HELEN SUZMAN FOUNDATION

THE STATE OF WATER DELIVERY IN SOUTH AFRICA IN AN ERA OF CLIMATE UNCERTAINTY

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We acknowledge gratefully the financial support received from the Friedrich Naumann Foundation for the project.

FRIEDRICH NAUMANN STIFTUNG Für die Freiheit.

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ABBREVIATIONS

BGCMA	Breede-Gouritz Catchment Management Agency
BD	Blue Drop
CMA	Catchment Management Agency
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DHSWS	Department of Human Settlements, Water and Sanitation
DWS	Department of Water and Sanitation
G&D	Growth and Development
IDP	Integrated Development Plan
IRIS	Integrated Regulatory Information System
JRA	Johannesburg Roads Authority
KOBWA	Komati River Basin Water Authority
LIMCOM	Limpopo Watercourse Commission
MFMA	Municipal Finance Management Act
mg/L	milligram per litre
µg/L	microgram per litre
mL	millilitre
MPAC	Municipal Public Accounts Committee
NEMA	National Environmental Management Act
NIWIS	National Integrated Water Information System
NWA	National Water Act
NWRS	National Water Resource Strategy
ORASECOM	Orange/Sengu River Basin Commission
OUTA	Organization Undoing Tax Abuse
SADC	Southern African Development Community
SALGA	South African Local Government Association
SANS	South African National Standard
SDF	Spatial Development Framework
StatsSA	Statistics South Africa
UN	United Nations
USO	Universal Service Organisation
WHO	World Health Organization
WRC	Water Research Committee
WSA	Water Services Act or Water Services Authority
WSDP	Water Services Development Plan
WSKS	Water Services Knowledge System
WSUD	Water Sensitive Urban Design
WUA	Water User Association

A. INTRODUCTION

1. Scope and output

In late 2018, the Helen Suzman Foundation embarked on a study of the provision of water in South Africa. The outputs from this project are:

1. A set of thirty-three briefs, published between January 2019 and February 2020. Listed in Appendix 3, they report our findings in detail.
2. This consolidated report, which provides an overview of the framework for delivery of water services and its outcomes, and which was finalised in April 2020.
3. A list of recommendations, included in this document, and also published separately.

We quickly realised that we would have to choose between alternative approaches to a very large topic. We have chosen to concentrate on water services rather than on water sources. And we have developed a fuller account of the legal and institutional framework for the delivery of water services than of delivery outcomes. Nonetheless, we have some things to say about sources, and more to present on the extent of water infrastructure, its reliability and the quality of water delivered. Our account will reveal incomplete implementation of legislation and policy, disarticulation between provinces on the one hand, and catchment management agencies and water boards on the other, and the highly uneven abilities of water service authorities to deliver water to consumers. Given the aridity of much of the country, the continuing growth of the population and the increasing stress from climate change, much remains to be done if there are to be minimally adequate water services in the coming years.

Gariep dam on a clear day, one of the biggest dams in South Africa

B. LEGISLATIVE AND INSTITUTIONAL BACKGROUND

1. Legislative framework

Since the advent of democracy, South Africa has set out to reform its water law to align with constitutional values. The newly elected democratic government was tasked with developing a legal framework that governed access to and use of water in an equitable and sustainable manner. In response, the White Paper on a National Water Policy for South Africa was published in 1997 with a set of 28 principles developed to guide the drafting of a new water management framework. Included was the principle that water is held in public trust by the government. In addition, the principles emphasised the need to ensure equitable access to and allocation of water, preferential rights of usage instead of ownership, sustainability and integrated water management. This laid the foundation for South Africa's current legal framework, which seeks to regulate and integrate water resources on the one hand, and water services on the other. In addition, given the role of climate-related impacts on the water sector, domestic and international strategies on climate change have become progressively more important within the legislative framework.

1.1. Constitutional imperatives

The Constitution, in its very first section, entrenches South Africa's founding values of human dignity, the achievement of equality and the advancement of human rights and freedoms.

