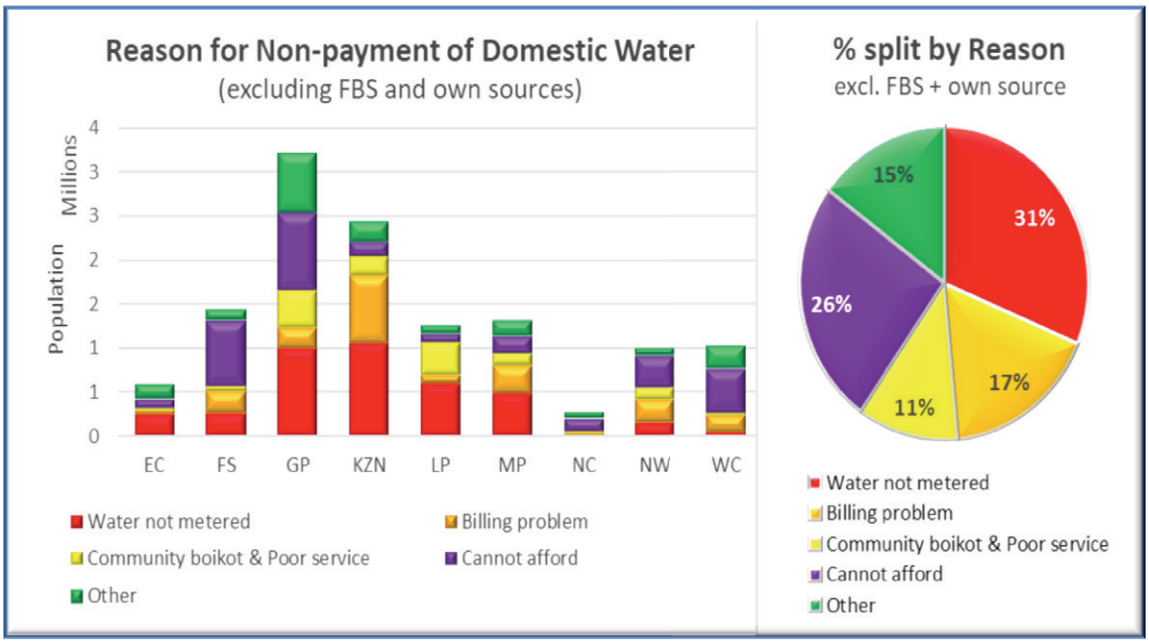


Figure 12-11: Reason for Non-Payment

Debt is growing. This coincides with poor revenue collection, often due to political interference and capacity challenges, leaving municipalities cash-strapped and unable to pay for bulk water and electricity supply, infrastructure spare parts and other essential services. While metros have the highest debt collection ratio of about 95%, their mere size holds them accountable for close to 50% of the debt value. Secondary cities collect about 84% of their bills, with the worst 44 revenue collecting municipalities collecting less than 50% of their bills. About 65% of the debt is with households.

Aggregated municipal consumer debt amounted to R143,6 billion in 2017 with the water portion continuing to escalate

Municipalities in turn owe their creditors R43,8 billion of which electricity is about R11,5 billion and water about R10,7 billion. Both DWS and Eskom initiated legal action at the end of 2017 threatening to cut-off water supply and electricity or invoking Section 216(2) of the Constitution to ask National Treasury to withhold equitable share from such municipalities.

Revenue streams originate at end consumers and if this is not collected, ripples through the entire water supply chain.

Key principles for domestic water and sanitation tariffs are:

- water services tariffs should remain affordable and supportive of socio-economic development

- a rising tariff block structure should be applied that caters for both the free basic services and higher service level consumers in a municipal area
- tariffs should also be used to address sustainability risks created by wasteful water uses, droughts and water scarcity *and*
- tariffs can be a means to increase revenue collection from those who can afford to those who can't, thereby achieve and maintain financially sustainable water services provisioning. The ability to cross-subsidize is dependent on the income profile of the user base.

Improved revenue collection from non-paying customers can raise an additional R26 billion per annum from domestic users.

12.4.3 Increase Fiscal Transfers

The third key driver to financial sustainability is to increase fiscal transfers and Government support for funding structures.

Government's risk approach: It would largely assist the sector if Government could strengthen or extend its role to create an enabling environment for socio-economic development through water and sanitation provision and critically review the risk it is willing/capable to assume in this regard. In certain large infrastructure developments, Government requires fully committed off-take agreements to mobilise borrowing limits to water utilities via the PFMA. This model works well where the infrastructure is purpose-built for a small number of off-takers but does not share the risk on a project to be developed between public and private sector that involves a number of users or sectors where bankability of the entire project cannot be proven in the early years. If 80% is bankable, no funding can be raised until the last 20% is also proven bankable.

Government could play this catalytic role to support the final 20% and ensure that the project is funded and implemented. Government recently approved such a structure for Phase 2 of the Mokolo and Crocodile River (West) Water Augmentation Projects between the Department of Energy, National Treasury, Department Water and Sanitation and the TCTA and this model could be extended, depending on the ability of the state to carry such residual off-take risk.

Increased financial support: The biggest risk to Government would be a dysfunctional sector and where possible and appropriate, increased financial support from the fiscus has to be provided (whether it be through increased allocations/grants, support or leniency to support alternative funding solutions where additional transfers are not possible).

Articulation of priorities: Allocations should be prioritized and considered in light of its impact on the sector. The PFMA and MFMA provide clear guidelines on promotion of projects for fiscal funding and the water and sanitation sector has to provide well-structured business cases for its projects as well as clear priorities to the NT which could result in increased fiscal allocations to the sector.

Incentivise grants: Government has the option to incentivize grants to municipalities complying with Blue Drop, Green Drop and No Drop benchmarks to support sustainability of the sector in a broader sense. This could include incentives for good financial management.

Longer-term financing strategies: For longer-term investments, Government would to need to look beyond the 5-year political administration window to plan and support projects that has longer planning and implementation horizons (refer to the Long-Term Financing Strategy of National Treasury).

Additional grants: Some grants/transfers from other spheres of government or from actors outside of government can include the following:

- Inter-Governmental Transfers that are normally "tied" to specific projects or aims (e.g. new or refurbished infrastructure) and subject to conditions published in the budget in the annual Division of Revenue Act (DoRA).
- The Equitable Share of national revenue is theoretically an unconditional transfer but established practice has resulted in a portion of it being unofficially "earmarked" to support municipal water and sanitation services, by means of a guideline in the DoRA.
- A range of other sources that may be mobilized such as international donor grants (always very specific and relatively small amounts), private sector corporate social responsibility grants (with same limitations as donor grants) and partnerships with big water users (e.g. water stewardship partners). Private sector equity normally forms part of an integrated funding structure and is considered as part of a loan/funding structure rather than a transfer.

12.4.4 Increase Loan Funding

The fourth key driver to financial sustainability is to increase loan funding through the private sector.

Private sector participation: Loans form an integral part of the funding solution to address cash flow mismatches between timing of infrastructure development needs or management interventions required versus revenue which is received over a longer-term. The need for loan funding creates an opportunity to mobilise sizable private sector participation. There are many degrees of private sector participation in the water sector from something as simple as out-sourcing meter readings through to letting a long-term concession involving capital investment and direct contact with customers. Some of these are true partnerships where risk is shared, typically called PPP (Public-Private Partnership) and some erroneously called privatization – as occurred in England, Wales and Chile.

Borrowing powers: Water boards, the TCTA and municipalities are mandated to borrow funds within defined limits set under the PFMA and 3-year MTEF window for municipalities or specifically authorized longer commitments under the MFMA. Water boards and municipalities depend on the reliability of revenue and the strength of current assets in their balance sheets. Borrowing by TCTA is largely on the strength of explicit and implicit government guarantees, the availability of which will be more difficult to rely on in future. DWS may not borrow directly from

the private sector, but National Treasury can raise funds through borrowing and provide the capital funding to the DWS. The cheapest source of funding would be via the National Treasury but where possible, the sector also needs to find funding solutions that will relieve the Government from additional fiscal borrowings.

Long-term implications: Loans should not be entered into "at any cost" as they create future obligations and the legacy left to future generations should be affordable and fair. Interest cost should not be overlooked as a cost to be borne by the users and it could impact substantially on the future cost of water. Loans tie future revenue streams to debt repayment and affordability has to be established to prove bankability. However, loans also create an opportunity to develop quicker and fast track implementation of the turn-around and if managed well, it could be successfully applied to achieve the objectives of the sector to the benefit its users. Implemented incorrectly or sub-optimally, the consequences will burden the sector for very long.

Application of loans: While water utilities might need to take short-term loans to provide temporary working capital they must never consider long term borrowing for operating expenses but limit its application to capital expenditure on infrastructure (an exception might be made for spending on institutional reform and other credit enhancements that could be seen as once-off capital investments).

Risk sharing: Funders require bankable projects and repayment of loans have to be proven. Funders tend to request some form of Government support or "back-stop" to ensure that ultimate risk allocation is borne by Government which is not sustainable for Government and will not achieve sufficient risk sharing between public and private sector. Funders would need to look at alternative measures of performance and risk mitigation in the loan conditions, rather than a safety-net by Government for variability in input assumptions, unless justifiably a Government risk.

Protection of water cost: The sector is monopolistic in nature and "profit making" from water and sanitation should be controlled. Private sector participation has to include a level of profit by its very design, but the users need to be protected through value-for-money procurement decisions and capacity to manage the contracts to ensure users get what they pay for.

Investor friendly environment: Funders indicated the need for an enabling environment to mobilise larger private sector involvement. The funding sector is well structured to enter into discussions and platforms for interaction are either existing, or quick to mobilise and to participate in the funding work streams.

There is not a "one-size-fits-all" funding approach for the South African water sector. Each project and water institution will have its own specific funding need and financing options, based on its socio-economic profile and the available revenue from economic tariffs, social grants and cross-subsidization.

Ring-fencing of projects in the water sector is different to standard ring-fenced project financing. Water projects are generally linked to the revenue stream from the system and not the individual project. Bankability is therefore assessed against the revenue stream of the larger scheme or its management institution (e.g. municipality, water board or WUA).

A programmatic support programme to help municipalities prepare bankable project proposals is a key requirement of the "turn-around" plan. Such a programme will assist water institutions to manage the project development cycle from inception, through financing and construction into operations, until hand-over can be made to the official operator (this can be in different contractual arrangements, including a Build-Operate-Train-and-Transfer (BOTT), a Build-Own-Operate-and-Transfer (BOOT) or similar contractual arrangement).

Implement a dedicated and centralized approach to ensure cost and time efficient financing and implementation of the "turn-around" process.

The collective capacity of entities like the TCTA/NWSIA, MISA and DBSA could be suitable agents for Government to coordinate such a programme, considering their financial management mandates, contract management ability, involvement in water utilities (municipalities, water boards and water user associations), knowledge of funding options and oversight by DWS and National Treasury.

Seed funding from development funding institutions (DFI) could be made available to prepare bankable project proposals and assist in fast-tracking projects through standardized processes and support mechanisms.

The poor profitability of water is at the heart of its financing problem. Due to delayed positive cash flow and resistance to tariff increases, financial rates of return in the water sector are among the lowest of all other sectors. Sanitation and wastewater services are even more difficult to make profitable, and in most cases the sanitation tariff is linked to water billing or other property taxes.

The state of municipal finances is currently one of the biggest risks for water sector investments as its revenue streams are already heavily burdened by accumulated debt and records of poor financial management.

Mobilise Funding Work Stream: Various work streams will be set-up to ensure the implementation of the NW&SMP and the urgency of the Financing Work Stream has to be considered as a high priority as mobilization of international and multilateral DFI's generally take longer than local DFI's, commercial banks and long-term investment managers.

Following are some of the funding structure options that could be considered in addition to typical loans:

Public-Private Partnerships (PPP) have been viewed with suspicion in the past, largely on ideological grounds, but the growing crisis in the sector is beginning to encourage decision-makers to see private sector participation as a pragmatic and beneficial response. However, PSP/PPP contracts need to be carefully designed, competitively procured and diligently supervised, with suitable sanctions if agreed service levels are not maintained.

The longer the contract period, and the larger the private sector investment, the longer they take to prepare, the greater the need for good advice and skills (technical, financial and legal), and

the thicker the contract document becomes to be managed. PPP's are overly cumbersome and expensive to enter into and National Treasury needs to consider a simplified PPP approach on smaller scale which is specific the sector's guidelines and rules. The sector needs funding solutions for large mega projects but also a renewed focus on smaller projects which could even be structured as a community involvement project.

Special Purpose Vehicles (SPVs) can be created as standalone legal entities to manage the risk, performance and financing in a contractual manner. This effectively ringfences the business for preparation of bankability and accountability that funders will require which is well-known to the South African market. SPV's are quick to setup compared to PPP's.

Private sector equity (shares in a private utility) is technically also a funding option but it is not considered significant. Only investment-linked contracts include equity which is typically less than 20% of the total investment amount. With water being a strategic resource of the country, ownership of infrastructure normally vests in Government which reduces the suitability of equity structures. Where private sector equity is used in a blended financing option and the risks, obligations and performance measures are clearly articulated and managed, equity structures would not have to be excluded.

Blended financing: Most schemes comprise social and economic users. In most cases, the social component would be partly or fully funded from grants while the economic component would require one or more of the financing solutions discussed in the previous paragraph. The best "blend" of funds needs to be determined using financial and economic modelling. This could comprise of a combination of grants, short-term and long-term loans, private equity and gearing from commercial banks. Certain risks could be mitigated through insurance or specialist funds (e.g. Climate Finance Fund, Green Funds or Carbon-credits).

Pooled funding: Some funds require a minimum investment amount to be feasible. Projects of similar type and similar risk profile could then be "pooled" / combined to achieve the necessary economy-of-scale required by the funder. Pooling could also create the economy of scale for the launch of specialist bonds and be a mechanism to securitize risks. While the individual projects are not bankable due to limited size, the pool of projects can be. Pooled funding (in its most basic sense) is used by municipalities where non-ringfenced funding is sourced and revenue from a number of services is used to repay a loan. In exceptional cases, pooled funding could be applied to a group of projects with different risk profiles to enable cross-subsidisation between the projects. In these cases, the stronger revenue stream must be adequate to also repay the weaker project's commitments.

Funding for re-financing purposes: Financing is seldom rigid and could be changed over the life-time of the investment when the risk profile changes. This could typically apply to projects post completion of the construction phase where the risk profile has changed (greenfield to brownfield projects) or where projects became more bankable due to enhanced revenue management. The cost of interest on large projects funded over the long-term, often outweighs construction cost and interest should be managed in line with the risk profile of the project to ensure a cheaper funding cost to the users. Breakage cost conditions and voluntary

prepayment arrangements in the loans should therefore also be considered to allow an entity to become more creditworthy and able to re-finance.

12.5 PRIORITIES FOR THE FUTURE

To attract investors, Government needs to provide investors with transparent long-term investment paths and manage a pipeline of projects to achieve the development goals set by Cabinet (e.g. the MTSF for 2019) and international agreements such as the sustainable development goals (SDG) by 2030. The proposed pipeline of projects must be affordable and bankable considering grant funding for the social component. The following sub-section describes a high-level action list to manage finances and investment for the sector.

The goal of the intervention action plan is to achieve:

"Financial Sustainability".

The following **framework** is proposed for the "turn-around" intervention and prioritisation of actions.

Table 12-2: Proposed Framework

Immediate actions Political commitment, cost savings and revenue enhancement	Medium-term actions Regain investor confidence, improve credit rating & increase funding	Longer-term actions
• *Political leadership to promote investor confidence in sector institutions* • *Sector institutions to prioritize cost savings and revenue enhancement* • *Prioritization of grants and serviceable loans for critical renewal and new developments*	• *Affordable cost-reflective tariffs and revenue optimization to improve credit rating & borrowing capacity* • *Establish adequate capacity and skills for effective operation and maintenance* • *Increase borrowing in-line with improvement in economy and creditworthiness*	• *Good financial management (budgeting, cashflow management & accountability)* • *Introduction of affordable and enabling economic use charges* • *Polluter-pays principle and rehabilitation of water quality impacts (incl. acid mine drainage)* • *Good infrastructure asset management to optimize asset life and return on investment*

The following **enablers** are needed to achieve the "turn-around" in financial health:

- Political leadership to manage the strategy across the entire water sector
- Dedicated "turn-around" management with firm performance targets and rewards
- Dedicated institutional support, training and mentoring to redress weaknesses
- Dedicated funding from Government and the sector to enable the turn-around actions
- Differentiated approaches for economic and socio-economic scheme developments *and*
- Effective monitoring, evaluation, reporting and adjustment to keep the turn-around on track

The goal is "financial sustainability" and can only be achieved if the 'turn-around" in financial health is realised. It requires commitment and diligent implementation by key sector stakeholders under the leadership of the Ministers of Finance, the Minister of Water and Sanitation and the Minister of Cooperative Governance and Traditional Affairs.

Volume 1 of the NW&SMP identifies the following list of actions necessary to initiate the financial turnaround.

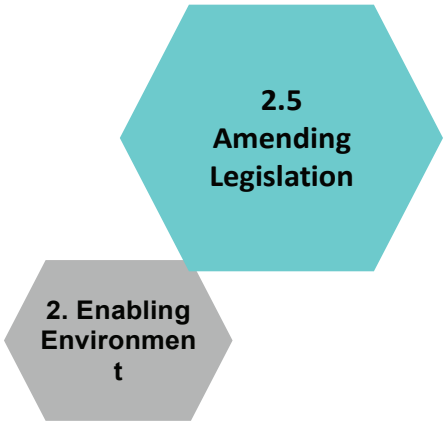
Table 12-3: Priority Actions

Action	Responsibility	Completion date
Set cap on water use with reducing targets over time (Volume 3, Action 1.1.2)	DWS, CMAs, WSAs, CoGTA	**2030**
Develop and implement a long-term plan for the turn-around of water supply and sanitation services in the country based on a sector-wide approach, that recognises DWS as regulator of W&S provision that includes the development of centralised programmes to obtain economies of scale and to ensure impact (e.g. driving municipal non-revenue-water improvements, and assessing the cost-effectiveness and appropriate systems for desalination) (1.3.1)	DWS, CoGTA, NT, SALGA	**Annually**
Implement the Waste Discharge Charge System (WDCS) in priority catchments (SA5, SA41, SA42, SA43 & SA44) (1.5.8)	NT, DWS, CMAs	**2030**
Ensure fiscal support for IWQM (SA38 & SA39) (1.5.11)	DWS, WSAs	**2021**
Establish a business case for streamlined institutional arrangements in the water and sanitation sector (2.1.1)	DWS	**2020**
Develop and implement institutional arrangements that recognise the diversity of circumstances across South Africa, the legacy of Apartheid and allow for regional cross subsidisation (2.4.1)	NT, DWS	**2021**

Action	Responsibility	Completion date
Implement accurate billing and effective revenue management systems in all entities in the water value chain with a strict "*No payment = no water*" approach to agriculture/industrial/commercial users and restricted supply to domestic users (2.4.2)	WSAs, WBs, DWS, AGSA	**2024**
All conditional grants to be dependent on meeting of current payments to the next entity in the value chain, improvements to Blue Drop, Green Drop and No Drop Scores to meeting targets and audit outcome. Allow conditional grants to be used for operational costs (2.4.3)	NT, AGSA, DWS	**2023**
Develop regulations in terms of Section 139 (8) of the Constitution, which allows for a national entity to take over the water service functions, including revenue and billing, in a municipality if service deliver criteria are not met (2.4.4)	DWS, CoGTA	**2022**
Ensure that sufficient revenue is received through tariffs and grants to operate, maintain and improve the water supply and sanitation system. The tariff structure must allow for cross subsidisation for the indigent and building of a reserve for periods of drought (2.4.5)	WSAs, WBs, DWS, NT, AGSA	**2024**
In all entities put in place mechanisms to deal with accumulated debts (2.4.6)	WSAs, WBs, DWS, NT, AGSA	**2020**
Roll out of ring-fenced institutional models to increase private sector investment (2.4.7)	DWS, NT, CoGTA	**2021**
National Treasury – linkage to Medium Term Sector Expenditure Framework (MTSEF) (2.4.8)	NT, DWS	**Ongoing**

The current financial crisis presents risks, but also opportunities to reinforce commitments to the water sector, and to invest in water infrastructure as part of fiscal stimulus packages.

13 AMENDING THE LEGISLATION



13.1 PRESENT STATE

The water sector is guided by the following national policies as approved by Cabinet:

- White Paper on Water Supply and Sanitation (1994)
- White Paper on a National Water Resources Paper for South Africa (1997)
- White Paper on Basic Household Sanitation (2001)
- Strategic Framework for Water Services (2003)
- National Water Policy Review (2013) *and*
- National Sanitation Policy (2016).