Section 27 guarantees everyone's right to access sufficient water and places an obligation on the state to take legislative and other measures to achieve the progressive realisation of this right. It also affords the rights to equal benefit of the law – ensuring that there is no unfair discrimination in providing water services – human dignity, and life. Further enshrined are the right to an environment that is not harmful to one's health or wellbeing and the right to just administrative action in water-related decisions. The Constitution also sets out values and principles by which the public administration should be governed.

Finally, it allocates different competencies to local, provincial and national government in the management of water. Central to managing water as a resource, national government has legislative and executive authority over fresh water resources,[1] while municipalities must administer water and sanitation services limited to potable water supply, domestic waste water and sewage disposal systems.[2] Local government must structure and manage its administration, budgeting and planning processes in a manner that gives priority to the basic needs of the community, including water services, and promotes the social and economic development of that community.[3] Therefore, national government has authority over water resources while municipalities, as the governance sphere closest to communities, are placed in charge of delivering water services. National government's regulatory role in water services is constrained by the constitutional mandate given to local government, and several challenges exist in intervening in support of the right to water in this sense.

The Banana bridge, over the Woodstock dam in South Africa

1. Fresh water resource management is not listed in Schedule 4 or 5 of the Constitution dealing with functional areas of concurrent national and provincial legislative competence and functional areas of exclusive provincial legislative competence respectively. Therefore, it falls within the residual competence of national government.
2. Section 156 read with Schedule 4, Part B of the Constitution.
3. Section 153(a) of the Constitution.

1.2. National Water Act

The National Water Act 36 of 1998 (NWA) provides the legislative framework for managing South Africa's water resources. As public trustee, an obligation is placed on national government – acting through the Minister of Water and Sanitation – to ensure that water resources are managed for the benefit of all. Guided by central principles of sustainability and equity, the Act is structured to ensure the protection, conservation, use, management, development and control of water resources. In doing so, it places significant focus on (i) protection, (ii) use, and (iii) management.

Protection: The Act recognises that protecting water resources is essential to effective water management. It puts measures in place for establishing a water resource classification system, resource quality objectives and what is known as "the reserve" to ensure they are comprehensively protected. The water resource classification system places each significant water resource in one of three defined classes, using a seven-step procedure prescribed by regulation, which determines the level of protection required for a water resource and the extent to which water from that resource is used.[4] A Class I water resource is minimally used, Class II is moderately used and Class III is heavily used. Once a water resource is classified, the Minister must determine the resource quality objectives which set out clear goals relating to the quality of each resource and the level of protection required to maintain the necessary quantity and quality for the prescribed use of the resource. The NWA also provides for determining the reserve for every water resource. This refers to the quantity and quality of water required to be set aside, or reserved, to satisfy basic human needs and protect aquatic ecosystems. These three systems are envisioned to work together to ensure resource protection.

Use: Given South Africa's shift from riparian rights of ownership of water to rights of usage, a core feature of the Act is regulating permissible water use. This is done by setting regulatory parameters for licensed and unlicensed entitlements to use water. "Water use" is defined broadly to include taking water from a water resource, storing water, impeding or diverting the flow of water in a watercourse, reducing stream flow through certain activities, discharging water, altering characteristics of watercourses, removing or discharging water found underground, and using water for recreational purposes. Generally, water use must be licensed unless included in Schedule 1 of the NWA, which provides for reasonable water use for domestic purposes, small gardening, animal grazing, and emergency situations, amongst other things.

Management: The Act regulates the management of water resources through officials, instruments and institutional bodies. Officials, like the Minister and the Director-General, are given general powers and duties to manage water resources. Pursuant to this, the Minister is directed to develop the National Water Resource Strategy (NWRS) – a binding framework for strategically managing water resources on a national scale. While the Strategy does not constitute legislation, all authorities and institutions that exercise powers in terms of the NWA must give effect to it.[5] NWRS II responds to the National Development Plan and is framed to achieve three core objectives, namely water that: supports development and the elimination of poverty; contributes to the economy and job creation; and is protected, used, developed, conserved, managed and controlled sustainably and equitably. The objectives are supported by key themes including water resource planning, development and infrastructure management, resource protection, water conservation and demand management, climate change, regulation and international water resource management. On an institutional level, the Act envisions a decentralised institutional structure to management where local and regional communities are intricately involved in managing water resources in their area.

4. Regulations for the Establishment of a Water Resource Classification System, GN R810 in GG 33541 (17 September 2010).
5. Section 7 of the NWA.

1.3. Water Services Act

While the NWA deals with water as a resource, the Water Services Act 108 of 1997 (WSA) regulates access and delivery of water as a service. At its core, the WSA aims to provide for the right of access to basic water supply and sanitation necessary to secure constitutionally entrenched rights to sufficient water and to an environment that is not harmful to human health and wellbeing. In line with the constitutional imperative, the WSA acknowledges the authority of local government to deliver water and sanitation services and the respective role of national government to support and strengthen municipalities in this mandate.

To this end, a duty is placed on municipalities, as water services authorities as defined by the WSA,[6] to ensure over time efficient, affordable, economical and sustainable access to water services. From a planning perspective, this includes developing a water services development plan (WSDP) – usually as part of its integrated development planning processes – setting out strategies for service delivery in the area. Norms and standards related to the delivery of water are prescribed by the Minister in terms of the WSA, and various institutions – including providers, intermediaries, committees and water boards – are established to manage access and delivery of water services effectively.

The WSA also compliments the NWA by promoting effective water resource management and conservation.

1.4. Local Government legislation

As local government is constitutionally obliged to provide access to water services, three Acts regulating municipalities are central features in the framework governing these services. First, the Local Government: Municipal Structures Act 117 of 1998 (Municipal Structures Act) provides the basis for establishing municipalities into the three categories defined by the Constitution – metropolitan, local and district municipalities – and defines the executive systems, functionaries and operational requirements available to municipal councils.

Secondly, the Local Government: Municipal Systems Act 32 of 2000 (Municipal Systems Act) establishes mechanisms necessary to ensure access to services, like water and sanitation services. It compels each municipality to develop an integrated development plan (IDP) – an essential tool for ensuring that local government achieves its constitutional objectives, gives effect to its developmental duties and addresses service delivery implementation. Essentially, each IDP must integrate developmental plans and objectives for the area and align resources and capacity to implement the plan.[7] Once adopted, the IDP is binding on the municipality in the exercise of its executive authority. Oftentimes, the municipality's WSDP and IDP is incorporated into a single plan but, if not, the objectives of the plan must be aligned to ensure an integrated vision and development.

Lastly, the Local Government: Municipal Finance Management Act 56 of 2003 (MFMA) provides mechanisms to ensure the financial affairs of municipalities are managed effectively and sustainably. This, together with its national counterpart,[8] provides for financial reporting and auditing within municipalities and sets out mechanisms for provincial intervention where municipalities fail to provide basic services to their communities.

1.5. Environmental legislation

Given the relationship between water as a natural resource and the delivery of water services, environmental legislation is central to the regulatory framework. The National Environmental Management Act 107 of 1998 (NEMA) is South Africa's framework environmental legislation which gives effect to the environmental rights enshrined in the Constitution. It provides for principles intended to inform the management of natural resources including principles of sustainable development, environmental justice, equitable access, public trust, access to information, and transparency, accountability and public participation. In addition to these principles, NEMA's leading feature is the obligation to obtain an environmental authorisation before proceeding with an activity which has been listed as having an impact or potential impact on the environment.[9] Where an activity triggers authorisations from several different environmental Acts, NEMA allows for the relevant authorities to issue an integrated environmental licence to streamline the process. From a water use perspective, this mechanism aligns environmental licensing rights and obligations with those issued in terms of the NWA, for example.

6. A water services authority is a municipality responsible for ensuring access to water services. Not all municipalities in South Africa are water services authorities.
7. An IDP must reflect the municipal council's vision for the long-term development of the municipality, an assessment of the existing level of development in the municipality, including an identification of communities which do not have access to basic municipal services, the council's development priorities and objectives, a spatial development framework, operational strategies, disaster management plans, a financial plan, including a budget projection, and key performance indicators.
8. Public Finance Management Act 1 of 1999.