These policy documents are given legislative force through the Water Services Act, Act 108 of 1997 (WSAct) and the National Water Act, 36 of 1998 (NWA) although amendments are needed to incorporate the more recent policy developments. The NWA addresses the water resource component while the Water Services Act addresses the water services component. In addition, many small-scale water users obtain water through customary law and practices in communal areas.

While consideration has been given to incorporating both the Acts into a single piece of legislation over the past few years, the current approach of government is to limit the tabling of new legislation, and therefore work towards necessary amendment of the current Acts is anticipated.

A number of important strategies and operational policies have been compiled since the enactment of the national policy and water acts in order to flesh out and implement the legislation and policy. These include:

- The Second Edition of the *National Water Resources Strategy* (NWRS2, 2013)
- *Policy Position on Water Use in Bio-Fuel Production in South Africa* (2015)
- *Mine Water Management Policy* (2017)
- *Integrated Water Quality Management Policy* (2017)
- *Water and Sanitation Sector Policy on Climate Change* (2017)
- *Infrastructure Ownership and Management Draft Policy* (2017)
- *Wetland Policy* (2017)
- *Sustainable Hydropower Development Policy* (2017) *and*
- Mechanisms for Partnerships in the Water and Sanitation Sector – *Water Stewardship Policy* (2017).

Further policies have been initiated recently and are in various stages of completion:

- Water for Development: Sustainable Livelihoods
- International Water Obligations
- Water Scarcity and Security in the Water Sector
- Water for Mining and Industry
- Groundwater Management and Use
- Water Mix
- Uncertainties and Risks of Water Related Hazards, such as Floods: Droughts and Pollution
- National Water and Sanitation Resources and Services Strategy *and*
- The adoption of the Sustainable Development Goals (SDGs).

As discussed elsewhere, there is acknowledgement that the current legislative environment is overly complex, insufficiently streamlined and hampering effective service delivery, the attainment of transformation objectives and the leveraging of economic growth. The Department of Water and Sanitation will therefore lead a process that ensures that water sector legislation is amended and aligned, and ready for the future and ahead of the curve.

13.2 DRIVERS

DWS's policy mandate covers the full value chain of water resources, water services and sanitation services. While the legislation and policies are well aligned with the Constitution and older legislative frameworks, the policies are still relatively silent on the National Development Plan and the Sustainable Development Goals (SDGs). A further challenge lies in balancing the use of scarce water resources for economic development, urban use, and rural development, poverty eradication and ecological protection.

DWS is responsible for implementation of the legislation in relation to water resources, while its mandate in relation to water services is one of setting and monitoring adherence to national norms and standards, monitoring delivery of services, establishing and regulating water boards, and providing oversight and support to municipalities.

However, there are still grey areas in responsibility and accountability and the policy and legislative framework is not conducive to promoting appropriate and effective regulation of the whole water and sanitation business value chain.

The current legislative split between water resources and water services does not provide a single cohesive legislative framework which addresses the entire value chain in the water sector and there are gaps in relation to regional bulk infrastructure in particular, as well as the role of the department in regulating water services delivery.

Institutional arrangements are currently fragmented among a large number of water boards, catchment management agencies and municipalities and although consolidation is envisaged, it has not been effectively actioned through the revision of policy and legislation.

In addition, poor alignment of policies and strategies between various government departments and spheres of government have an impact on the ability of DWS to deliver on its mandate.

The lack of policy and legislative integration between DWS, DAFF, and the Department of Minerals (DMR) and inadequate maintenance and control of effluent from waste water treatment by municipalities has contributed to a deterioration in potable water quality and the quality of water in wetlands.

The failure of alignment between agricultural, land and water reform processes has seen land transferred to beneficiaries without water rights, and the collapse of once productive farms through land reform.

The policies are also not sufficiently clear on the risk and the remedies associated with climate change.

13.3 PRIORITIES FOR THE FUTURE

It is necessary to amend both the National Water Act and the Water Services Act to better respond to the needs of the entire value chain.

An updated and consolidated National Water and Sanitation Strategy is required that is aligned to updated legislation will be necessary, and is in keeping with the five-pillar approach of the Minister: Water and Sanitation, announced in May 2018:

- ✓ a national water resources and services water authority for South Africa;
- ✓ a national water resources and services regulator;
- ✓ a water resources and services value chain for water;
- ✓ a water resources and services master plan; and
- ✓ institutional rationalising and alignment.

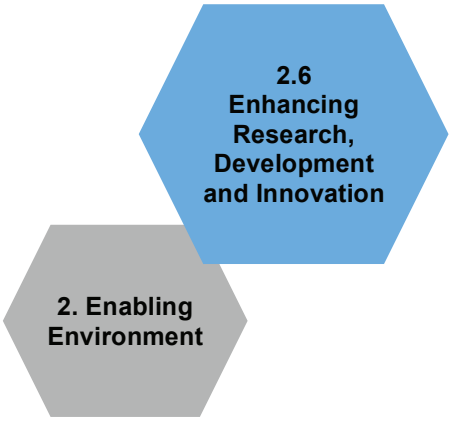
The following table as summarised in Volume 1 of the NW&SMP provides a list of priority actions to be implemented in this work stream:

Table 13-1: Priority Actions

Action	Responsibility	Completion Date
Gazette the National Water Amendment Bill, Water Services Amendment Bill and Water Research Amendment Bill (Volume 3, Action 2.5.1)	DWS, Portfolio Committee, Standing Committee	2021
Hold public consultation on National Water Amendment Bill, Water Services Amendment Bill and Water Research Amendment Bill (2.5.2)	DWS, Portfolio Committee, Standing Committee	2022
Revise and promulgate the National Water Amendment Bill, Water Services Amendment Bill, and the Water Research Amendment Act (2.5.3)	DWS, Portfolio Committee, Standing Committee	2023
Review the Municipal Financial Management Act (MFMA) and the Municipal Systems Act (specifically chapter 8) to ensure that they provide an enabling environment for the provision of reliable water and sanitation services (2.5.4)	NT, DWS, CoGTA, SALGA	2020
Develop new policies and strategies on matters not previously addressed, in consultation with all stakeholders, to facilitate the sustainability of various water sector programmes (2.5.5)	DWS	2025

14 ENHANCING RESEARCH, DEVELOPMENT AND INNOVATION

Research, Development and Innovation (RDI) is a cross cutting theme in the overall NW&SMP. This chapter thus feeds into all chapters of the plan and is fundamental to driving the paradigm shift envisioned by the Master Plan. This is because robust water RDI planning and implementation enables:



- faster and more effective deployment of context-appropriate technologies
- the provision of evidence that guides policy and implementation thereof
- opportunities for the export of know-how and technology into the African continent and beyond
- the development of content that guides education and awareness campaigns
- the development of new opportunities for business and industry
- insight on how best to balance protection and use of the environment
- facilitates a learning culture in water sector institutions about the challenges, risks, opportunities and solutions of the water sectors

This chapter of the National Water and Sanitation Master Plan presents a solid affirmation and commitment from the sector to support water-related research, development and innovation. The Chapter is a distillation of three key documents described below:

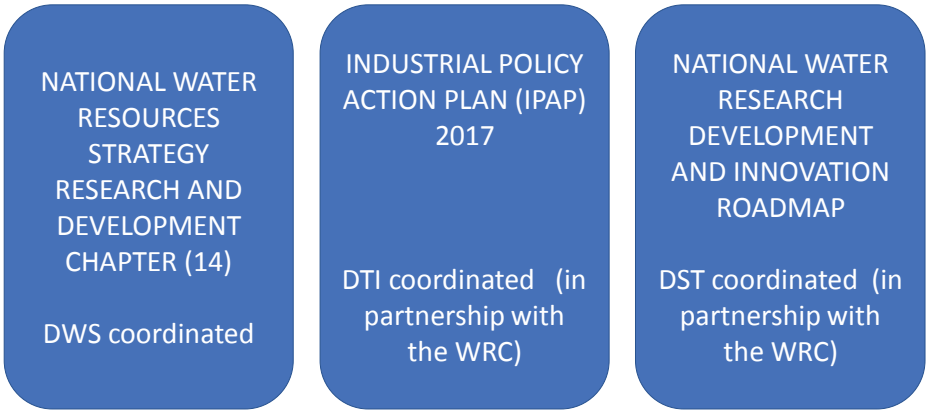


Figure 14-1: Distillation of three documents

Firstly, Chapter 14 of the Second Edition of the National Water Resources Strategy (NWRS2) focuses on research and innovation. This chapter highlights the need to develop and implement national plan for research and innovation, improve the utilization of outputs of research and clarify roles and mandates between various institutions involved in research and development[74].

Secondly, in response to Chapter 14 of the NWRS2, the Department of Science and Technology (DST), DWS and the Water Research Commission (WRC) collaborated to develop the National Water RDI Roadmap. This was finalised in 2015 and was adopted as the implementation plan for Chapter 14 of the NWRS2. The Water RDI Roadmap[75] is the National innovation plan for RDI in the water sector and thus is the basis for the content and recommendations of the Water RDI Master Plan. The Water RDI Roadmap was developed through an exhaustive, structured process of eliciting responses from the professional community, reviewing the inputs, and assessing their implications. The Roadmap mapping process included participation from key stakeholders in industry, government and organisations within the National System of Innovation. The plan provides strategic direction, a set of action plans and an implementation framework to guide, plan, coordinate and manage South Africa's RDI investment.

Thirdly, a water chapter has been included in the 2017/18-2019/20 Industrial Policy Action Plan[76] (IPAP) of the Department of Trade and Industry in South Africa. This builds on the focal areas of the National Water RDI Roadmap and has a particular focus on desalination and water manufacturing, the next generation of sanitation solutions, and waste water technologies.

14.1 PRESENT STATE

South Africa has a long history of research and innovation within the water and sanitation sector, with research institutions, universities and the private sector having made internationally recognised breakthroughs in various fields. The South African contribution to the global share of water-related papers in journals indexed by the Thomson Reuters Web of Science is more than 3 times the average for all disciplines in the country, and South Africa ranks 19th in the world in the domain of 'Water Resources'[77]. This provides a firm basis to build from in implementing the RDI aspects of the Water Master Plan.

There are various institutions engaged in different aspects of water research, development and innovation to start building from. The WRC is the leading funder of water research in South

[74] Department of Water and Sanitation. 2013. National Water Resources Strategy. Pretoria.
[75] Department of Science and Technology. 2015. National Water RDI Roadmap. WRC: Pretoria.
[76] Department of Trade and Industry. 2017. Industrial Policy Action Plan 2017/18 – 2019/20. Pretoria.
[77] Jacobs, IM., Pouris, A., Naidoo, D. 2014. A scientometric examination of the performance of water research in South Africa, Water SA, Vol 40(4).

Africa. It is funded from water user charges and leverages additional resources from various partnerships and programmes. Various government departments are involved with funding and supporting research and innovation activities in different ways. There is also a range of science councils, tertiary academic institutions, non-profit organisations and private sector role players that are involved in developing and supporting water research and innovation.

Whilst there is a rich institutional and skills environment to draw from; water research, development and innovation continues to face a range of challenges including: poor coordination and synergising of activities between institutions; a weak understanding of the role of all water sector organisations in driving innovation and shifting solutions to practise, challenges in scaling up of solutions to be ready for the market, and highly limited funding for innovation (particularly in its scale up/ deployment stages). This results in many solutions that emerge from the research and development space not being implemented in practise. For South Africa to be ready for the future we must be able to address the innovation chasm where emerging solutions fail to be tested at scale or be developed into viable business that are able to engage with different public and private sector role players.

14.1.1 Pillars of the RDI Master Plan

Like the National Water RDI Roadmap, this chapter rests on three pillars. Firstly, there is a focus on research activities, secondly a focus on skills and thirdly a focus on deployment of innovation.

The intention of the Research Pillar is to address ongoing research gaps, deepen insight and output in areas where South Africa has a unique global contribution to make, and continue to grow capability in areas key to South African water security.

The pillar on skills focuses on high-end skills with a particular emphasis on post graduate, post-doctoral and research skills (in line with international RDI trends). In addition to ensuring that there are suitably qualified people to drive the system of innovation for water, there is also a need to understand how universities are preparing their graduates for future jobs in the water sector. There is also a need to interrogate how to better orient graduates towards workplace readiness through applied learning in the research and innovation space. Here there are a suite of national skills programmes and learning sites that could potentially be used in a more synergised and coordinated manner. In addition, it is important for these skills to be understood within a wider landscape of artisanal, undergraduate, workplace-based learning/ reskilling needs and opportunities.

The third pillar focuses on deploying innovation into practice. This happens in a range of different ways. It involves packaging the outputs of research in a way that supports decision-making or policy-making. It involves the demonstration and validation of a range of technology, and decision support tools. A range of other knowledge brokering platforms are also valuable in the innovation deployment space.

14.1.2 Supporting implementation of the RDI aspects of the Master Plan

Currently there are three core partners driving the water research, development and innovation strategy nationally: the DWS, DST and the WRC. Linked to these core partners there are a

range of traditional research role players that are key including the National Research Foundation (NRF), Technology Innovation Agency (TIA), Research Councils, Units and Universities. There are also a range of other organisations that are pivotal in scaling up, testing and deploying new innovations to practise. These include utilities, municipalities, the private sector, non-profit organisations and others.

There is a Portfolio Management Unit for National Water RDI Coordination and Implementation housed at the WRC, funded by the DST. The function of the unit includes:

- Prioritisation and Project Management: Managing and reporting on a suite of priority interventions within available budgets, and tracking emerging priorities and opportunities;
- Partnerships and Investment: Developing and managing partnerships with water RDI role players that enable more synergised monitoring and reporting of RDI investments and activities in the water sector; new Water RDI funding contributions; and improved research, development and innovation capacity in the system;
- Visibility: Profiling the successes of the water RDI sector in achieving impact;
- Monitoring and Evaluation: Managing and reporting on the Monitoring, Evaluation and Learning (MEL) outcomes related to the Water RDI Roadmap;
- Governance and Positioning: Influencing strategies, policies, processes and plans to drive the vision of the RDI Roadmap and ensure effective governance of Roadmap implementation.

14.2 DRIVERS

Although there are many drivers to consider, two in particular are key to unlocking the RDI priorities of the Master Plan: 1) re-imagining of RDI investment and Partnerships; 2) effective RDI implementation mechanisms.

14.2.1 Re-imagining Water RDI Investment and Partnership

The overall investment ambition required to achieve all aspects of the RDI ambition laid out in the Water RDI Roadmap is R 8.4 billion over a 10-year period. Detailed breakdown of this costing is laid out in the Water RDI Roadmap Document[78]. In 2015 it is estimated that there was an average of R 415 million was spent on water research, development and innovation[79].This illustrates that there is a large deficit (approximately R 400 million a year) on an annual basis hindering the achievement of the RDI ambition and opportunity in South Africa.

[78] Department of Science and Technology. 2015. National Water RDI Roadmap. WRC: Pretoria.
[79] Pouris, A. 2018. Water RDI Roadmap 2015 Baseline. WRC. Pretoria.

Addressing this gap requires a re-imaging of how to drive investment into Water RDI in South Africa. It is essential to recognise that achieving the ambition of the Research, Development and Innovation component of the NW&SMP demands coordination and investment from multiple institutions. The traditional RDI funding institutions such as the National Research Foundation and Water Research Commission remain key players in driving the research and high-end skills opportunities and needs of the water sector. However, these institutions and their associated budgets cannot manage the full investment aspiration for RDI alone.

Achieving this investment aspiration demands a range of multi-partner collaborative initiatives to drive opportunities in a range of gaps. There is a particular need to look at the cost sharing associated with the later stages of the innovation pipeline (technology demonstrations, professional service centres, etc) as this is typically the higher cost and more complex funding space. Getting this right requires inputs from utilities, municipalities, the private sector, donor community and strong investment, leadership and support from the Department of Water and Sanitation in collaboration with partners.

In order to unlock the needed investment, partnerships are going to have to:

- Address how best to link the testing and de-risking of an emerging pipeline of technologies to bulk infrastructure planning and implementation processes;
- Explore how to open up the water sector to nurturing and engaging with new market entrants and SMEs;
- Explore how to handle public procurement in a way that incentivises the implementation of new innovations
- Look smartly at technology localisation processes and the development of an industry to drive areas opportunity.

14.2.2 Effective RDI Implementation Mechanisms

Alongside partnership and investment, the next drive is a suite of RDI implementation mechanisms that address research needs and gaps, grow capacity and capability and deploy research and new solutions to practise. It is particularly important to focus on conceptualising, positioning and resourcing the deployment mechanisms as this is where impact of research is most directly affected but is also the least resourced and most poorly coordinated part of the innovation continuum. Table 14-3 provides a summary of some of the RDI implementation mechanisms that can be drawn on in implementing the Water RDI aspects of the NW&SMP.

Table 14-1: Key RDI Implementation Mechanisms

Key Innovation Activity	Envisioned implementation instruments	Comments
Research	Research Calls/Programmes	Research calls to address gaps in knowledge or deepen areas of opportunity/SA Niche
	Research Chairs	The research chair instrument consolidates capacity in a specific area, in a specific institution and drives post graduate support and development. There are v*arious models to look to in terms of* funding models including the NRF and industry chairs.
	Centres of Excellence	Centres of Excellence consolidate expertise in a specific area through a hub and spoke institutional collaboration model. They are valuable in driving the development of team expertise in specific areas, providing security to research teams with high potential and driving post graduate development.
Skills	Honours, Masters, PhD and post-doctoral Support	Bursary calls and student support to postgraduate and post-doctoral candidates
	Skills landscape mapping and Consolidation of learning sites	Understand the types of training, and training facilities available nationally
Deployment of Innovation	Patenting	Internationally registered patents and collaboration with Technology Transfer Offices
	Technology Demonstration	Showcasing and testing technology or decision support tools at a scale in a real-live setting. This is important to showing how new solutions work and perform in real life setting
	Centres of Competence/Test bed networks	Play grounds or testing sites for suites of technologies being explored and developed
	Communities of practise	Structured platforms for the epistemic community to collaborate, share and network.
	Professional Service Centres	Knowledge Brokering units and workplace-based training facilities

14.3 PRIORITIES FOR THE FUTURE

The Water RDI Roadmap highlights 6 priority thematic clusters that research, skills development and innovation deployment activities should be focused on. These clusters, summarised in Table 14-2, are aligned to the various focal areas and technical chapters of the NW&SMP.

Table 14-2 summarises the high-level objective, outcome and description of each cluster. It also highlights some of the important first steps/priorities in addressing the RDI need of each cluster.

Note that these priorities should be treated in a reflexive way. New priorities may need to be added, and additional projects may to the fore as a wide array of institutions work on different aspects of these clusters.