1.6. Climate change strategies

With rising temperatures, climate-related impacts are most severely felt within the water sector.[10] In response, South Africa has initiated a process – aligned to international efforts – to define its vision for effectively addressing the impacts of climate change. The process culminated in the National Climate Change Response White Paper[11] (Response White Paper) which outlined South Africa's plan to mitigate against and adapt to the changing climate. Since then, the transition of South Africa to a more resilient, lower-carbon economy and society has been slow as most adaptation and mitigation mechanisms have yet to be formally put in place. Although the Carbon Tax Act was enacted on 23 May 2019, the Climate Change Bill, 2018 has still not been tabled. The Minister, in a presentation to a Parliamentary Committee, indicated that it would be tabled in 2021.

While the mitigation potential in the water sector is relatively small,[12] adaptation measures are ideally placed to reduce vulnerability and enhance resilience within the water sector. Given uncertainty about the impact of projected changes to climate, South Africa has opted for a scenario-based approach to explore adaptation options generally, and within vulnerable sectors, including water.[13] Each scenario provides a set of appropriate adaptation responses. A flagship research programme focusing on the long-term adaptation scenarios for the water sector was also initiated.[14] It set out three broad response options. First, integrating adaptation into the water resources planning framework; secondly, incorporating climate change into reconciliation studies; and lastly, including adaptation priority measures in the draft climate change adaptation strategy for the water sector.

More generally, the National Climate Change Adaptation Strategy, adopted in August 2020[15], sets out South Africa's primary adaptation plan in fulfilment of its international obligations. The plan is strategically driven by four key objectives: (i) to build climate resilience and adaptive capacity to respond to climate change risk and vulnerability; (ii) to promote the integration of climate change adaption response into development objectives, policy, planning and implementation; (iii) to improve understanding of climate change impacts and capacity to respond to these impacts; and (iv) to ensure resources and systems are in place to enable implementation of climate change responses. These objectives are linked to interventions, outcomes and actions.

9. This includes a requirement that an environmental impact assessment be undertaken.
10. DHSWS, 2013, National Water Resources Strategy II.
11. DEA, 2011, National Climate Change Response White Paper.
12. Although adaptation measures such as desalination, for example, may have mitigation implications through their energy demands.
13. DEA, 2014, Climate Change Adaptation Scenarios. South Africa has identified three fundamental climate scenarios: (i) warmer and drier climate (temperature increase of less than 3°C and reduced rainfall); (ii) warmer and wetter climate (temperature increase of less than 3°C and increased rainfall); or (iii) a hotter climate (temperature increase of more than 3°C).
14. DEA, 2013, Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) for South Africa: Implications for the Water Sector in South Africa.

2. International and regional obligations

Water is a shared commodity that transcends international borders and requires cooperation between states. South Africa shares four major water resources with its neighbours. This demands that water is managed in a way that optimises benefits for all states sharing a water resource. Transboundary water management requires upstream and downstream states to strike a balance between the equitable and reasonable use and protection of a shared resource while recognising state sovereignty – all this, while ensuring access to safe and sufficient water for everyone within each state. In appreciating the transboundary nature of water resources, South Africa has ratified international and regional instruments that seek to provide a framework for transboundary watercourse management.

The UN Convention on the Law of the Non-navigational Uses of International Watercourses (UN Water Convention) is a framework instrument – setting out general principles to guide states in negotiating agreements relating to shared watercourses.[16] In doing so, the Convention is aimed at ensuring that shared watercourses are managed and used equitably, reasonably, optimally and sustainably. Drawing from principles developed in the Helsinki Rules of 1966,[17] the Convention includes the principles of equitable and reasonable use and participation, the obligation not to cause significant harm, an obligation to cooperate and share information, and the principle that no single use enjoys inherent priority over another. It goes on to provide a framework for states to enter into agreements which apply and adjust the provisions of the Convention to the characteristics and uses of the shared watercourse.[18]

The regional framework, developed by the Southern African Development Community (SADC), creates similar obligations. In fact, the original Protocol on Shared Watercourses, which was developed by SADC states two years before the UN Water Convention was adopted, was later revised to recognise and align with its UN counterpart (Revised Protocol).[19] The purpose of the Revised Protocol is to promote closer cooperation between states for sustainable and co-ordinated management, protection and utilisation of shared watercourses and to advance SADC's primary agenda of regional integration and poverty alleviation.[20]

To facilitate sustainable and co-ordinated watercourse management, the Revised Protocol encourages member states to enter into agreements and establish institutions tasked with managing specific shared watercourses. It is envisioned that these institutions will facilitate integrated water management on a regional scale. As stated above, South Africa shares four major watercourses with all its neighbouring countries. Of the four major river basins that South Africa shares with its neighbouring countries, three institutions have been developed – the Orange/Senqu River Basin Commission (ORASECOM), the Limpopo Watercourse Commission (LIMCOM) and the Komati River Basin Water Authority (KOBWA). The primary purpose of these institutions is to advise the contracting states and provide recommendations on the uses, measures of protection and management of the respective watercourses.

Maguga Dam on river Komati in Swaziland

15. See https://www.environment.gov.za/mediarelease/nationalclimatechange_adaptationstrategy_ue10november19
16. The Convention was adopted in May 1997 and came into force in 2014. South Africa signed the Convention on 13 August 1997 and ratified it on 26 October 1998.
17. The Helsinki Rules on the Uses of Waters of International Rivers was developed in 1966 by the International Law Society as a guideline on how transboundary watercourses should be used and protected.
18. Article 3 of the Convention.
19. SADC Revised Protocol on Shared Watercourses, 2000.
20. Article 2 of the Revised Protocol.

3. Institutional framework

3.1. Institutional framework for managing water resources

The NWA introduced a legislative shift away from the centralised governance framework established by the Water Act of 1956 by directing the establishment of water institutions aimed at decentralising the management of water resources. These institutions, when properly constituted and fully functional, are envisioned to promote the sustainable use of water for the benefit of all users – the ultimate aim of water resource management[21] – and encourage community participation.

The NWA defines a water management institution as a catchment management agency (CMA), a water user association (WUA), a body responsible for international water management, or any person who fulfils the functions of a water management institution in terms of the NWA.

3.1.1. Department of Water and Sanitation

As the custodian of South Africa's water resources, the Department is ultimately responsible for ensuring that water is allocated equitably and used beneficially in the public interest, while promoting environmental values.[22] It is primarily responsible for developing and implementing the regulatory and policy frameworks within the water resources sector – including the NWRS, national monitoring and information systems, norms and standards, and pricing targets.

Central to its duties, the Department must manage and oversee water use allocations and ensure water sources are properly protected. But the Minister is also given the power to progressively establish CMAs and WUAs in pursuit of decentralising water resource management. These institutions ensure that local communities actively participate in water resource management. Where no functional CMA exists in a water management area, the Minister must fulfil the functions of a CMA in that area.

3.1.2. Catchment management agencies

CMAs are established to ensure that water resources are managed effectively at regional or catchment level where local community involvement is most effective.[23] It is here where local communities are envisaged to actively participate in the decision-making processes and encouraged to promote equitable access to water, ensuring that usage meets basic human needs and facilitates social and economic growth in the area.

The Minister, through the NWRS, must establish defined water management areas across the country within which CMAs will operate. The NWA envisages that each water management area will have a CMA. South Africa currently has nine water management areas (which are not aligned with provincial boundaries),[24] but only two fully operational CMAs have been established since the enactment of the NWA.[25] While other CMAs have been established, they are not yet functional.