Table 14-2: Investment Themes for the NW&SMP

Cluster	Objective	RDI Outcome	High level description	Emergent Priorities/ collaborative interventions
Cluster 1: Unlock Alternative Sources of Water	Increase ability to make use of more sources of water, including alternatives.	Technology assessment and development for utilisation of diverse water sources at different locations, with source localisation and exploitation driven by fitness for use	The focus is on unlocking large volumes of water that can assist in achieving the targets of NWRS II) Sources can be derived from all aspects of the water cycle (river, ground, atmosphere, rain, sea and green water) Grey & brackish water (including storm and industrial water reuse) are a key part of this mix	▪ Initiate a consolidation research programme for alternative sources ▪ Implement a suite of alternate source solutions and technologies to demonstrate a mix in a specific location (drawn from feasibility research)
Cluster 2: Govern, plan and manage supply and demand	Improve governance, planning and management of supply and delivery, and management of demand and use.	Focus on improved quality and resilience of planning for the future – ability to respond to changes, including climate change. There is equitable and transparent access to water supplies that are managed at catchment level by DWS co-operatively with DoH, DAFF, DHS, and DEA. Transparency over rights, quotas, allocations, and transfers has been achieved and co-operative governance with respect to planning and management has been improved.	For supply there is a focus on: ▪ Governance of water sources ▪ Water resources management institutions ▪ Climate change adaptation and disaster response ▪ Accountability For demand there is a focus on: ▪ Regulation and self-regulation ▪ Insertion of new solutions into communities ▪ Equity is a key issue	▪ Initiate a focused Research Programme: Water governance and society ▪ Run a transboundary data analytics research programme ▪ Create Communities of Practice: Transboundary Water Data and general Governance issues
Cluster 3: Built and Ecological Infrastructure	Improve adequacy and performance of supply infrastructure.	Increased volume and adaptability of storage capacity for raw water and treated effluent is available. Focus on increased levels of protection and reliability of ecological infrastructure and having	▪ New ways of approaching water supply and distribution infrastructure ▪ Managing ecological infrastructure ▪ Combining built and ecological approaches	▪ Initiate a focused research programme on water smart cities/towns and climate resilient planning and nurture a Water Sensitive Design Community of Practise ▪ Run an Ecological

Cluster	Objective	RDI Outcome	High level description	Emergent Priorities/ collaborative interventions
		sufficient ecological reserve.	▪ Waste Water Treatment and drinking water treatment bulk technologies	Infrastructure Research Programme. ▪ Engage and support the GEF 6 (Water and Ecosystems) initiative managed by SANBI (embed ecosystems into water management planning and financing) ▪ Support an alternative sanitation portfolio of technologies and localisation ▪ Initiate a Tech solutions portfolio: Infrastructure
Cluster 4: Run the Water Sector as a sustainable business	Improve operational performance and run Water as a sustainable "business".	The financial sustainability of the water services system is secured. Pricing is equitable, and the attribution of water use is accurate. Non-revenue water is below 15% and revenues are collected punctually. Operational efficiency has been gained and >90% of water and wastewater treatment works have Blue Drop / Green Drop status.	▪ Economic impacts of poor water quality and drought ▪ Creating the investment case for investing in water innovation ▪ Pricing and Billing ▪ Public-private partnerships ▪ Procurement, Service delivery and Asset management	▪ Initiate a Research Chair/Research Programme in Water Sector Economics ▪ Initiate a Municipal Water services support and advisory function (RDI output focused)
Cluster 5: Efficiency	Reduce unintended losses and increase efficiency of productive use.	Non-productive uses of water have been eliminated or minimised. Evidenced by reduction in: water transport losses, leakages, volume of water use, output to unrecoverable sources, volume and toxicity of pollution, and discharge of poor quality water.	▪ Respond to non-revenue water challenges ▪ Industrial/large scale focus ▪ Consumer/household focus ▪ Industry, Agriculture, Business best practise	▪ Initiate a technology solutions portfolio: Efficiency (Household, industrial, public & agri efficiency), ▪ Support Mine Water Demonstration validation and process learning

Cluster	Objective	RDI Outcome	High level description	Emergent Priorities/ collaborative interventions
Cluster 6: Monitoring and Metering	Improve performance of Pricing, Monitoring, Billing, Metering and Collection.	Improved accuracy has been attained in water use monitoring, and metering management	▪ Intelligence gathering ▪ Big data and smart systems ▪ Responsiveness ▪ Evidence informed investment in infrastructure and solutions ▪ Citizen science	▪ Support the catalysing of a Hydrological Monitoring Centre for South Africa ▪ Initiative a Technology Solutions Portfolio: (water quality testing, monitoring tech, ICT innovations)

Action	Responsibility	Completion date
Implement accurate billing and effective revenue management systems in all entities in the water value chain with a strict "*No payment = no water*" approach to agriculture/industrial/commercial users and restricted supply to domestic users (2.4.2)	WSAs, WBs, DWS, AGSA	**2024**
All conditional grants to be dependent on meeting of current payments to the next entity in the value chain, improvements to Blue Drop, Green Drop and No Drop Scores to meeting targets and audit outcome. Allow conditional grants to be used for operational costs (2.4.3)	NT, AGSA, DWS	**2023**
Develop regulations in terms of Section 139 (8) of the Constitution, which allows for a national entity to take over the water service functions, including revenue and billing, in a municipality if service deliver criteria are not met (2.4.4)	DWS, CoGTA	**2022**
Ensure that sufficient revenue is received through tariffs and grants to operate, maintain and improve the water supply and sanitation system. The tariff structure must allow for cross subsidisation for the indigent and building of a reserve for periods of drought (2.4.5)	WSAs, WBs, DWS, NT, AGSA	**2024**
In all entities put in place mechanisms to deal with accumulated debts (2.4.6)	WSAs, WBs, DWS, NT, AGSA	**2020**
Roll out of ring-fenced institutional models to increase private sector investment (2.4.7)	DWS, NT, CoGTA	**2021**
National Treasury – linkage to Medium Term Sector Expenditure Framework (MTSEF) (2.4.8)	NT, DWS	**Ongoing**

The current financial crisis presents risks, but also opportunities to reinforce commitments to the water sector, and to invest in water infrastructure as part of fiscal stimulus packages.

Action	Responsibility	Completion date
Implement accurate billing and effective revenue management systems in all entities in the water value chain with a strict "*No payment = no water*" approach to agriculture/industrial/commercial users and restricted supply to domestic users (2.4.2)	WSAs, WBs, DWS, AGSA	**2024**
All conditional grants to be dependent on meeting of current payments to the next entity in the value chain, improvements to Blue Drop, Green Drop and No Drop Scores to meeting targets and audit outcome. Allow conditional grants to be used for operational costs (2.4.3)	NT, AGSA, DWS	**2023**
Develop regulations in terms of Section 139 (8) of the Constitution, which allows for a national entity to take over the water service functions, including revenue and billing, in a municipality if service deliver criteria are not met (2.4.4)	DWS, CoGTA	**2022**
Ensure that sufficient revenue is received through tariffs and grants to operate, maintain and improve the water supply and sanitation system. The tariff structure must allow for cross subsidisation for the indigent and building of a reserve for periods of drought (2.4.5)	WSAs, WBs, DWS, NT, AGSA	**2024**
In all entities put in place mechanisms to deal with accumulated debts (2.4.6)	WSAs, WBs, DWS, NT, AGSA	**2020**
Roll out of ring-fenced institutional models to increase private sector investment (2.4.7)	DWS, NT, CoGTA	**2021**
National Treasury – linkage to Medium Term Sector Expenditure Framework (MTSEF) (2.4.8)	NT, DWS	**Ongoing**

The current financial crisis presents risks, but also opportunities to reinforce commitments to the water sector, and to invest in water infrastructure as part of fiscal stimulus packages.

Table 14-3 highlights the key systemic actions that need to be taken to start orienting the Water RDI system towards effectively addressing research gaps/knowledge needs, growing the innovation skills base and shifting RDI derived solutions and know-how into practise.

Table 14-3: Action

Action	Responsibility	Completion Date
Implement and regularly review/revise Research, Development and Innovation Policies, Plans and Roadmaps across the sector (Volume 3, Action 2.6.1)	DWS, DST, WRC, CSIR	2021
Unlock investment, procurement and other localisation barriers to reposition the sector to implement new/niche solutions and approaches and roadmap the NMIU (2.6.2)	DWS, NT, CoGTA, DST, NMIU	Ongoing
Coordinate, and where needed establish new platforms, to enable a synergised set of institutions that enable the shifting of innovations into the market (including business development and SME support) (2.6.3)	DWS, the dti, Dept Small Business, EDD	2019
Strengthen partnerships with key water sector institutions to accelerate research and solutions into practice (2.6.4)	DWS, WRC, CSIR, DST, CoGTA, SALGA, the dti, DAFF	2020
Structure test bed partners with key water sector institutions in order to accelerate innovations to the market/public sector (2.6.5)	WRC, CSIR, DWS, DST, SALGA, Municipalities	Ongoing
Fund research into new models to better understand implementation approaches for water allocation reform, and equity issues (2.6.6)	DWS, WRC, CSIR, DST	Ongoing
Develop technologies, guidelines and implementation support tools that enable SA to use alternative and appropriate sources as part of water supply (2.6.7)	DWS, WRC, CSIR, DST, SALGA, CoGTA, WSAs	2023
Apply the concepts of water sensitive urban design to a robust city-wide case study to demonstrate and learn how a city can transition to a sustainable city (2.6.8)	DWS, SALGA, Metros, District Municipalities	2027

Action	Responsibility	Completion Date
Tools for agriculture early warning systems need to be developed and tested at scale (2.6.9)	WRC, CSIR, DWS, DAFF, ARC	Ongoing
Scan and sort the innovation sector for solutions that are ready for application and invest in their implementation (2.6.10)	WRC, CSIR, DST, DWS	2021
Alternative Sanitation: Develop and demonstrate and validate appropriate alternative, water-less and off grid sanitation solutions (Current – 2025) (2.6.11)	DWS, WRC, CSIR, DST, BMGF, the dti, Municipalities	Ongoing
Domestic and industrial Waste Water: Develop and Demonstrate appropriate waste water technologies for cost effectiveness, energy efficiency and beneficiation (2.6.12)	DWS, TCTA, WRC, CSIR, the dti, DST, TIA, MINTEK	Ongoing
Scan and sort the innovation sector for solutions that are ready for application and invest in their implementation (2.6.13)	WRC, CSIR, DST, DWS	2021
Drinking Water Treatment: Develop and Demonstrate solutions that allow for the use of alternative sources of water for safe human consumption and water security (2.6.14)	DWS, WRC, CSIR, Municipalities	Ongoing
Continue to invest in understanding emerging contaminants (detection and treatment) in order to improve our transition to reuse, reclamation and recycling of water (2.6.15)	DWS, WRC, CSIR, Municipalities	Ongoing
Improving raw water quality: **Invest in Communities of practise that bring together built and ecological infrastructure experts and solutions (2.6.16)**	DWS, DEA, SANBI, WRC, CSIR, DST	Ongoing
Link the Global Environment Fund 6 project on Water Pricing and Ecosystems to Water Master Plan implementation and position DWS to be closely involved in this process (2.6.17)	DWS, DEA, SANBI, WRC, CSIR	2024

Action	Responsibility	Completion Date
Continue to do research on land use impact on water linked ecosystems (2.6.18)	WRC, CSIR, DEA, DWS, DAFF, ARC	Ongoing
Ongoing research, modelling and planning around climate change and its impacts on water security and water infrastructure needs to be conducted (2.6.19)	DWS, DEA, DST WRC, CSIR	Ongoing
Initiate a hydrological monitoring centre for South Africa in order to re-establish a robust data, monitoring and information capability for more effective water resources planning and climate change forecasting in future (2.6.20)	DWS, DEA, ARC, DAFF, WRC, CSIR, DST, SAWS, CSIR, StatsSA	2021
Test a suit of ICT and citizen science tools for data sourcing (2.6.21)	WRC, CSIR, DWS, DST, CoGTA, SALGA, the dti, DAFF	Ongoing
Partner with institutions to fund training of water sector practitioners in the curation, management and use of data as well as the associated technologies (2.6.22)	DWS, EWSETA	Ongoing
Review all relevant guidelines and R&D products to understand where training modules need to be developed around new knowledge (2.6.23)	DWS, WRC, CSIR, SETAs, WISA, DHET	

SECTION 3: SUPPORTING IMPLEMENTATION

15 PERFORMANCE MANAGEMENT, MONITORING AND EVALUATION

15.1 INTRODUCTION

Performance information is used to assess how well an institution is delivering on its mandate. It is a crucial management tool to coordinate planning, budgeting, monitoring and evaluation. It facilitates accountability and enables legislators as well as interested and affected parties to monitor progress whilst also identifying areas of improvement. The availability of performance information enhances institutional decision-making and supports results-based management approaches (for example, performance contracting and risk management).

South Africa has had various reforms in the management of performance information. In 2004, government programmes and policies were set out in a Medium Term Strategic Framework (MTSF). Subsequently, in an effort to achieve more with the limited available resources, in 2009 the government outcomes approach was introduced. In 2011, the National Development Plan (NDP) provided long-term targets for government.

Sound indicators that will be the basis for clear and comprehensive monitoring are essential to effectively monitor and evaluate any plan. As the NW&SMP guides delivery in the water and sanitation sector, it is paramount to understand the relationships between the various government planning tools and the planning, budgeting, monitoring and evaluation cycle. The understanding of these processes will provide the basis for aligning the ongoing monitoring and evaluation of progress in implementing the NW&SMP with that of other related government plans.

It is critical to monitor progress at regular intervals and provide the necessary performance information that enable adjustments to approach and, where needed, in intent. Therefore, whilst it is important to understand the broader monitoring and evaluation environment, it is equally important to enable the modalities for a more “live” approach.

15.2 PRESENT STATE OF PLANNING

Government performance planning focuses on a longer period (i.e. five to twenty years) while budgeting has a short-term perspective (i.e. one to three years). This creates an “inherent tension” between planning and budgeting resulting in difficult integration of the two. Given South Africa’s position as a developmental state with limited resources, long term plans need to inform the allocation of resources so that “historical inequities can be progressively addressed”. Therefore, operational or implementation plans that are informed by the long term strategic plans will be developed within the context of limited resources. In view of this, the NW&SMP is anticipated to be a strategic plan that will inform the water and sanitation sectors’ operational plans.

In an effort to align planning and budgeting, departments will develop budget programme structures that link their objectives with their detailed operational budgets. The underlying principle for this is to "ensure a stable framework linking successive plans and strategic priorities to budget allocations and performance indicators that track delivery over medium to long term".

There is a significant focus on strengthening the integration of performance planning and budgeting with sophisticated methods proposed in ensuring outcomes-based costing. Each department will define "performance enhancing processes, costs those processes and establish the unit cost of delivery". This information will "inform budget calculations and the choice of performance targets".

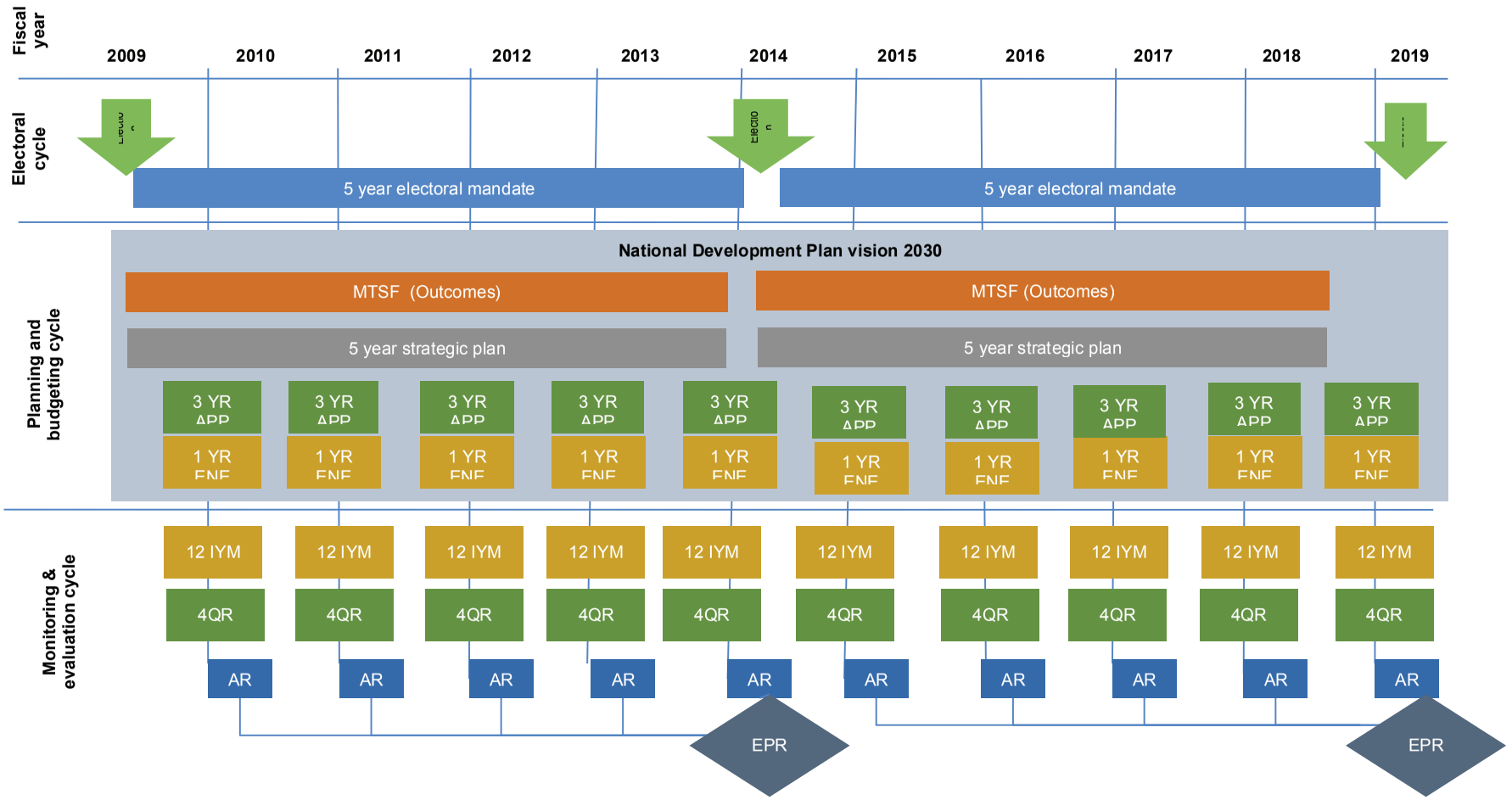


Figure 15.1: Long-term Relationship and Timing of Government Accountability Documents
(Source: Adapted from Framework for Strategic Plans and Annual Performance Plans)

15.2.1 Present Planning Requirements

The figure on the previous page illustrates the relationships between the government planning tools and the timing of associated monitoring and evaluation requirements. It can be summarised as follows:

15.2.1.1 The National Development Plan

This is government's long-term plan that determines what the country should look like by 2030. It highlights two strategic goals of eliminating poverty and sharply reducing inequality with associated objectives to ensure their achievement. As it identifies the various priority areas over the long-term period, it is the underlying document for all government plans.

15.2.1.2 The Medium Term Strategic Framework

This is a government five-year strategic plan (i.e. within a given electoral term) that reflects commitments made in the governing party's election manifesto and commitments to implement the NDP. It is a building block towards achieving the country's long-term plan and contains priority actions from various government plans within a given electoral term. It is thus a link between priorities in the governing party's election manifesto and the individual plans of government departments. As the performance agreements signed between the President and each Minister are based on relevant actions in the MTSF, it is crucial for each department to ensure that their respective strategic and annual performance plans are aligned with the MTSF targets. The MTSF is the result of an intensive iterative planning process involving all three spheres of government. For the MTSF to be systematically implemented, its actions must be incorporated into other government plans. Efficient and effective monitoring of the implementation of the NDP requires that there is a high level of alignment of the measurable indicators and targets across all these plans.

15.2.1.3 The Strategic Plan

This is a departmental level five-year plan that identifies policy priorities, programmes and projects within the scope of the available resources that are consistent with the MTEF. It should focus on the department's strategic outcome oriented goals and objectives for each service delivery areas that are aligned to its budget programmes and sub-programmes. It lays the basis for the development of an annual performance plan and must be reviewed every five years, ideally from the first planning cycle following an election (i.e. towards the end of the period it covers). Its revision may occur during the five-year period it covers but changes should be limited to revisions relating to significant policy shifts or service delivery changes. If reviewed during this period, it should also be re-tabled with the updated Annual Performance Plan. It should consider the NDP, the MTSF, Provincial Growth and Development Strategies, municipal Integrated Development Plans, relevant executive authority performance agreements signed with the President and relevant intergovernmental service delivery agreements and international commitments.

15.2.1.4 The Annual Performance Plan:

This is a three-year departmental plan that sets out among other things the performance indicators and targets per budget programme and sub-programme within the scope of available resources. It must align with the strategic plan, NDP, the MTSF, PGDS, municipal IDPs, relevant executive authority performance agreements signed with the President and relevant intergovernmental service delivery agreements and international commitments. It lays the basis for the development of the department's medium-term expenditure framework, programme business plans and officials' performance agreements. It is reviewed annually to factor in changes in the indicative budget allocations as well as recommendations from various interested and affected parties. It must include quarterly performance targets and budget for the following financial year per budget programmes and sub-programmes. Although in-year changes are not encouraged, in instances where they occur the approval of the Executive Authority needs to be obtained before Parliament passes the midterm Appropriation Bill. In addition, these changes should be indicated in the annual report.

15.2.1.5 The Estimates of National Expenditure:

This sets out what funds have been allocated to each department to deliver services as per the APP. It provides comprehensive information on how budget resources are generated and how they will be spent by respective departments. It covers financial resources for the current financial year and indicative figures for the two following years (Medium Term Expenditure Framework). It is developed within the framework of a department's strategic plan and must be informed by and inform the annual performance plan.

15.3 PRESENT STATE OF MONITORING AND EVALUATION

15.3.1 Current Monitoring Requirements

Monitoring and evaluation are essential components of effective management. The various reforms in the management of performance information stipulated above resulted in a change of emphasis in the monitoring, reporting and evaluation requirements within the public sector. The introduction of the government wide monitoring and evaluation framework (GWME) brought the integration of monitoring requirements with other government spheres.