Once a CMA is established and becomes operational it obtains general powers inherent to its establishment- like entering into contracts and borrowing money, for example. In order to manage regional water resources effectively, its initial functions include advising interested persons on handling water resources in the area, promoting community participation in water resource management and coordinating activities between water users and water management institutions within its designated area.[26] A CMA must develop a catchment management strategy for its area which it must implement in line with the NWRS. In addition to this, the Minister may delegate or assign a range of further powers and duties to CMAs. [27]

3.1.3. Water user associations

WUAs are water management institutions established by the Minister that operate at a local level.[28] While they are defined as water management institutions, their primary role is not water management (although the Minister and CMAs may delegate water management functions to WUAs). Instead, WUAs provide the institutional structure necessary for individual water users to cooperate and pool their resources – allowing them to carry out water-related activities more effectively. The functions of a WUA depend largely on its constitution drafted in terms of the NWA.

Another means of creating WUAs is through irrigation boards. Historically, irrigation boards were established to fund poor white farmers. Under the NWA, irrigation boards are to be transformed into WUAs and made available to previously disadvantaged individuals, particularly farmers. But this process has been slow – in 2017, the Minister reported that the Department had achieved little transformation.[29]

21. Preamble of the NWA.
22. Section 3(2) of the NWA.
23. CMAs are regulated by Chapter 7 of the NWA.
24. New Nine Water Management Areas of South Africa, GN 40279 in GG 1056 (16 September 2016).
25. Breede-Gouritz CMA in parts of the Western Cape and Eastern Cape provinces and Inkomati-Usuthu CMA largely falling within Mpumalanga.
26. Section 80 of the NWA.
27. In terms of section 63(1)(c) of the NWA, the Minister may delegate a power and duty to a water management institution, including a CMA.
28. Established and regulated by Chapter 8 of the NWA.
29. See the Report to the Parliamentary Committee for Water and Sanitation, 2017. In the 20 years since the enactment of the NWA, only 99 irrigation boards have been transformed into WUAs, with 100 boards still waiting to undergo the process. The Department attributes the slow transformation rate to access to land, capacity and skills, and allocation of services.

Figure 1 – Catchment Management Agencies

Note: New Catchment Management Agencies are labelled in blue and old Water Management Areas are subdivisions of them.

3.1.4. International Water Management Organisations

The NWA gives the Minister the authority to establish bodies, or institutions, for purposes of implementing international agreements that deal with the management and development of shared water resources. Certain bodies that were established before the enactment of the NWA are considered international water management bodies under Chapter 10 of the NWA. These include the Trans-Caledon Tunnel Authority (1986), the Komati Basin Water Authority (1992)[30] and the Vioolsdrift Noordoewer Joint Irrigation Authority (1992). These bodies may perform their functions outside of South Africa.[31]

3.2. Institutional framework for delivering water services

The WSA sets out the regulatory framework for institutions that are permitted to manage the access and delivery of water services. These institutions include (i) water services authorities, or municipalities, (ii) water services providers, (iii) water boards, (iv) water services intermediaries, and (v) water services committees.

3.2.1. Water services authorities

A water services authority is a local or district municipality that is responsible for ensuring access to water services in its jurisdiction.[32] Therefore, not every municipality is a water services authority for purposes of WSA. Of South Africa's 278 municipalities, only 145 are water services authorities.[33]

Given that the type, size and capacity of municipalities differ across the country, the means by which they ensure that these services are delivered will vary. Water services authorities may themselves provide these water services, contract these services out to water services providers or enter into a joint venture with another water services institution to provide the services.[34] If a municipality (that is a water services authority) performs the functions of a water services provider itself, it must manage and account separately for those functions.[35] It may also provide such services outside its area of jurisdiction if contracted to do so by another municipality. If, on the other hand, it contracts these services out to other providers, it must monitor their performance to ensure compliance.[36]

30. Section 108 of the NWA.
31. Section 103(3) of the NWA.
32. Section 1 of the WSA.
33. The list of water services authorities is taken from the Department's National Water Services Knowledge System.
34. Section 19 of the WSA.
35. Section 20(1) of the WSA.
36. Section 27 of the WSA.