The current accountability documents that fall within government's monitoring the reporting framework are as follows:

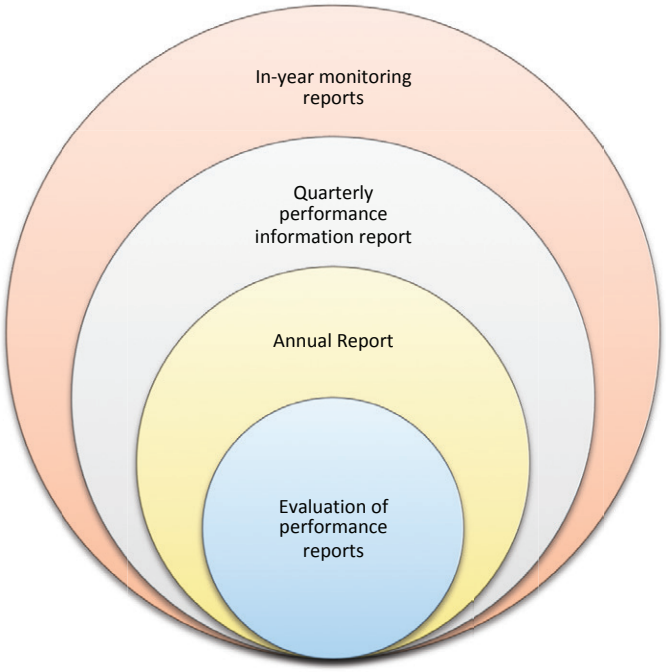


Figure 15.2: Accountability Documents within the Reporting Framework

15.3.1.1 In-year monitoring reports

These are monthly financial reports that all government departments should provide by the prescribed timeframes. These include 30 day payment certificates, bank reconciliations, in-year monitoring and cash flow projections, suspense accounts reconciliation and age analysis, deviation from normal procurement process, awarded contracts, commitments, irregular, fruitless and wasteful expenditure, movable assets verified, value in Rands for finance leased assets.

15.3.1.2 Quarterly performance information reports

These are required quarterly reports that provide progress updates on the implementation of the APP's predetermined targets. These progress reports provide the Accounting Officer with an opportunity to indicate measures that will be taken to ensure that the APP's implementation is on track. There are also other intergovernmental reports monitoring the implementation of the MTSF (e.g. outcomes and mid-year reports) that are developed from quarterly reports of respective departments and submitted to coordinating departments within the required timeframes. The coordinating department will collate and analyse all contributions and submit to Cabinet for approval.

15.3.1.3 Annual report

This provides information on the organisation's performance in the preceding financial year for the purposes of oversight. It looks at the department's performance relative to the targets

set in the APP and provides audited annual financial statements revealing how the budget was implemented and the state of the institution's financial management systems.

15.3.1.4 Evaluation of performance reports:

An institution should produce an end-term review towards the end of the period covered by its Strategic Plan. The review should broadly follow the format of the plan. The institution should report on the extent to which it has succeeded in achieving each of the strategic outcome oriented goals and objectives set at the beginning of the five-year period, as well as on any other evaluations conducted during the period.

15.3.2 Current Evaluation Requirements

An evaluation is the systematic collection and objective analysis of evidence on public policies, programmes, projects, functions and organisations to assess issues such as relevance, performance (effectiveness and efficiency), value for money, impact and sustainability and recommend ways forward.

The National Evaluation Policy Framework indicates that evaluation should be undertaken for four primary purposes of improving performance; improving accountability; generating knowledge (i.e. what works and what does not work) and improving decision-making.

Each department is required to develop a multi-year evaluation plan summarising the evaluations that will be conducted over one to three years. In addition, the department is required to conduct at least one evaluation report with recommendations for specific policies or programmes.

The importance of the NW&SMP in guiding sector-wide processes in support of the NDP, indicates that regular evaluation to improve performance will be essential. Alignment of these evaluations with other evaluation processes across the broader sector will be critical. The timing of these must align with the broader governmental frameworks.

15.3.3 Current Evaluation Processes

Corporate Planning and Organisational Performance is the central coordinator for evaluation in the organisation with the following processes followed:

Call for evaluations:

The CPOP unit circulates a call for evaluations to all programme managers to identify programmes that should be evaluated and if concept notes exist and budgets have been allocated.

Departmental evaluation plan:

The CPOP unit is the repository of evaluations that will be and have been undertaken in the department. In addition, the unit liaises with programme managers to suggest evaluations to be included in the annual and three-year national evaluation plan managed by the DPME.

15.4 DESIRED STATE OF MONITORING AND EVALUATION FOR THE NW&SMP

- The departmental strategic plan is replaced by the National Water and Sanitation Strategy with a minimum of a 5-year horizon;
- The NW&SMP sets out strategic actions that will be included in the department's APP and entities' corporate plans with a 3-year horizon that will be reviewed annually;
- NW&SMP timelines are aligned with governmental timelines to streamline them with budgeting timelines

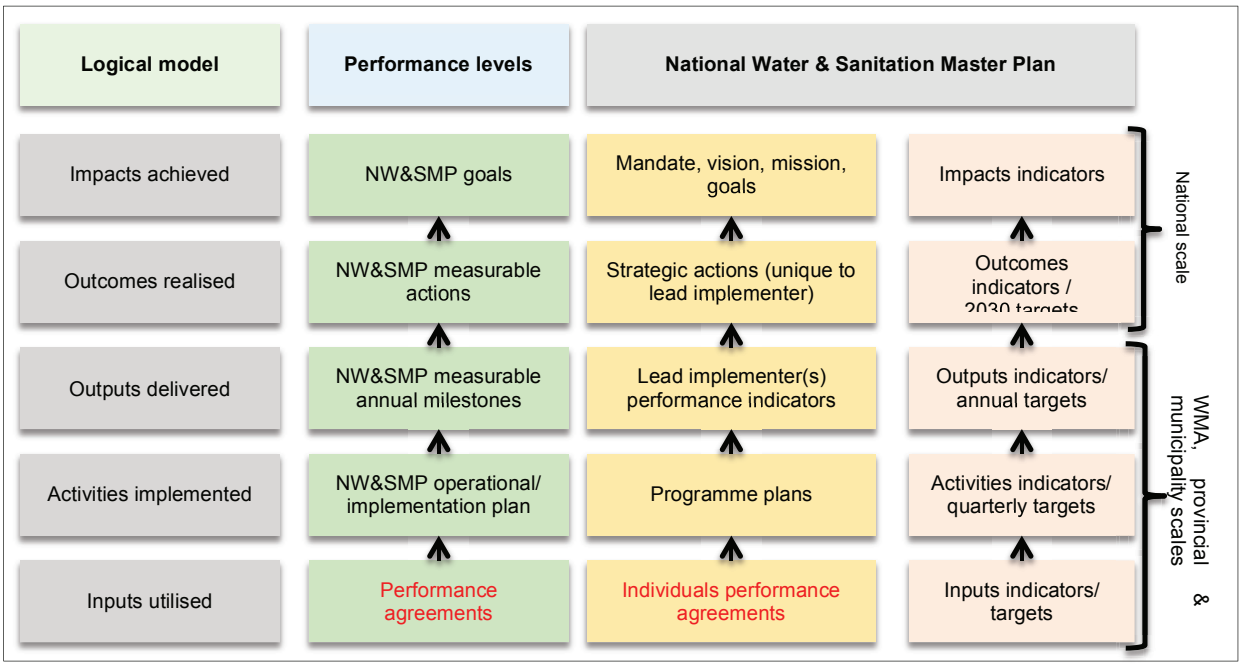


Figure 15.3: Theory of change for the National Water and Sanitation Master Pan

15.4.1 Proposed Monitoring and Evaluation Processes

DWS will develop, based on current systems, a monitoring and evaluation system to measure implementation of the NW&SMP. Successful monitoring and evaluation will require DWS to collate relevant information from other departments, WSAs and public entities, and to evaluate performance, measure trends, and adjust implementation targets and approaches based on these results. The annual reporting to FOSAD on implementation of the NW&SMP will be based on this monitoring, reporting and evaluation system.

It is critical that the monitoring and evaluation is used to adjust the implementation plan, and this must be done with the relevant government partners.

15.4.1.1.1 INFORMATION MANAGEMENT AND DATA PORTAL

This chapter focuses on information management and development of a data portal for the National Water & Sanitation Master Plan (NW&SMP).

Most decision-making is driven by the availability and content of information at hand. The Master Plan is based on existing policies, strategies, studies and spatial information that assist in setting the scene in terms of the current status, desired status and activities to achieve planned outcomes.

15.5 PRESENT STATE

The DWS has a well-established website and document management system that provide users access to information on the DWS's structure, programmes, activities and services. The website is updated daily and serves as the first point of contact with the DWS and the sector stakeholders including; consumers, water institutions and those interested in the water and sanitation sector.

The website also communicates new initiatives, inviting comments on draft policies such as the Mine Water Management Policy (currently being workshopped, October 2017) and provides linkages to water entities (water boards, the Water Research Commission and the Trans-Caledon Tunnel Authority).

The document management system consists of a library that provides access, via a search function, to legislated documents, study reports and strategic plans. Users can perform searches based on a geographic area or by entering keywords.

15.6 DRIVERS FOR NW&SMP WEB PORTAL

The purpose of the NW&SMP web portal is to disseminate information on the content and actions from the Master Plan and to report on progress in implementation. The portal is therefore a communication tool not only on the development process of the MP or the content and actions from the completed NW&SMP, but also the lifecycle of implementation, review and updates of the NW&SMP.

The portal will also provide access to information on stakeholder engagement activities planned and held to ensure active participation during the development process and thereafter.

15.7 CONTENT AND FUNCTIONALITY

The content of the NW&SMP web portal will reflect the key theme areas of the NW&SMP, but will also include elements related to the implementation of the plan, communication and documentation in support of the NW&SMP and its activities.

The portal will provide concise, informative content for each NW&SMP theme related to the drivers, vision and enabling activities to achieve the desired future state. Where appropriate, linkages to existing portals and programmes of the DWS will be included.

Supporting documentation would form part of the DWS document management portal or library, with specific reference to the MP.

A preliminary design of the MP portal is illustrated in the figure below. It has a similar design to the existing DWS web portals to ensure easy navigation and familiarity in the user experience.

The web portal will include a GIS component, illustrating aspects related to projects and activities. The hosting of the GIS component is still to be determined: either as part of the NW&SMP portal or as part of the existing Spatial and Land Information Management (SLIMS) portal or the National Integrated Water Information System (NIWIS).

Functionality of the portal will encourage users to be interactive when viewing the contents of the portal or engaging on the themes of the NW&SMP. Appropriate social media applications will therefore be incorporated.

15.8 ACTION PLAN

The existing DWS website provides the platform from which the NW&SMP web portal will function. It is therefore an extension of the existing website functionality and should enjoy a high level of visibility and ease of access. Technical maintenance of the portal forms part of the DWS website maintenance. Content maintenance of the portal will be assigned to the relevant DWS officials involved in the development and implementation of the NW&SMP.

South Africans share common interests and challenges in the pursuit of water security.

Achieving water security requires sound evidence to inform policy and dialogue, good governance, advances in research and technology, the mobilisation of finance and investment, management of climate risks, and cooperation in managing transboundary water resources.

Water security also requires balancing demand (reducing individual use) and supply (increasing supply for a growing population and economy), redistributing water equitably, managing water and sanitation services effectively, regulating water with a focus on high impact use, improving raw water quality and protecting and restoring ecosystems.

These themes orient the NW&SMP and provide a rallying point for government, civil society, the private sector, researchers and innovators, the international community and ordinary South Africans.

16 ENGAGING SECTOR PARTNERS

The Department of Water and Sanitation embarked on a consultative process of engagement towards the development of the NW&SMP with valuable input received from a wide range of stakeholders and organs of state. The Master Plan has been greatly improved and informed by these engagements and inputs and remains a "living" document to be reviewed annually, regularly updated and continuously improved in order to ensure that it does indeed, best serve the needs of the country as it strives to ensure a water secure, sustainable water sector.

Key stakeholder engagement was undertaken as follows:

Date	Stakeholders engaged/Engagement event
19 May 2017	Various/National Dialogue
	REGIONAL WORKSHOPS: Round 1
21 Jun 2017	Eastern Cape
26 Jun 2017	Mpumalanga
4 Jul 2017	Northern Cape
6 Jul 2017	Limpopo
13 Jul 2017	Free State
18 Jul 2017	Gauteng
21 Jul 2017	Western Cape: Brede-Gouritz WMA
25 Jul 2017	KwaZulu Natal
27 Jul 2017	Western Cape: Berg-Olifants WMA
31 Jul 2017	North West
Jan 2018	**REGIONAL WORKSHOPS: Round 2**
19 Jan 2018	Gauteng
22 Jan 2018	Limpopo
24 Jan 2018	KwaZulu Natal, Eastern Cape & Free State
25 Jan 2018	Gauteng & Northern Cape
26 Jan 2018	North West
26 Jan 2018	Western Cape

Date	Stakeholders engaged/Engagement event
29 Jan 2018	Mpumalanga
	OTHER ENGAGEMENTS
15 Sept 2017	National Treasury
12 Oct 2017	3rd Annual Water Stewardship Event: Municipal Water Infrastructure Financing
1 Nov 2017	Parliament Portfolio Committee on Water and Sanitation
15 Nov 2017	SANCOLD keynote and presentation
20 Nov 2017	Director Generals Meeting with CE's of Entities
21 Nov 2017	Minister Meeting with Chairpersons of Entities
23 Nov 2017	NSBA Breakfast Seminar: "Water in South Africa – Opportunity in Crisis"
27 Nov 2017	TCTA Board Strategy Session
30 Nov 2017	Water Infrastructure Summit
6 Dec 2017	Professional Bodies (1st session)
7 Dec 2017	National Departments (including National Treasury
14 Dec 2017	Eskom and Sasol
19 Dec 2017	WRC: Steering committee on Road Map for Water RDI
10 Jan 2018	SALGA (1st session)
1 Feb 2018	National Departments (including National Treasury) and related associations: 2nd session
2 Feb 2018	Civil Groups, Business Association, Academic Institutions and Professional Bodies: 2nd session
2 Feb 2018	Wetlands Seminar
2 Feb 2018	Outcome 10: Working Group Meeting
5 Feb 2018	National Treasury
13 Feb 2018	SAICE
15 Feb 2018	SALGA (2nd session)
	CSIR
22 Feb 2018	SALGA: Dialogue and Showcasing Water Innovation and Technology Options

Date	Stakeholders engaged/Engagement event
9 Mar 2018	Department of Trade and Industry IPAP
14 Mar 2018	FOSAD: Social Protection, Community and Human Development (SPCHD) Cluster
16 Mar 2018	WRC/ISS on Preventing a National Water Crisis
20 Mar 2018	National Committee on Climate Change: stakeholder dialogue
23 Mar 2018	DPME: discussion on mini-Phakisa
27 Mar 2018	Symposium on Water Scarcity Impact on Business: Mail & Guardian
12 Apr 2018	FOSAD: ESEID Cluster presentation
27 June 2018	Presentation to RSA Cabinet Committee

16.1 NARROWING FOCUS TO MAXIMISE BREAK THROUGH

The Constitution of South African contains several provisions that give direction to the water and sanitation sector.

Firstly, the values of the Constitution include those of human dignity, the achievement of equality and the advancement of human rights and freedoms.

Secondly, the Constitution states that everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that

(i) prevent pollution and ecological degradation

(ii) promote conservation *and*

(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

Thirdly, the Constitution states that everyone has the right to have access to sufficient food and water.

Fourthly, the Constitution states that the property clause may not impede the state from taking measures to achieve land, water and related reform, in order to redress the results of past discrimination.

These constitutional imperatives, combined with the national water and sanitation policy papers, the National Water Act and the Water Services Act, give the mandate to the water sector to:

- Provide universal and equitable access to reliable water supply and sanitation services
- Protect, manage and develop the nation's water resources in a manner that supports justifiable and ecologically sustainable economic and social development *and*
- Transform access to water to redress the racial imbalances created by apartheid.

As demonstrated in this volume of the National Water and Sanitation Master Plan, and as articulated in the Call to Action (Volume 1), there are significant challenges in achieving the Constitutional and policy mandate of the water sector. Understanding the critical need for maximum progress, the Master Plan has exercised great restraint and deliberately focussed on a basket of critical national interest challenges. The declining reliability of water services and sanitation services, as evidenced *inter alia* by the poor condition of numerous waste water treatment works (WWTWs) and water treatment works (WTWs) is putting the health of the nation at risk. Other operational realities include, some municipalities consistently failing to deliver adequate services, increasing water scarcity, and decreasing raw water quality.

Over 3 million people still do not have access to a basic water supply and 14.1 million people do not have access to a safe sanitation facility. At the same time, although access to water and sanitation services have improved significantly, the reliability of services that have been provided since the advent of democracy is declining, with only 64 % of households now having access to a reliable and safe water supply.

Climate change adds significant additional stress to an already stressed environment and is changing rainfall patterns in ways that we have yet to understand fully.

The NW&SMP (Volumes 1 – 3 read together) has identified a number of critical priority actions that must be implemented to address the current crisis in the water sector and to achieve the constitutional and legal mandate given to the sector. It prioritises the actions that will deliver the greatest impact with limited resources, with a focus on reducing water individual demand, increasing supply, ensuring universal, reliable and safe water supply and sanitation, protecting infrastructure through effective asset management, restoring ecological infrastructure and improving raw water quality, and ensuring equity in access to water for productive uses.

Of critical importance is the issue of financial sustainability. Currently the sector is not financially sustainable and increases in excess of inflationary targets will be required to address the historic undervaluation of water and sanitation services. High levels of debt at municipal level reverberate up the value chain, impacting on the financial sustainability of all institutions in the water sector, exacerbated by poor revenue collection by the Department of Water and Sanitation itself. There are five legs to the financial sustainability issue that must be addressed as a matter of urgent national priority:

- A strong message must be given that - apart from free basic water - all water users must pay for water and that water will become progressively more expensive

- The significant subsidy provided to the agricultural sector through water use charges must be removed
- Municipal tariffs must be revised to protect the rights of the poor to affordable water, ensure cost recovery (of true costs) and establish punitive tariffs for those wasting water
- The grant system must be restructured to incentivise the life cycle infrastructure asset management approach *and*
- The waste discharge charges system must be implemented immediately to provide funding for the reduction of pollution and the rehabilitation of polluted river systems.

Sound financial management will have to start at DWS where the latest reports by both the Office of the Auditor General (AG) and Parliament's Standing Committee on Public Accounts (SCOPA) painted a grim picture. Improved financial sustainability will enable the sector to turn around the currently poor levels of maintenance and refurbishment that are contributing to the decline in reliability of services and the high levels of wastage of water through leaks. Improvement in the condition of WWTWs will also contribute to improved water resource quality and the reduction of public health risks.

Addressing unacceptably high levels of water loss is a critical element of reducing individual water demand. Non-revenue water levels in municipalities are estimated at an average of 41%, which is unacceptably high. As a result, municipalities are losing some R 9.9 billion of potential revenue per year. The reduction of water losses and the introduction of water conservation and demand management measures in municipalities must be enforced to achieve the targets in the NDP. A national programme is proposed that will drive the reduction of non-revenue water levels to meet national and catchment targets. In addition, water conservation and demand management targets will be set for all municipalities and reflected in the KPIs of Municipal Managers and other senior staff.

At the municipal level, the current crisis will need the combined engagement of DWS, COGTA, National Treasury, SALGA, water boards and WSAs. The reintroduction of a sector-wide approach (SWAP) programme is proposed, led by DWS, to tackle the current challenges. In this programme, a differentiated (*triage*) approach will be adopted in which WSAs will be categorised according to the challenges that they are facing, and targeted responses will be developed and implemented for the various categories. A specialised municipal intervention unit for water and sanitation (MIUWS) will be established by DWS, staffed with a small team of highly competent experts, to run the diagnostic analysis necessary to categorise the WSAs, and to drive the national programme of interventions where required.

A national programme, driven by the MIUWS, is also proposed to support the adoption of alternative water sources such as desalination and water re-use. It is proposed that DWS lead a programme that will examine the costs and benefits of these technologies at a regional level to support WSAs in making decisions on the most appropriate water sources to use to increase supply. In addition, a national, targeted programme of refurbishing and turning around failing WWTWs to protect our natural resources and citizen health is non-

negotiable. DWS will also, with effect from 2019/20, re-introduce the highly-respected Blue, Green and No Drop programmes.

At present, the constitutional water supply and sanitation services responsibility lies with 144 municipalities that are WSAs. At least a third of these WSAs are regarded as dysfunctional and more than half have no, or very limited, technical staff. Twenty-seven priority district municipalities have been identified as being particularly dysfunctional and requiring specific intervention (though not all are WSAs). High levels of corruption have impacted on service delivery in a number of municipalities.

Where WSAs show consistent inability to deliver effective water and sanitation services, a national intervention lead by the MIUWS will determine the appropriate water services provider to be used as well as the appropriate service delivery model such as management contracts and concessions. This will require a revision of Chapter 8 of the Municipal Systems Act which DWS will engage COGTA and NT on. In addition, a legislative review will be done to ensure that internal procedures and decision-making systems in local government support effective water and sanitation provision.

A national curriculum will be put in place for municipal water managers, which will become a mandatory qualification for all such water managers.

On the water resources side, the strategic water sources of the country, the 8% of the land which produces 50% of the nation's water resources, are under threat from development including mining. In order to ensure the water security of the country, these areas will be declared as protected areas as soon as possible. DWS will engage DEA on this. Metering of water use in the agricultural sector and the removal of the subsidy on agricultural water charges will drive water conservation in this sector.

DWS, working in partnership with DEA, will get tough on enforcement. A high-profile campaign of enforcement of water use licence conditions for both abstraction and waste discharge, accompanied by a public communication programme will see the prosecution of high-impact non-compliant water users with significant publicity around the campaign and the results. This is aimed at reducing non-compliant water use and creating an awareness of the work being done by DWS in this regard. This will be an important signal that this is 'business unusual' and that those who are non-compliant can no longer risk continued illegal water use activities.

The water sector research, development and innovation programme, driven by the DST and the WRC will support the implementation of the NW&SMP.

Finally, the water sector has, over the past 20 years, failed to deliver on its mandate for water allocation reform, or the reallocation of water to black water users. This, along with land reform, remains a major challenge facing the country, and one that must be addressed. It is proposed that a joint land, water and agrarian reform programme, to be led by the Department of Rural Development and Land Reform be established to ensure that the reallocation of both land and water are aligned and take place within a framework of agrarian reform and effective rural development.

16.2 INITIATING IMPLEMENTATION

Recognising the need to ensure that the water sector converges around the key water and sanitation challenges confronting South Africa and commits to working collaboratively to define and implement game-changing solutions, the Department of Water and Sanitation has ensured that Cabinet has noted the NW&SMP. The intention is that upon approval by Cabinet, the Department will host a Phakisa process (rapid results planning initiative) in the latter part of 2018. `Phakisa[80]' is South Africa's coining of a planning methodology implemented initially by the Malaysian Government. This big, fast results approach was launched in South Africa by the Presidency in 2014, with the Department of Performance Monitoring and Evaluation (DPME) as its custodian. The methodology, which seeks to implement the objectives of the NDP, is transformatory in nature and aims to unlock economic benefits. The Phakisa methodology has been used to great effect by several sectors, including Agriculture, Education and Health.

As the development of the NW&SMP has already been through an extensive consultative process, the mini-Phakisa for the water sector will invite stakeholders to spend two weeks deepening, refining and focusing the Plan, including the completion of the agreed Schedule of Actions (Volume 3 of the NW& SMP) for the first planning cycle. The utilisation of the Government-led Phakisa tool recognises that due to limited resources, implementation priorities may need to be narrowed down to fewer but essential critical actions and will bring decision-makers together to facilitate this advancement.

Sector departments participating in the water sector Phakisa:

- Department of Planning, Monitoring and Evaluation (DPME)
- Department of Health (DOH)
- National Treasury (NT)
- Department of Environmental Affairs (DOE)
- Department of Public Enterprises (DPE)
- Department of Minerals (DOM)
- Department of Energy (DOE)
- Department of Cooperative Governance and Traditional Affairs (COGTA)
- Department of Agriculture, Forestry and Fisheries (DAFF)
- Department of Rural Development and Land Reform (DRDLR)
- Department of Human Settlement (DHS)
- Offices of the Premier (OTP)

[80] Department of Planning, Monitoring & Evaluation, 2014: https://www.operationphakisa.gov.za/pages/home.aspx#

On approval of the Phakisa process by Cabinet, The Department of Water and Sanitation and DPME, will set up an organising committee for the Phakisa, and will ensure broad sector participation in this game-changing initiative led by Government. Budget to support this process needs to be secured for the 2018/19 FY. With the Master Plan acknowledged as one of the five pillars of the programme of the newly appointed Minster, it is anticipated that all relevant programmes of the Department of Water and Sanitation will be mobilised and harnessed to support the implementation of the Master Plan. As Phakisa processes are subjected to rigorous monitoring and reporting co-ordinated on behalf of Government by DPME, NW&SMP implementation progress will be tracked, and information available to stakeholders, through the NW&SMP Portal currently under development by DWS. Communication support to both the mobilisation of the Phakisa and its subsequent implementation will be provided by the DWS Branch: Communications. Similarly, Phakisa outcomes are expected to impact the programmes of all affected sector departments and sector stakeholders, as the country works together to be “Ready for the Future, and Ahead of the Curve”.

Due to the nature of a Phakisa process, it will replace previously envisaged stakeholder consultation, intergovernmental cooperation and monitoring and evaluation processes, which will then be driven by the DPME.

17 CONCLUSION

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Clearly, however, there are significant challenges in achieving this mandate, with declining reliability of water services and sanitation services, numerous WWTWs and WTWs in poor condition putting the health of the nation at risk, some municipalities consistently failing to deliver adequate services, increasing water scarcity, and decreasing raw water quality. Over 3 million people still do not have access to a basic water supply and 14.1 million people do not have access to a safe sanitation facility. At the same time, although access to water and sanitation services have improved significantly, the reliability of services that have been provided since the advent of democracy is declining, with only 64 % of households now having access to a reliable and safe water supply. Climate change adds significant additional stress to an already stressed environment and is changing rainfall patterns in ways that we have yet to understand fully.

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This NW&SMP has been widely consulted on and has been developed with input from a range of stakeholders and organs of state and has been greatly improved and informed by these engagements and inputs. It remains a living document to be annually reviewed, updated and improved. To this end, a mini-Phakisa will be held in the latter part of 2018, where stakeholders will be invited to spend two weeks deepening, refining and focusing the NW&SMP. Due to limited resources for implementation priorities may need to be narrowed down to fewer but essential critical actions.

South Africans share common interests and challenges in the pursuit of water security. Achieving water security requires sound evidence to inform policy and dialogue, good governance, advances in research and technology, the mobilisation of finance and investment, management of climate risks, and cooperation in managing transboundary water resources. It requires balancing supply and demand, redistributing water, managing water and sanitation services effectively, regulating water with a focus on high impact use, improving raw water quality and protecting and restoring ecosystems. These themes orient the NW&SMP and provide a rallying point for government, civil society, the private sector, researchers and innovators, the international community and ordinary South Africans.

Ready for the future and ahead of the curve

ANNEXURE 1: DEFINITIONS

Acid rain	Rainfall of abnormally high acidity which results from atmospheric pollution by emissions of sulphur dioxide, nitrogen oxide, and chloride.
Anti-pollution measures	The reduction or elimination of pollution by restricting or prohibiting activities which cause pollution.
Aquifer	Aquifer' means a geological formation which has structures or textures that hold water or permit appreciable water movement through them
Biodiversity	The number and variety of organisms and life forms, including all species, representing the totality of all their genes, found in an ecosystem or in a region.
Biosphere	The global sum of all ecosystems in the zone of life on Earth; integrating all living beings and their relationships. All life forms in the atmosphere, all oceans, freshwater, soils, land surfaces and the underlying geological horizons.
Capable and developmental state	A state that has sufficient human, financial, economic and natural resources to achieve the national objectives for the benefit of all citizens, through effective institutions and infrastructure that enable the economy and society to operate to its full potential.
Catchment	An area from which any rainfall will drain into the watercourse or watercourses or part of a watercourse, through surface flow to a common point or common points.
Climate change	Changes in climatic conditions due to natural causes or to anthropogenic (man-made) effects such as emissions of greenhouse gases, e.g. carbon dioxide, nitrous oxide, and methane, from industry, transport, farming and deforestation, that are expected to have significant consequences for rainfall and water availability on earth.
Constituents	Individual components, elements, or biological entities, such as suspended solids or dissolved salts.
Consumption	Use of water abstracted from any source, such as a river, groundwater or water supply system, for domestic, commercial, industrial, power generation, irrigation or any other purpose.
Contaminants	Constituents which are added to a water supply through the use thereof.
Deforestation	Removing natural forests from the landscape for the purpose of harvesting the timber or for making the land available for other purposes.
Democracy	Rule by the people.
Desalination	The removal of unwanted salts (constituents) from water to make it fit for use.
Development	The systematic use of scientific and technical knowledge, together with traditional knowledge systems and cultural values, to realise the potential of natural resources to support social and economic transformation.
Ecosystem	A community of all the organisms, such as plants, animals, fish and microbes, living in complex but balanced relationships with the physical features of their environment such as light, heat, moisture, wind, water, nutrients and minerals.
Efficiency-equity trade off	Seeking the socially, economically and politically most acceptable outcome of decision-making concerning the competing merits of efficiency and of equity and fairness.
Effluent	The liquid discharged from a processing step, usually from an industry, from a water purification works or from a waste water treatment plant.
Effluent discharge Standards	Minimum standards set for the quality of effluent streams as a means of controlling externalities, i.e. the economic and other effects on others.

Efficient water allocation	A situation in which the available water resources are allocated in a way that achieves maximum benefit.
Emissions	Solid, liquid or gaseous substances, or energy in the form of heat, usually discharged into the environment, by people and other living organisms or by chemical or physical processes; usually refers to products of combustion emitted into the atmosphere.
Environmental engineering	The application of science and technology to minimise the negative and to maximise the positive impacts on the environment of physical development and of the utilization of natural resources for the benefit of society.
Environmental protection	Avoiding negative impacts on the environment caused by physical activities, by the discharge of harmful solid, liquid or gaseous wastes or by the release of radiation.
Equity	Fairness, justice and impartiality which supplements or overrides common and statute law.
Externalities	Consequences of an action, usually negative but could be positive, which affect other parties but are not reflected in the costs.
Hydraulic fracturing	Also known as fracking. It is the process of injecting pressurised fluids into various rock layers in order to create cracks to allow natural gas to move freely.
Fog harvesting	The interception and precipitation of moisture in fog to form water.
Governance	Action or manner of governing by implementing sound rules and procedures.
Global warming	The increase in the average surface temperatures across the globe, usually measured over long periods of time; reported to have increased by 1^{0}C over the past hundred years.
Government	This refers to the total of all levels of government, including national, provincial, and local government as in South Africa. It is always necessary to check what level of government is being referred to in any particular context.
Greenhouse gas	Gases such as water vapour, carbon dioxide and methane in the atmosphere that do not affect incoming sunlight, but trap heat emitted from the Earth, thus contributing to global warming; hence the greenhouse effect.
Green water footprint	The volume of water evaporated from rainfall stored in the soil as soil moisture.
Grey water footprint	The volume of freshwater required to assimilate a pollution load to at least comply with acceptable water quality standards.
Groundwater	Rainfall that infiltrates into the soil surface and percolates downwards, seepage from water in streams, lakes and artificial impoundments, and irrigation water that percolates down into the ground and accumulates in aquifers comprising permeable underground layers of sand, gravel and rock.
Growth	An increase in an economic factor or variable, normally persisting over successive periods. Rapid or persistent growth is likely to involve changes in the nature of economic activity, with new products or processes, and new types of labour skills, capital goods, and economic conditions.
Impurities	Constituents which are added to the water supply through use.
Management	The people who make decisions in an organization; the effect, impact and outcome of these decisions.
Mandate	Authority to carry out a policy, course of action or legal command from a superior.
Pollutants	Constituents which are added to water through use.
Pollution control	Methods for controlling pollution, usually by monitoring against minimum standards and acting against contraventions.
Potable	Water safe 23 to be used for drinking purposes.

Private sector	Those parts of the economy not run by the government, including households, voluntary associations, community organizations, sole traders, partnerships, and privately owned company.
Property rights	The rights of an owner over property.
Public sector	Those parts of the economy which are not controlled by individuals, voluntary organizations, or privately-owned companies.
Rain water harvesting	Interception, collection and storage of water during rain seasons for use in other times
Reclamation	Treatment of wastewater for reuse, including indirectly or directly as potable water.
Recycling	The reuse of wastewater, with or without various degrees of treatment.
Regulation	A rule or directive made and implemented by an authority, which individuals or organizations are obliged to respect and comply with.
Regulatory agency	A body created to decide on and enforce regulations or rules.
Research and development	The use of resources to create new knowledge, and to develop new and improved products or processes, to enhance economic activities and the quality of life.
Repurification	Treatment of wastewater to a quality standard suitable for various uses, including for indirect or direct reuse as potable water.
Reuse	Beneficial use of reclaimed or re-purified wastewater.
Rights based approach	Priority given to the allocation of water to people who do not have access to water, even to satisfy their basic human needs which is a constitutionally entrenched right; individuals and communities are given access to full information, justice, and to participation in decision-making processes concerning water-related issues. Such water allocations enjoy priority over other uses such as for irrigated agriculture and for industrial use.
Right to access to water	Every person in South Africa is entitled to sufficient, acceptable, safe, physically accessible and affordable water for personal and domestic uses.
River pollution	The effects on rivers of the discharge or dumping into the environment of industrial, agricultural and any other waste products.
Runoff	The portion of rainfall on land or on any other surface that drains away to accumulate in a stream or a river, and which does not infiltrate into the surface, get intercepted by vegetation and other covers where it is stored, or evaporate back into the atmosphere. Runoff is also fed by groundwater which moves naturally into streams and rivers.
Sanitation Services	The collection, removal, disposal or treatment of human excreta and domestic wastewater, and the collection, treatment and disposal of industrial wastewater. This includes all the organisational arrangements necessary to ensure the provision of sanitation services including, amongst others, appropriate health, hygiene and sanitation-related awareness, the measurement of the quantity and quality of discharges where appropriate, and the associated billing, collection of revenue and consumer care. Water services authorities have a right but not an obligation to accept industrial wastewater from industries within their area of jurisdiction.
Sand mining	The removal of sand (mainly from river beds and banks) for commercial purposes; including the screening and washing of fine material out of the product.
Sewage	Liquid waste, with some suspended material, mainly human excrement.
Sewage disposal	The discharge of liquid waste from human occupation to the environment, usually after some of full treatment.

Sewerage	Infrastructure for the collection, treatment, and disposal of liquid waste (sewage).
Sludge	Solids removed from wastewater during treatment.
Storm water	Runoff from an area after heavy rain
Surface water	Runoff that occurs in streams and rivers, also in natural lakes and reservoirs; a major resource for water supplies.
Virtual water	The volume of water required to produce products which a country imports and exports; the volume of water embedded in products that are traded between countries or regions. Most relevant to arid or semi-arid countries with scarce water resources.
Value Engineering	A systematic method to improve the value of infrastructure or services by either improving the function or reducing the cost. It is a primary tenet of value engineering that basic functions must be preserved and may not be reduced because of pursuing value improvements. (Value is defined as the ratio of function to cost.)
Wastewater treatment	This includes any process which may be used to favourably modify the characteristics of the wastewater.
Water authorisation	Permission to use water for a specific purpose.
Water balance	The regulation or rationalisation of human activity to match the sustainable local water supply, rather than base, or a process of balancing water supply and demand to ensure that water use does not exceed supply.
Water efficiency	Getting any given results such as equity, gravity, and development with the smallest possible inputs, or getting the maximum possible output from given resources.
Water footprint	An indicator of water use that considers both direct and indirect water use. The water footprint of a product (good or services) is the volume of fresh water used to produce the product, summed over the various steps of the production chain. Water footprint includes 3 components: Volume of water as consumptive use or evaporation of rainwater/stored in soil moisture (green water) Volume of water as consumptive use or evaporation of water withdrawn from groundwater or surface water (blue water) and Volume of polluted water, calculated as water that is required to dilute pollutants to such an extent that the quality of the water remains above agreed water quality standards (grey water).
Water licence	A general authorisation issued by a responsible authority for water use is authorised by a licence under the National Water Act, 1998.
Water neutral	The reducing of the impact of the water consuming activity in making the impact 'water neutral' by simultaneous investment in water conservation measures of other alternatives. Water neutral thereby means that one reduces the water footprint of an activity as much as reasonably possible, and offsets the negative externalities of the remaining water.
Water offsetting	The residual water footprint is offset by making a 'reasonable investment' in establishing or supporting projects that aim at the sustainable and equitable use of water.
Water resource strategy	A plan for dealing with uncertain future circumstances with respect to the availability of clean and sufficient water for domestic and commercial use. This is the set of rules by which the action to be taken depends on the circumstances, including natural events such as climate change and the actions of other people.
Water resource	Water that can be used to contribute to economic activity, including a water

	course, surface water, estuary and ground water in an aquifer.
Water resources protection	Protection in relation to a water resource, means: maintenance of the quality of the water resource to the extent that the water resource may be used in an ecologically sustainable way; prevention of the degradation of the water resource; and rehabilitation of the water resource.
Water risk	Essentially the pressure of decreasing water availability and the reliability of supplies. The fact that the results of any use of water resources are not certain but may take more than one value.
Water scarcity	Water is scarce relative to human demands, not in and of itself.
Water services	Water supply services and/or sanitation services, or any part thereof.
Water Supply Services	The abstraction from a water resource, conveyance, treatment, storage and distribution of potable water, water intended to be converted to potable water and water for industrial or other use, to consumers or other water services providers. This includes all the organisational arrangements necessary to ensure the provision of water supply services including, amongst others, appropriate health, hygiene and water-related awareness, the measurement of consumption and the associated billing, collection of revenue and consumer care. Water services authorities have a right but not an obligation to provide industrial water to industries within their area of jurisdiction.
Water trading	The process of buying and selling of water access or use entitlements, also called water rights. The terms of the trade can be either permanent or temporary, depending on the legal status of the water rights.
Wetland	Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

ANNEXURE 2: INFORMATION ON THIRTEEN MAJOR RECONCILIATION STRATEGIES

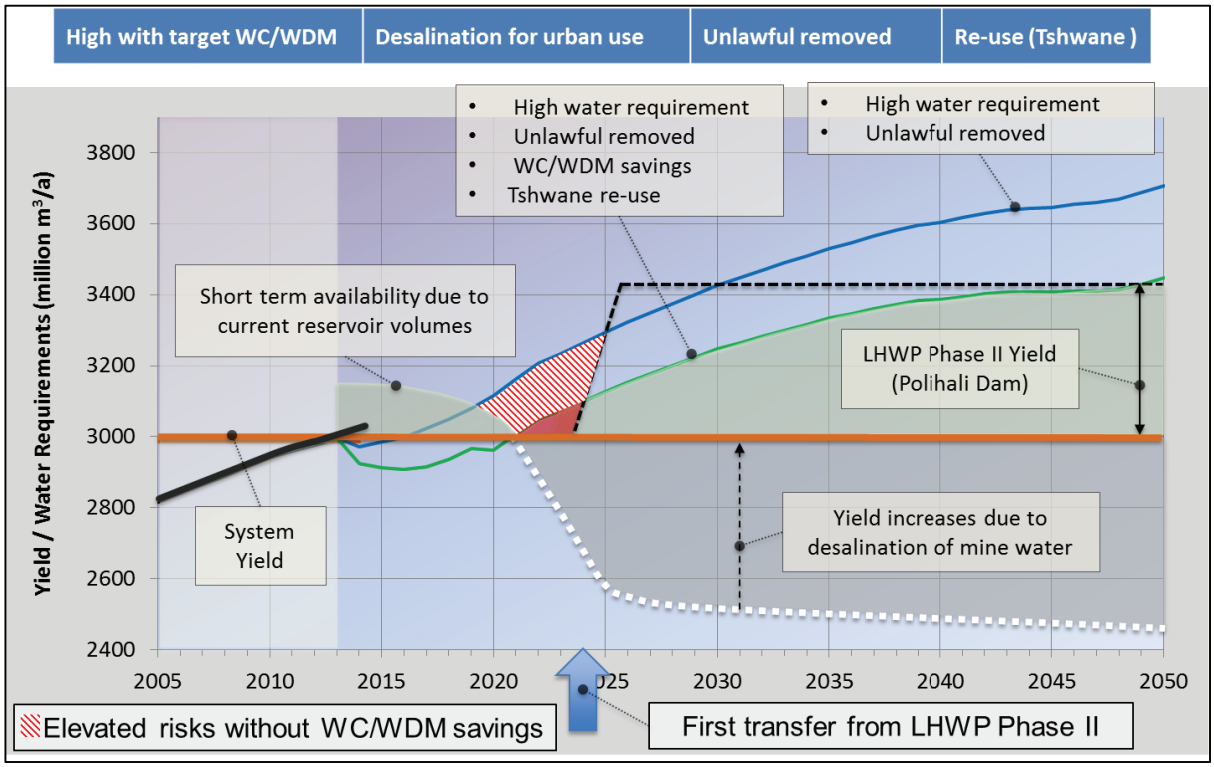
The Vaal River System (Developed in 2009[81] now in the second phase of implementation[82])

The supply area of the Vaal River System stretches far beyond the catchment boundaries of the Vaal River and includes most of Gauteng, Eskom's power-stations and Sasol's petro-chemical plants on the Mpumalanga Highveld, the North-West and Free State goldfields, iron and manganese mines in the Northern Cape, Kimberley, several small towns along the main course of the river, as well as the Vaalharts Irrigation Scheme. It will soon be extended to also supply water to the developments on the Waterberg coal-fields near the town of Lephalale in the Mokolo catchment.

The size of the Vaal River System, the various inter-basin transfers coupled with the extensive bulk water distribution infrastructure and the geographical location of the water users in relation to the position of the water resource components provides for a complex mix of variables that influences both the demand and availability.

[81] DWS, 2009, *Vaal River System: Large Bulk Water Supply Reconciliation Strategy*, P RSA C000/00/4406/09, Prepared by DMM, Golder, SRK, WRP & Zitholele

[82] DWS, 2015, Strategy Steering Committee of the Vaal River System (VRS): Status Report June 2015, Prepared by WRP



Vaal River System proposed reconciliation interventions[23]

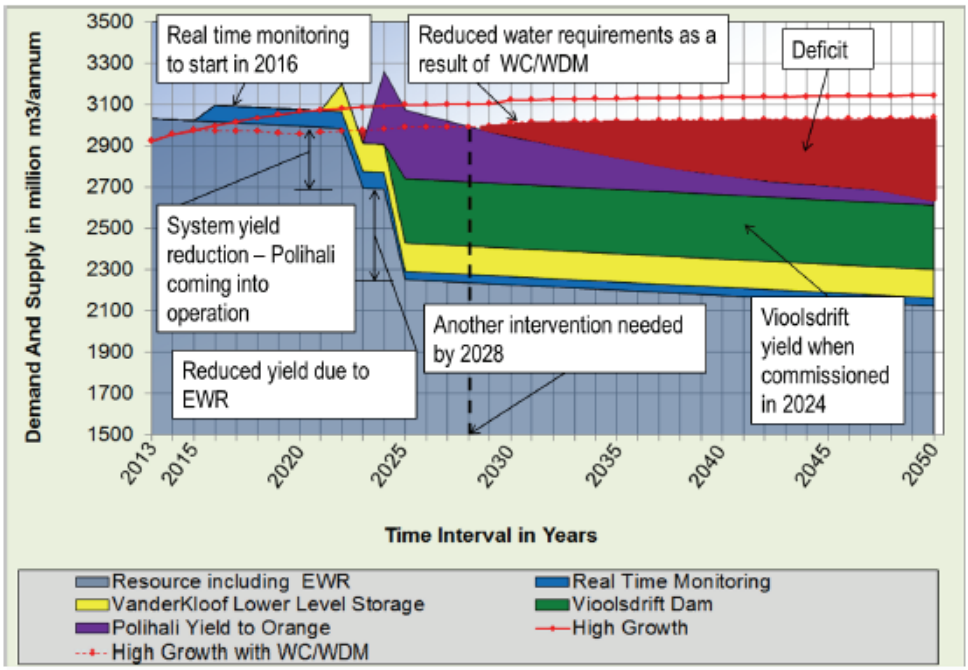
Ensuring that sufficient water is available to supply the future water requirements in the supply area of the Vaal River System requires the following main interventions:

- Eradicate unlawful water use;
- Continuation with the implementation of WC/WDM;
- Mine water effluent (acid mine drainage) must be treated and ready for use by 2020/21;
- Implement Phase 2 of LHWP, the Polihali Dam and transfer infrastructure, to deliver water by the year 2024; and
- Implement re-use of water as proposed in Tshwane's Water Resource Master Plan.

The Orange River System[83] (Developed in 2014)

The Orange River System extents into four International Basin States with the Senqu River originating in the highlands of Lesotho, Botswana in the north eastern part of the Basin, the Fish River in Namibia and the largest area situated in South Africa.

From the Reconciliation Strategy it is noted that water required to supply the current and future social and economic activities, as well as supporting the transfer to the Vaal River System, will have to come from within the Orange/Senqu basin. The existing EWR needs to be maintained, and the implementation of the EWR additional releases, can only be implemented after a new



dam is commissioned.

Orange River System proposed reconciliation interventions, including implementation of EWR, excluding raising of Gariep/implementation of Verbeeldingskraal Dam[24]

Interventions and Measures envisaged for the Orange River system (South African portion) to maintain a water balance between the water needs and availability up to the year 2050 have been identified, as follows.

- Plan and implement WC/WDM in the domestic and irrigation water use sectors.

[83] DWS, 2013, Development of Reconciliation Strategies for Large Bulk Water Supply Systems: Orange River: Final Reconciliation Strategy, P RSA D000/00/18312/10, Prepared by WRP, Aurecon, Golder & Zitholele

- Implement the real time monitoring of the Vaal River and Orange River flows downstream of Bloemhof and Vanderkloof dams as soon as possible, as this option is regarded as a quick win.
- Feasibility study on the proposed Noordoewer/Vioolsdrift Dam on the Lower Orange River.
- Investigate the utilisation of the Vanderkloof Dam lower level storage. Then proceed with the design and implementation of the pumping station and pipelines for pumping water from the reduced minimum operating level of Vanderkloof Dam into the existing Oranje Riet canal.
- Commission a pre-feasibility study for choosing between the raising of Gariep Dam and the Verbeeldingskraal Dam, to provide additional storage in the middle Orange River, followed by the relevant feasibility study.

The Kwa-Zulu Natal Coastal Metropolitan Bulk Water Supply System (Developed in 2010, second phase of continuation completed)

The Kwa-Zulu Natal Coastal Metropolitan Bulk Water Supply System extends from the Thukela River Mouth on the KZN North Coast to the uMtwalume River on the South Coast, as well as from Howick in the KwaZulu-Natal (KZN) Midlands to Durban on the east coast. It includes the eThekwini Metropolitan Municipality (MM), Msunduzi Local Municipality (LM), as well as portions of uMgungundlovu, iLembe, and Ugu District Municipalities (DMs). The area consists of three main water supply systems (WSSs), that are interlinked, namely North Coast WSS, Integrated Mgeni WSS and the South Coast WSS.

The KwaZulu-Natal Coastal Metropolitan area is the third largest contributor to the national economy and is the economic hub of KZN. This area is experiencing rapid growth in water requirements because of the influx of people from the rural areas, economic growth and development initiatives. Although a high level of emphasis is placed on a drive to increase the efficiency of water use through on-going water conservation and water demand management (WC/WDM) initiatives in order to delay other interventions, the Strategy shows that the development of water resource infrastructure is the solution to satisfy long-term water needs.

The following priority interventions are required:

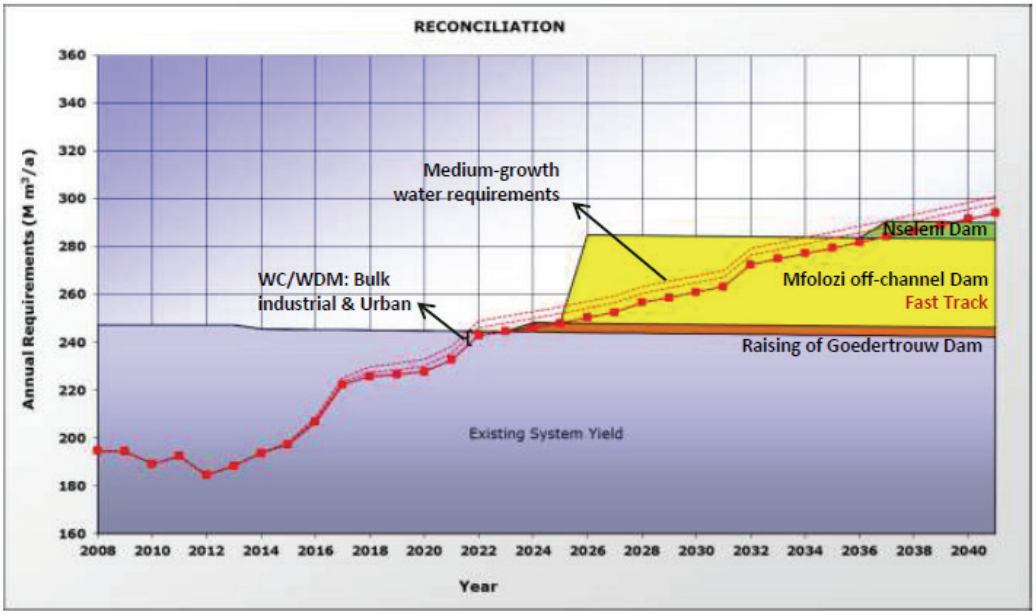
- North Coast WSS:
    - Complete the raising of Hazelmere Dam by August 2018/2019 (DWS);
    - Commissioning of the Lower Thukela Bulk Water Supply Scheme Phase 2 (LTBWSS-2) by the end of 2019 (Umgeni Water);
    - Desalination of sea water at Lovu (Umgeni Water): 150 Ml/d; and
    - direct reuse of treated wastewater (eThekwini MM): (2018) 41 million m³/a.

- Integrated Mgeni WSS:
    - Implement the uMkhomazi Water Project Phase 1 (uMWP-1), with the proposed Smithfield Dam and associated transfer and bulk infrastructure scheme, as soon as possible (DWS and Umgeni Water);
    - Complete the Western and Northern aqueducts to deliver water from uMWP-1 to the planned areas in eThekwini (Umgeni Water); and
    - Implementation of the eThekwini Re-mix Project pilot plant (eThekwini MM).
- South Coast WSS:
    - The Lower uMkhomazi Bulk Water Supply System (Ngwadini Dam) by 2022 (Umgeni Water): 100 Ml/d; and
    - Desalination of seawater at Tongaat (Umgeni Water): 150 Ml/d.

The Richards Bay Water Supply System[84] (Developed in 2014)

The Richards Bay Water System covers the City of uMhlathuze Local Municipality, comprising Empangeni, Ngwelezana, Esikhaweni and a number of rural villages as well as large well-developed industries, commercial areas and business centres, such as Mondi Richards Bay, Tronox, Foskor, Richards Bay Minerals, Hillside and Bayside Aluminium and the Richards Bay Coal Terminal. Richards Bay is the economic centre of the uMhlathuze Local Municipality and is one of the strategic economic hubs of the country. Though the water resources available to the uMhlathuze Municipality are currently sufficient to cater for the existing requirements, should anticipated growth and industrial development materialise the current water sources are likely to come under stress within years.

[84] DWS, 2015, Water Reconciliation Strategy for Richards Bay and Surrounding Towns: Extended Executive Summary, 109343, Prepared by Aurecon



Richards Bay Water Supply System proposed reconciliation interventions[8]

The following interventions have been identified:

- Raising of Goedertrouw Dam by 2.8 m.
- A pre-feasibility comparison of one or more of the following augmentation schemes, followed by a feasibility study:
    - Increased capacity of the Thukela-Mhlathuze Transfer Scheme at Middledrift and potential phasing thereof,
    - Coastal transfer pipeline from the lower Thukela River at Mandini,
    - The preferred Mfolozi River transfer scheme to the Richards Bay WSS.
- Evaluation and potential implementation of the following development options: a) a dam on the Nseleni River, b) Use of treated effluent from the Arboretum macerator site, and c) Seawater desalination.

The Mbombela Bulk Water Supply System[85] (Developed in 2014)

The Mbombela Bulk Water Supply System covers Mbombela Municipal Area. However, this area straddles the Crocodile and Sabie River catchment and hence it necessitated a broader approach than only considering the water use and water resources within the municipal boundaries. The water resources of the Sabie and Crocodile catchments were included in the study area for the purposed of sourcing possible future water resources for Mbombela. For the purposes of this study, eight distinct supply centres were identified, namely: Nelspruit (including Mataffin, the Agricultural College and Matumi Golf Course), White River Town (including White River Country Estate and Rocky Drift), Hazyview, Nsikazi North, Nsikazi South, Karino Plaston Corridor, Matsulu, and Smaller centres, i.e. Kaapsche Hoop, Ngodwana and Elandshoek.

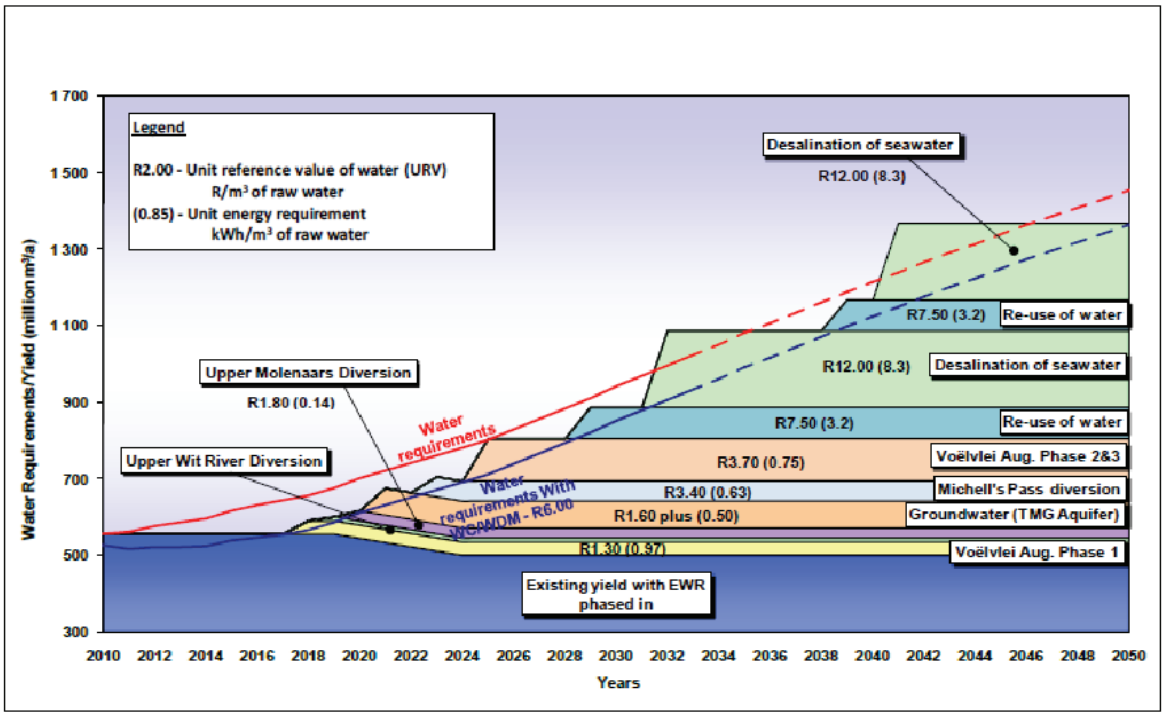
Several interventions are proposed for the supply centres, ranging from WC/WDM, removal of IAP, re-allocation of irrigation water, groundwater development, optimising of system operating rules, rain and fog harvesting, as well as a proposed regional scheme within the Crocodile River catchment, with the following three schemes to be further investigated, namely the Boschejeskop Dam; the Mountain View Dam; and the Strathmore off-channel storage dam.

The Western Cape Water Supply System (Developed in 2007, now in second phase of continuation[86])

The Western Cape Water Supply System covers the City of Cape Town and certain Overberg, Boland, West Coast and Swartland towns, as well as irrigators along the Berg, Eerste and Riviersonderend rivers. Although, the system was in surplus after the completion of the Berg River Dam (2006/07), estimated high growth in water requirements, including the successful implementation of the WC/WDM measures, indicated that the surplus would only be adequate to 2017.

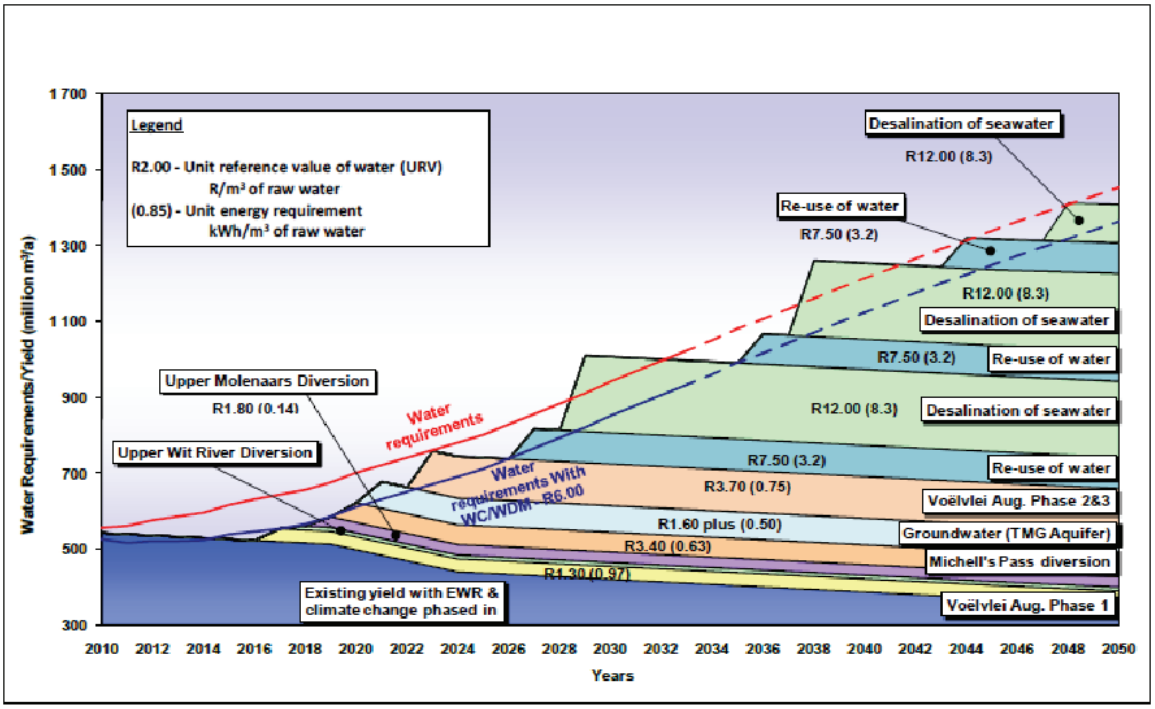
[85] DWS, 2014, *Water Requirements and Availability Reconciliation Strategy for the Mbombela Municipal Area*, PWMA 05/X22/00/2012/6, Prepared by IWR Water Resources, Aurecon, SRK, Kyamandi and WRP

[86] DWS, 2014, Western Cape Water Supply System Reconciliation Strategy: Status Report, Prepared by Umvoto



Western Cape Water Supply System proposed reconciliation interventions (without climate change)[87]

[87] DWS, 2010, Assessment of the ultimate potential and future marginal cost of water resources in South Africa, P RSA 000/00/12610, prepared by BKS Pty Ltd



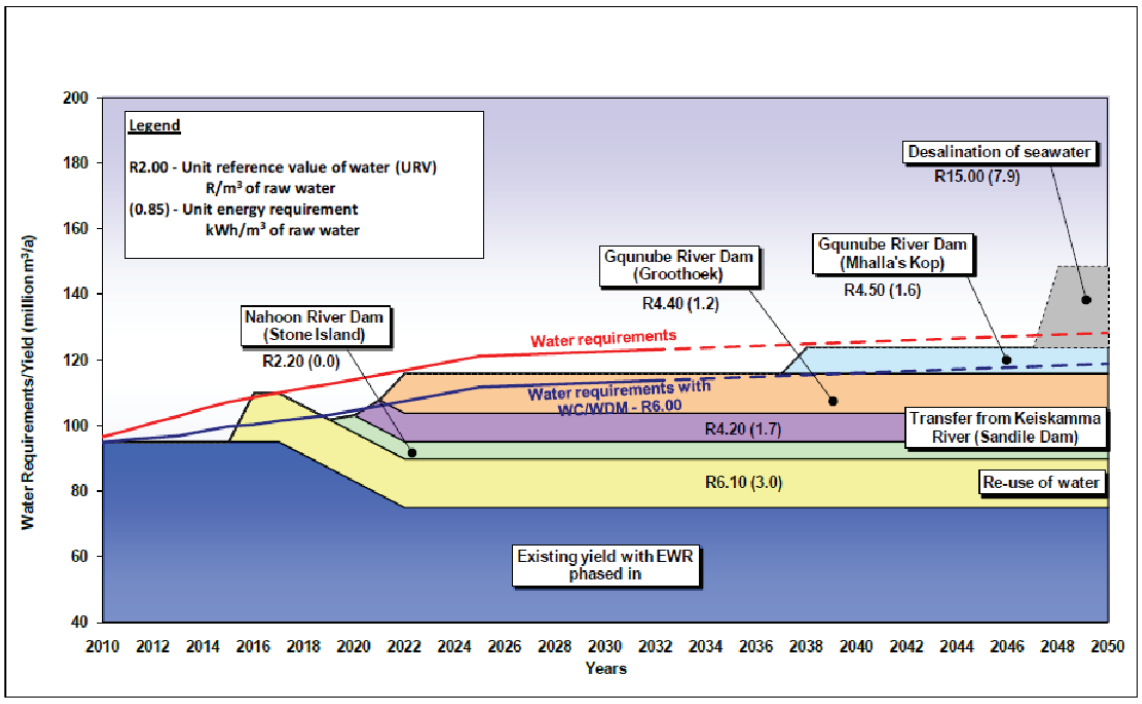
Western Cape Water Supply System proposed reconciliation interventions (includes the negative effects of climate change)

The following interventions were identified from the assessment of the current water requirements and updated scenario planning:

- Berg River-Voëlvlei (Phase 1) augmentation ;
- Langebaan Road Aquifer Artificial Recharge Scheme;
- Table Mountain Group Aquifer (TMG) development;
- Cape Flats and Newlands Aquifer development;
- Lourens River Diversion ;
- Water Re-use;
- Desalination of seawater;
- Michell's Pass Diversion Scheme;
- Raising of Steenbras Lower Dam;

The Amatole Bulk Water Supply System[88] (Developed in 2008)

The System covers urban, rural and agricultural users in the catchments of the Buffalo and Nahoon rivers, including the Buffalo City Municipality, King William's Town, Bisho and Stutterheim.



Amatole Bulk Water Supply System proposed reconciliation interventions, with the phasing in of EWR[89]

The following interventions have been identified:

- Implement the amended operating rules to maximized the system yield.
- Study potential water re-use schemes, which should seek to deliver an additional yield of 2.9 million m³/a per year over 5 years.
- Commence planning for the next surface water augmentation schemes by 2016, the Nahoon River Dam (Stone Island) and transfer from Keiskamma River (Sandile Dam), depending on the implementation of the EWR.

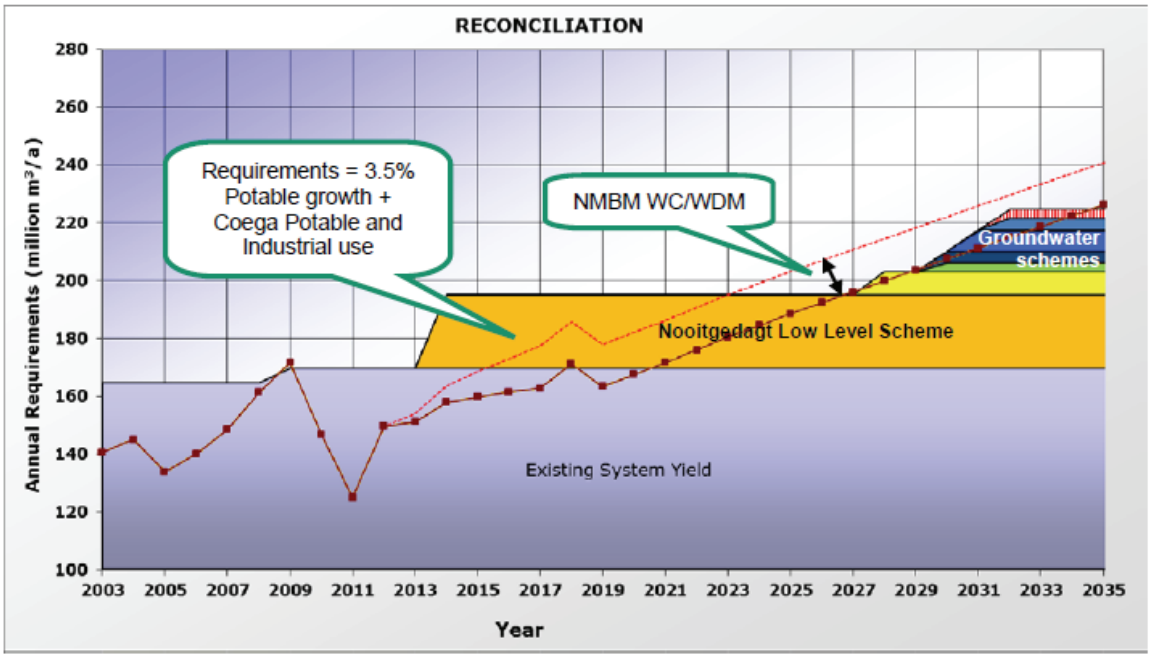
[88] DWS, 2012, Amatole Water Supply System Reconciliation Strategy: Status Report 2012, Prepared by UWP

[89] DWS, 2010, "Assessment of the ultimate potential and future marginal cost of water resources in South Africa", P RSA 000/00/12610, prepared by BKS Pty Ltd

- The extent of IAP and the potential for increased forestry be reviewed, as well as their potential impacts on System Yield.

The Algoa Water Supply System[90] (Developed in 2010)

The System covers, inter alia, the Nelson Mandela Bay Municipality, the Gamtoos Irrigation Board and the Sundays River Water User Association. Drought conditions in the region have forced the fast-tracking of several recommended interventions.



Algoa Water Supply System proposed reconciliation interventions[90]

[90] DWS, 2012, Water Reconciliation Strategy for the Algoa Water Supply Area: Status Report 2: 2012, Prepared by Aurecon

The supply interventions to meet future needs which have been identified as probably feasible to increase the available supply to the supply area of the Algoa WSS are:

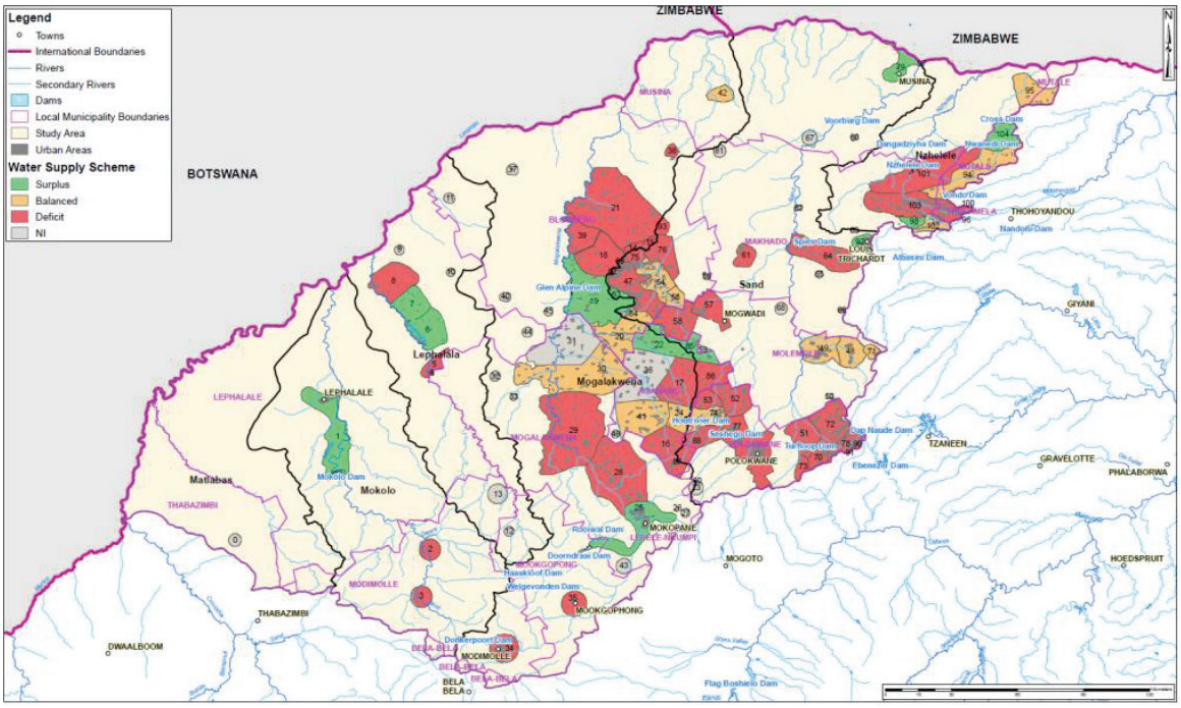
- Nooitgedacht Low-Level Scheme (which is currently being implemented), and later Phase 2.
- Groundwater development – Coega Kop aquifer and Churchill Dam area.
- Re-use of water treated to industrial standards for the Coega IDZ – Fish Water Flats WWTW.
- NMBM apply for a water use licence for the additional water use from Loerie Dam.
- Feasibility study on seawater desalination
- Investigate the possibility of raising the Kouga Dam.

Limpopo Water Management Area North[91] (Developed in 2016)

The Limpopo Water Management Area North Reconciliation Strategy includes the all the catchments of the Limpopo WMA (Matlabas, Mokolo, Lephalala, Mogalakwena, Sand and Nzhelele catchments), excluding the Marico, Crocodile (West) and Luvuvhu catchments that are included in separate Reconciliation Strategies. Several transfer schemes from respectively the Letaba, Olifants and Crocodile West catchments, provide about 34 million m³/a of water into the Limpopo WMA North.

The main urban areas within the WMA include Mokopane, Polokwane, Mookgophong, Modimolle, Lephalale, Musina and Louis Trichardt. The Limpopo WMA North forms part of the internationally shared Limpopo River Basin which also includes sections of Botswana, Zimbabwe and Mozambique.

[91] DWS, 2016, *Limpopo Water Management Area North Reconciliation Strategy*, P WMA 01/000/00/02914/11A, Prepared by AECOM



Limpopo Water Management Area North 2010 water balances[12]

The supply interventions to meet future needs in the Limpopo Water Management Area North have been identified in the Reconciliation Strategy, as listed below:

- Monitor observed flows and storage levels at strategic points as well as water quality and monitor water use to confirm water requirement projections before implementing options.
- Plan and implement WC/WDM in all water use sectors.
- Continue with the implementation of planned bulk water distribution systems, such as the MCWAP-1, ORWRDP phases (including transfer from the Olifants to Polokwane) and water supply systems from Nandoni Dam.
- Refurbish the canal downstream of the Nzhelele Dam.
- Construct canal downstream of the Glen Alpine Dam.
- Commission feasibility studies on groundwater development in relevant areas.
- Commission studies to investigate potential supply from Zimbabwe.

The Olifants River Water Supply System[92] (Developed in 2011)

The System covers, towns and rural areas within the Olifants Catchment as well as augmentation to the towns Polokwane and Mokopane and their surrounding rural areas northbound and outside of the catchment area serving more than 3 million people. The water requirements in the Olifants catchment and its adjacent supply areas have increased substantially over the last number of years due to increases in a range of activities including power generation, significantly increase in mining, the steel industry, urban development and agriculture. Due to this significant growth in water requirements, the recently commissioned De Hoop Dam's firm yield will soon be exceeded.

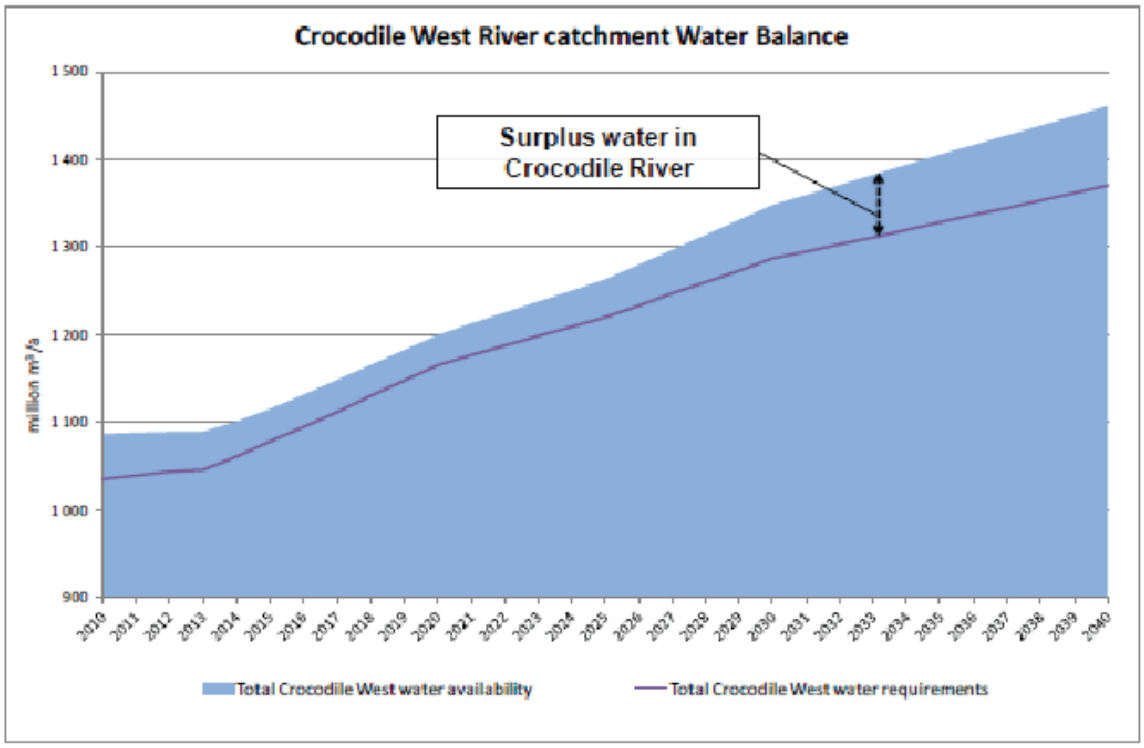
For the successful implementation of the Olifants River Reconciliation Strategy, the need for large scale interventions by 2026 are pressing. It is therefore recommended that:

- Plan and implement WC/WDM in all water use sectors.
- Completion of the current Olifants River Water Resources Development Project.
- Groundwater augmentation investigations underway, the implementation of groundwater schemes to be initiated as soon as possible.
- Elimination of unlawful use.
- Investigation and implement the use of treated mine water, as well as municipal effluent re-use.
- Compulsory licensing, or similar reallocation initiatives, may have to be initiated for the Olifants River catchment to ensure a positive water balance over the long-term future.
- An Integrated Olifants River Operating Rule Study needs to be initiated as soon as possible to optimise the system, thereby avoiding uncontrolled water supply shortages.

[92] DWS, 2015, Olifants River Water Supply System Reconciliation Strategy 2015, P WMA 04/B50/00/8715, prepared by WRP

The Crocodile West River System[93] (Developed in 2009, second phase of continuation completed[94])

The catchment area of the Crocodile West River is one of the most developed in the country. It is characterized by the sprawling urban and industrial areas of northern Johannesburg and Pretoria, extensive irrigation downstream of Hartbeespoort Dam and large mining developments north of the Magaliesberg. As a result, the Crocodile River is one of the rivers in the country that has been most influenced by human activities, and where more specific management strategies are of paramount importance.

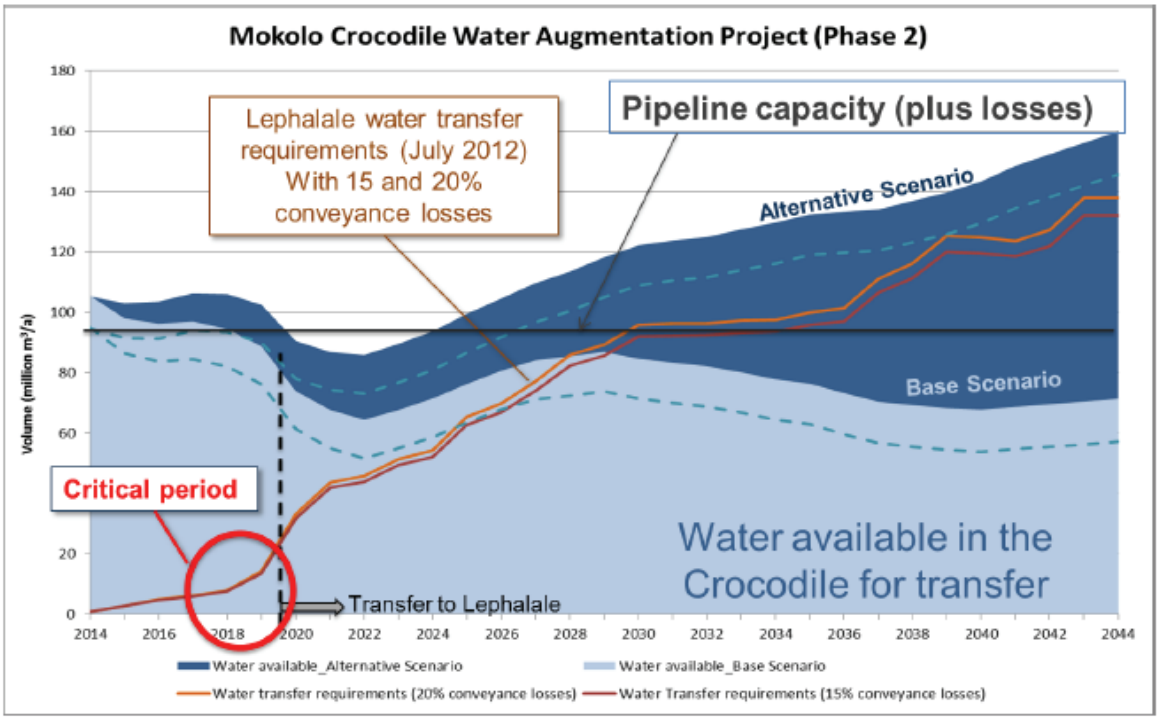


Crocodile West River System water balance[93]

[93] DWS, 2012, *Crocodile West River Reconciliation Strategy 2012*, P WMA 03/A31?00/6110/4, prepared by BKS and WRP

[94] DWS, 2015, *Crocodile West River Reconciliation Strategy*, P WMA 03/A31/00/6115/2, prepared by AECOM and WRP

The water resources that naturally occur in the catchment have already been fully developed and most of the tributaries as well as the main stem of the Crocodile River are highly regulated. Much of the water supplied to the metropolitan areas and some mining developments is transferred from the Vaal River system via Rand Water. This in turn results in large quantities of effluent from the urban and industrial users, most of which is discharged to the river system after treatment, for re-use downstream. In many of the streams and impoundments, water quality is severely compromised by the proportionate large return flows. The effluent return flows constitute a large portion of the water availability in the catchment and are an important resource, that is earmarked for the augmentation of the Mokolo System, as shown in figure below for a base and high growth scenario.



Surplus water available from Crocodile West River System for augmentation to the Mokolo[94]

The growing water requirements in the Lephalale area in the Mokolo River catchment to the north and north-east of the Crocodile River catchment exceed the available water from the Mokolo River system. The transfer of surplus water in the Crocodile River system to the Lephalale area (Mokolo-Crocodile Water Augmentation Project) will be implemented 2019/2020.

The following interventions have been identified in the Strategy:

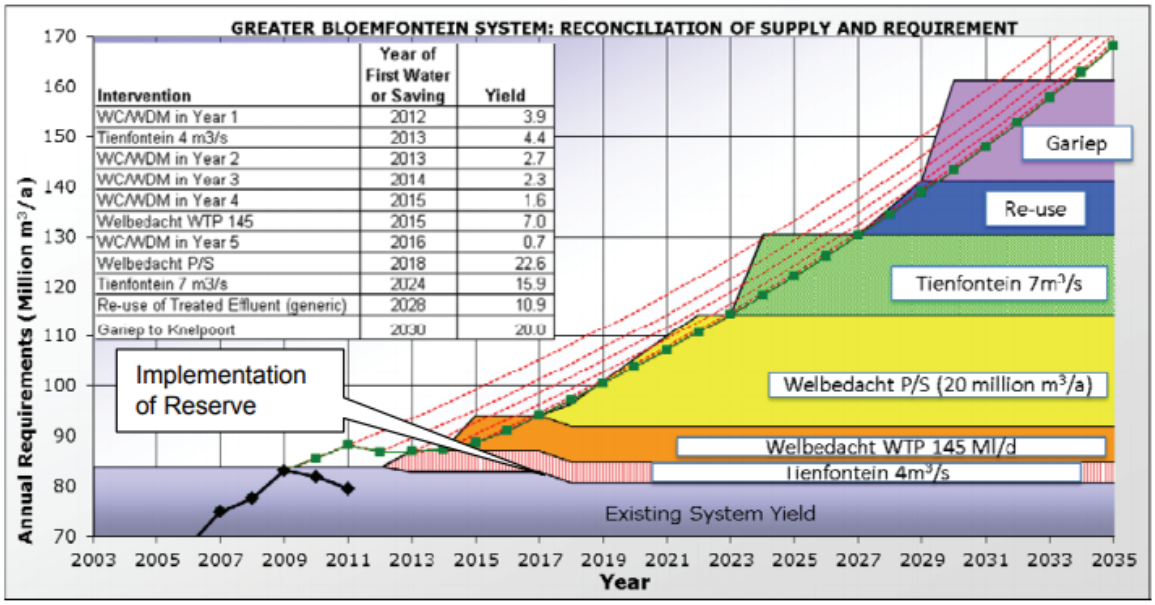
- The Rand Water service area in the Crocodile West River catchment will in future continue to be supplied from the Vaal River System and additional re-use will be considered only when surplus becomes available.
- The areas north of the Magaliesberg outside the Rand Water supply area will receive increased treated effluent from the metropolitan areas as a future source of water.

- In the Waterberg area (north of Crocodile West catchment) the optimal utilisation of local resources will continue and surplus water in the Crocodile West River System will be transferred to the Lephalale area.
- Intervention to supply short-duration shortfall will be evaluated by investigating demand side management and/or potential augmentation by transferring treated wastewater from the Vaal River System to the Crocodile West River System.
- Available groundwater resources should be utilised in all areas and opportunities for conjunctive surface / groundwater utilisation should be explored.
- Continue with the Crocodile (West) Annual Operating Analyses.

The Greater Bloemfontein Bulk Water Supply System[95] (Developed in 2011)

The System covers the larger centres of Bloemfontein, Thaba Nchu and Botshabelo, as well as to the smaller towns of Wepener, Dewetsdorp, Reddersburg, Edenburg and Excelsior, which are also dependent to varying degrees on local water sources. Currently approximately 66% of the treated water is supplied by Bloem Water, primarily through Welbedacht and Rustfontein Water Treatment Plant (WTP) and the balance via MMM's Maselspoort WTP.

[95] DWS, 2012, Water Reconciliation Strategy Study for the Large Bulk Water Supply Systems: Greater Bloemfontein Area: Final Strategy Report, P WMA 14/C520/00/0910/05, prepared by Aurecon, GHT Consulting Scientist, Illiso Consulting



Greater Bloemfontein Bulk Water Supply System proposed reconciliation interventions, including the Metolong Dam and implementation of the Caledon River EWR[95]

- The following interventions should be undertaken: Plan and implement WC/WDM in all water use sectors.
- Install two additional (1 m³/s) Pump Sets at Tienfontein Pump Station to increase the design capacity to 4 m³/s.
- The Welbedacht Dam should be scoured to increase the capacity of the dam and to ensure that the siltation at Tienfontein Pump Station does not further hamper operations and maintenance.
- Initiate a feasibility study to investigate the most appropriate means to augment Knellpoort Dam.
- Initiate a study to investigate feasibility of obtaining additional water from the Orange River.
- A Feasibility Study on Water Re-use should be undertaken.

Investigate and implement groundwater developments. The Luvuvhu and Letaba Water Supply System (Developed in 2015)[96]

The System covers the entire Luvuvhu and Letaba Water Management Area (WMA) and small parts of the adjacent WMAs. Most of the development in this water management area is agriculture based, with strong contributions by irrigated agriculture and afforestation.

Thohoyandou, Tzaneen and Giyani are the largest urban centres in WMA, with some agro-based industries, mainly in the Tzaneen area. The Kruger National Park (KNP) lies along the eastern boundary and occupies approximately 35% of the WMA.

The following measures are envisaged for the Luvuvhu and Letaba systems to maintain a water balance between the water needs and availability up to the year 2040.

- Implementation of the Groot Letaba Water Development Project (GLeWaP), comprising of the raising of the Tzaneen dam, and construction of a the new Nwamitwa dam on the Janetsi Farm 463LT, in process.
- Implement WC/WDM for both municipal and agriculture sectors.
- Investigate, plan to development of a pipeline to replace the canal between Middel Letaba and Nsami dams.
- Investigate the possible increase of the Nandoni sub-system yield by improved utilising of downstream incremental flows.
- Commission Feasibility studies on groundwater development in the relevant areas.
- Commission Feasibility studies on groundwater development in relevant areas, and the construction of storage dam in the Mutale River.

All Town studies

Over eight hundred (800) All-Town stand-alone strategies / studies are now in continuation phase. The All-Town Studies are in this phase to ensure that the strategies developed remain relevant and are live documents. These All-Town Strategies showed that, in most cases, water supply deficits are not the result of water resource shortages but rather of poor water supply management. Improved management will solve most of the immediate problems – these are typically:

[96] DWS, 2015, Development of Water of a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply System, P WMA 02/B810/00/1412/16, Prepared by WRP Consulting Engineers

- A lack of metering information, resulting in WSAs having limited information on how much water is used or wasted.
- A large wastage of water.
- High per capita use.
- Free water being provided far above the indigent level obligations.
- Poor cost recovery.
- Lack of proper maintenance and skilled operators.
- Low technical competency.

The All-Town Strategies also showed that groundwater is a very important resource for towns and an option in some instances.

ANNEXURE 3: REFERENCES

African Union (AU). 2015. **AGENDA 2063**.

Ashton, P. 2012. **WATER QUALITY CHALLENGES IN SOUTH AFRICA.** Council for Scientific and Industrial Research (CSIR). Pretoria, South Africa.

Central Statistics Service, 1993. **Standard Industrial Classification (SIC) of All Economic Activities.** Edition 5. Pretoria, South Africa. pp 1 - 247.

Colvin, C *et al*. 2013. **DEFINING SOUTH AFRICA'S WATER SOURCE AREAS.** WWF-World Wide Fund for Nature. Cape Town, South Africa.

Butler, D *et al*. 2016. **RELIABLE, RESILIENT AND SUSTAINABLE WATER MANAGEMENT: THE SAFE & SURE APPROACH.** Global Challenges**.** Vol. 1 pp- 63-77.

Department of Agriculture Forestry and Fisheries (DAFF). 2015. **IRRIGATION STRATEGY FOR SOUTH AFRICA**. Pretoria, South Africa.

Department of Environmental Affairs (DEA). 2011. **NATIONAL BIODIVERSITY ASSESSMENT 2011: An Assessment of South Africa's biodiversity and ecosystems.** pp 1-180.

Department of Environmental Affairs (DEA) 2010. **MINIMUM EMISSION STANDARDS.** Pretoria, South Africa.

Department of Environmental Affairs (DEA). 2013. **THE ECONOMICS OF ADAPTATION TO FUTURE CLIMATES IN SOUTH AFRICA: AN INTEGRATED BIOPHYSICAL AND ECONOMIC ANALYSIS.** Pretoria, South Africa.

Department of Economic Development. 2010. **NEW GROWTH PATH FRAMEWORK**. Pretoria, South Africa.

Department of Trade and Industry (DTI). 2017. **INDUSTRIAL POLICY ACTION PLAN (IPAP) 2017/18-2019/20.** Pretoria, South Africa.

Department of Water Affairs (DWA). **BLUE DROP REPORTS**. Pretoria, South Africa

Department of Water Affairs (DWA). **GREEN DROP REPORTS.** Pretoria, South Africa

Department of Water Affairs (DWA). 2011. **PLANNING-LEVEL REVIEW OF WATER QUALITY IN SOUTH AFRICA**. Pretoria, South Africa. pp. 1-167.

Department of Water Affairs. 2013. **STRATEGIC OVERVIEW OF THE WATER SECTOR IN RSA**. Directorate: Water Services Planning & Information. Pretoria, South Africa.

Department of Water Affairs (DWA). 2015. **PLANNING-LEVEL REVIEW OF WATER QUALITY IN SOUTH AFRICA**. Pretoria, South Africa. (draft).

Department of Water Affairs (DWA). **REGULATORY PERFORMANCE MEASUREMENT SYSTEM (RPMS) REPORTS.** Pretoria, South Africa.

Department of Water Affairs and Forestry (DWAF). 1991. **WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES IN THE REPUBLIC OF SOUTH AFRICA.** Pretoria, South Africa. pp. 1-39.

Department of Water Affairs and Forestry (DWAF). 2003. **NORMS AND STANDARDS FOR WATER SERVICES.**

Department of Water Affairs and Forestry (DWAF). 2004. **NATIONAL WATER RESOURCE STRATEGY.** Edition 1. Pretoria, South Africa.

Department of Water Affairs and Forestry (DWAF). 2006. **RESOURCE DIRECTED OF WATER QUALITY: GUIDELINE FOR DETERMINING RESOURCE WATER QUALITY OBJECTIVES (RWQOs), ALLOCATABLE WATER QUALITY AND THE STRESS OF THE WATER RESOURCE.** Edition 2. Pretoria, South Africa.

Department of Water Affairs and Forestry (DWAF). 2014**. NATIONAL WATER SERVICES INFRASTRUCTURE ASSET MANAGEMENT STRATEGY.** Pretoria, South Africa.

Department of Water and Sanitation (DWS). **ASSET VERIFICATION REPORTS ON NATIONAL WATER RESOURCE INFRASTRUCTURE.** Pretoria, South Africa.

Department of Water and Sanitation(DWS) . **ALL TOWNS RECONCILIATION STRATEGIES FOR THE NORTHERN PLANNING REGION** http://www.dwa.gov.za/Projects/AllTownsRecStrat_NP/default.aspx

Department of Water and Sanitation(DWS). **DAM SAFETY RECORDS.** South Africa.

Department of Water and Sanitation(DWS). **RECONCILIATION STRATEGIES FOR WESTERN CAPE WATER SUPPLY SYSTEM.** South Africa. http://www.dwa.gov.za/projects.aspx .

Department of Water and Sanitation(DWS). 2013a. **NATIONAL GROUNDWATER STRATEGY.** Pretoria, South Africa

Department of Water and Sanitation(DWS). 2013b. **NATIONAL WATER POLICY POSITIONS.** Pretoria, South Africa. Pp.16.

Department of Water and Sanitation (DWS). 2013c. **NATIONAL WATER RESOURCE STRATEGY.** Edition 2. Pretoria, South Africa. pp. 1-115.

Department of Water and Sanitation (DWS). 2015a. **MUNICIPAL STRATEGIC SELF-ASSESSMENT (MuSSA).** Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2015b. **2014 NO DROP REPORT- FIRST ORDER ASSESSMENT OF WATER LOSS, WATER USE EFFICIENCY AND NON-REVENUE WATER IN MUNICIPALITIES**

Department of Water and Sanitation (DWS). 2015c. **2015 NO DROP REPORT-THE STATUS OF WATER LOSS, WATER USE EFFICIENCY AND NON-REVENUE WATER IN METROPOLITAN MUNICIPALITIES.**

Department of Water and Sanitation (DWS). 2015d. **STRATEGY FOR INCENTIVE-BASED REGULATION OF WATER USE EFFICIENCY IN MUNICIPALITIES**

Department of Water and Sanitation (DWS). **REGULATIONS REGARDING THE SAFETY OF DAMS** i.t.o. **SECTION 123 OF THE NWA, 1998.** Pretoria, South Africa.

(Department of Water and Sanitation (DWS). 2016a. **BENCHMARKS FOR WATER CONSERVATION AND WATER DEMAND MANAGEMENT (WC/WDM) IN THE MINING SECTOR.** Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2016b.**CONDITION ASSESSMENT AUDIT OF IRRIGATION SCHEME INFRASTRUCTURE**. Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2016 **DRAFT POLICY ON SUSTAINABLE HYDROPOWER GENERATION.** General Notice No. 400 of 2016. Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2016c. **GUIDELINE FOR THE DEVELOPMENT AND IMPLEMENTATION OF WATER CONSERVATION AND WATER DEMAND MANAGEMENT PLANS FOR THE MINING SECTOR**. Pretoria, South Africa

Department of Water and Sanitation(DWS). 2016. **KZN METRO RECONCILIATION STRATEGY.**

Department of Water and Sanitation (DWS). 2017a**. MuSSA FOR WATER SERVICES FOR SOUTH AFRICA, 2016/2017.** Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2017b**. BENCHMARKING OF WATER LOSSES, WATER USE AND NON-REVENUE WATER IN SOUTH AFRICAN MUNICIPALITIES (2004/05 TO 2015/16).**

Department of Water and Sanitation (DWS). 2017c. **DEBT COLLECTION PERFORMANCE REPORT, 2017.** Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2017d. **NATIONAL GROUNDWATER STRATEGY**. Pretoria, South Africa. pp.2-111.

Department of Water and Sanitation (DWS). 2017e. DWS. 2017. **NATIONAL WATER INVESTMENT FRAMEWORK.**

Department of Water and Sanitation (DWS). 2017f. **REVIEW, EVALUATION AND OPTIMISATION OF THE SOUTH AFRICAN WATER RESOURCES MONITORING NETWORK: IMPLEMENTATION STRATEGY**. Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2017g. **STATUS REPORT ON WATER LOSSES WITHIN THE 8 LARGE WATER SUPPLY SYSTEMS.** Pretoria, South Africa**.**

Department of Water and Sanitation (DWS). 2017h. **WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES FOR SOUTH AFRICA: INTEGRATED WATER QUALITY MANAGEMENT IMPLEMENTATION PLAN.** Edition 2. Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2017i. **WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES FOR SOUTH AFRICA: INTEGRATED WATER QUALITY MANAGEMENT POLICY.** Edition 2. Pretoria, South Africa. pp. 1-75.

Department of Water and Sanitation (DWS). 2017j. **WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES FOR SOUTH AFRICA: INTEGRATED WATER QUALITY MANAGEMENT STRATEGY.** Edition 2. Pretoria, South Africa. pp. 1-85.

Department of Water and Sanitation (DWS). 2017k. **WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES FOR SOUTH AFRICA: MONITORING AND EVALUATION FRAMEWORK**. Edition 2. Pretoria, South Africa. pp. 1-51.

Department of Water and Sanitation (DWS). 2017l. **WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES FOR SOUTH AFRICA: WATER QUALITY AND WATER QUALITY MANAGEMENT CHALLENGES IN SOUTH AFRICA.** Edition 1. Pretoria, South Africa. pp. 1-123.

Department of Water and Sanitation (DWS) and National Treasury. 2017m. **NATIONAL WATER INVESTMENT FRAMEWORK & MUNICIPAL BUDGET DATABASE.** Pretoria, South Africa

Department of Water and Sanitation (DWS). 2018. **NATIONAL WATER INVESTMENT FRAMEWORK**. Pretoria, South Africa.

Escobor, I *et al.* 2009. **SUSTAINABLE WATER FOR THE FUTURE – WATER RECYCLING VERSUS DESALINATION**. Elsevier Publishers

Eskom. 2013. **COMPILATION OF AN APPLICATION FOR EXEMPTION FROM MINIMUM EMISSION STANDARDS AND EXTENSION OF THE MINIMUM EMISSION STANDARD TIMEFRAMES FOR ESKOM'S POWER STATIONS: WATER RESOURCES ASSESSMENT**.

Eskom Annual Report. 2016. **ANNUAL PERFORMANCE REPORT – WATER USE INTENSITIES FOR THE PAST THREE YEARS.**

FAO. 1993**. THE STATE OF FOOD AND AGRICULTURE 1993.** FAO Agriculture Series no 26.

Global Water Partnership. 2010. **WHAT IS WATER SECURITY? - THE WATER CHALLENGE**.

Grey, D & Sadoff, CW. 2007. **SINK OR SWIM: WATER SECURITY FOR GROWTH AND DEVELOPMENT.** World Bank, Washington DC.

Grobler, G. 2002. **PERSONAL COMMUNICATION**

Isabel Escobor *et al*. 2010. **SUSTAINABLE WATER FOR THE FUTURE – WATER RECYCLING VERSUS DESALINATION.** Elsevier Publishers.

Institute for Poverty, Land and Agrarian Studies. **FACT CHECK NO. 1 LAND REFORM, THE DISTRIBUTION OF LAND IN SOUTH AFRICA: AN OVERVIEW**. http://www.plaas.org.za/sites/default/files/publications-pdf/No1%20Fact%20check%20web.pdf

Li, Y. and Migliaccio, K. 2010. **WATER QUALITY CONCEPTS, SAMPLING, AND ANALYSES.** CRC Press.

National Planning Committee (NPC). 2011. **DIAGNOSTICS REPORT**, Pretoria, South Africa.

National Planning Commission (NPC).2011. **NATIONAL DEVELOPMENT PLAN 2030 OUR FUTURE-MAKE IT WORK**. Pretoria, South Africa.

National Treasury. 2016. **THE STATE OF LOCAL GOVERNMENT FINANCES AND FINANCIAL MANAGEMENT**. Pretoria, South Africa.

National Treasury. 2017a. **DIVISION OF REVENUE ACT.** Pretoria, South Africa.

National Treasury.2017b. **MUNICIPAL BORROWING BULLETIN & MUNICIPAL BUDGET DATA BASE.** Pretoria, South Africa.

National Treasury.2017c. **MUNICIPAL BUDGET DATA BASE (MSCoA).** Pretoria, South Africa.

Pitman, W, V. 2011. **OVERVIEW OF WATER RESOURCE ASSESSMENT IN SOUTH AFRICA: CURRENT STATE AND FUTURE CHALLENGES**. Water SA vol 37 no 5 Pretoria January 2011 http://www.scielo.org.za

Raziyeh Farmani David Butler et al**. RELIABLE, RESILIENT AND SUSTAINABLE WATER MANAGEMENT: THE SAFE & SURE APPROACH.**

Randall, A. 1981. **PROPERTY ENTITLEMENTS AND PRICING POLICIES FOR A MATURING WATER ECONOMY**. Australian Journal of Agricultural Economics, Vol. 25, No 3: 165-220.

Statistics South Africa. 2011. **CENSUS 2011 STATISTICAL RELEASE P0301.4.** Pretoria, South Africa.

Statistics South Africa. 2015. **LIVING CONDITIONS SURVEY 2014/2015**.P. Pretoria, South Africa.

Statistics South Africa. 2016. **COMMUNITY SURVEY 2016 STATISTICAL RELEASE P0301**.Pretoria, South Africa

Statistics South Africa. 2016. **STATS SA GENERAL HOUSEHOLD SURVEY 2016.** Pretoria, South Africa.

Strategic Water Partnership Network. 2016. **WATER ADMINISTRATION SYSTEM – FINAL REPORT PHASE 1 WATER RELEASE MODULE.**

Trans Caledon Tunnel Authority (TCTA). 2017**. TCTA ANNUAL REPORT, 2017.**

United Nations (UN Water). 2013. **WHAT IS WATER SECURITY?** http://www.unwater.org/publications/water-security-infographic/

United Nations (UN Water). 2016. **SUSTAINABLE DEVELOPMENT GOALS – 17 GOALS TO TRANSFORM OUR WORLD: INTEGRATED MONITORING GUIDE FOR SDG 6: TARGETS AND GLOBAL INDICATORS.** Work in progress. Pp 1-26.

Water Research Commission. 2005. **A COMPILATION OF ALL THE FRESHWATER AGREEMENTS ENTERED INTO BY SOUTH AFRICA WITH OTHER STATES**. Report No. WRC K5-1515. Pretoria, South Africa

Water Research Commission. 2012. **THE STATE OF NON-REVENUE WATER IN SOUTH AFRICA.** Report TT 522/12. Pretoria, South Africa.

Water Research Commission. 2015. **SOUTH AFRICA'S WATER RESEARCH, DEVELOPMENT, AND INNOVATION (RDI) ROADMAP: 2015-2025**

Water Research Commission (WRC). 2017. **NATIONAL GROUNDWATER STRATEGY (Report No.TT714/17).** Pretoria, South Africa.

World Wide Fund – South Africa (WWF-SA). 2013. **AN INTRODUCTION TO SOUTH AFRICA'S WATER SOURCE AREAS: THE 8% LAND AREA THAT PROVIDES 50% OF OUR SURFACE WATER.** Cape Town, South Africa. pp. 1-29

NOTES

DEPARTMENT OF WATER AND SANITATION
185 Francis Baard Street, PRETORIA, 0001, South Africa
Tel: +21 12 336 7500 • www.dws.gov.za