3.2.2. Water services providers

As stated earlier, a municipality may contract with a public or private water services provider to supply water and sanitation services.[37] The regulatory framework provides for a range of institutional arrangements to ensure provision of water services, each with its own set of benefits and restrictions. Arrangements may include providers in the form of the municipality itself, another municipality, a municipal utility, a multi-jurisdictional utility, a water board, a community-based organisation, a private company, and a venture owned jointly by a municipality and national government.[38]

When externally contracting out, municipalities may only enter into an agreement with a private sector provider after it has considered all known public sector providers who are willing and able to perform the functions.[39] The Minister has published regulations setting out compulsory contractual provisions to be included when contracting with a water services provider, including the scope of the water services to be provided, performance targets and indicators, and the obligations placed on municipalities that are necessary to achieve the targets.[40] Where the contract places an obligation on the provider to supply services directly to the consumer, the provider must prepare and publish a consumer charter that establishes a system for dealing with consumer complaints and sets out the consumer's right to redress.[41] Consumers in the area must be given an opportunity to participate in developing the charter.

3.2.3. Water boards

Water boards are organs of state established by the Minister,[42] which provide, as their primary activity, bulk water services to other water services institutions within a specific area.[43] While it may carry out other activities, a water board must ensure that these secondary activities do not interfere with its primary function of providing water services. All its activities must be laid out in a contractual agreement.[44] When a water services institution requests the services of a water board, it may not refuse the request unless it would not be viable, for technical and financial reasons, to provide the water services.[45]

South Africa currently has nine water boards, with Rand Water in Gauteng, Umgeni Water in KwaZulu-Natal and Overberg Water in the Western Cape being the largest three water boards in the country.[46]

3.2.4. Water services intermediaries

A water services intermediary is any person or organisation who is obliged to provide water services to another in terms of a contract where the obligation to provide water services is incidental to the main object of the contract. If the main purpose of the contract is to provide water services, the person is classified as a water services provider, not an intermediary. For example, farmers that are responsible for providing housing and related services to their employees living on the premises are considered intermediaries when they are contractually obliged to provide basic water services to their employees. This is also true for mining companies who provide water to their employees living in mining hostels and houses.

While the obligation placed on an intermediary is incidental and flows from a contract, it must still ensure the quality, quantity and sustainability of water services meets the minimum standards prescribed by the Minister and the municipality, and it may not charge tariffs that do not comply with the prescribed norms and standards. Municipalities may require that intermediaries are registered with them but, even if registration is not a requirement, municipalities must monitor them to ensure compliance with their duties and functions.

37. Section 19 of the WSA.
38. See WRC Report No. 1812/1/10, Situational Analysis of Water Services Provision in South Africa – Establishing Future Strategies for Consideration by Municipalities, March 2011, for a broad exposition of the institutional arrangements.
39. Section 19(2) of the WSA.
40. Water Services Provider Contract Regulations, GN R980 in GG 23636 (19 July 2002).
41. Regulation 13 of the Water Services Provider Contract Regulations.
42. Section 28(1)(a) of the WSA.
43. Section 29 of the WSA.
44. Section 32(a) of the WSA.
45. Section 32(b) of the WSA.
46. Other water boards include Amatola Water, Bloem Water, Lepelle Northern Water, Magalies Water, Mhlathuze Water and Sedibeng Water.

Primary water treatment clarifier at old water treatment plant, South Africa

3.2.5. Water services committees

The WSA empowers the Minister to establish water services committees to provide water supply and sanitation services to consumers within a specific area. The Minister must consult with the inhabitants of the proposed service area, the municipality, the relevant Minister and the relevant province.[47] A committee comprises a chairperson, deputy chairperson and additional members, appointed by the Minister. Once constituted, the committee must develop a constitution that provides for its daily functioning.[48] While committees of this nature are scarce, to the point of virtual non-existence, communities may increasingly turn to this mechanism given the inability of municipalities to provide services despite community members paying their tariffs.

Water management is complex. Not only does it demand an acute understanding of the social, economic, legal and environmental factors influencing the water management framework, but it also requires an awareness of the water sector's external impact on health, development, poverty alleviation, business, agriculture and energy. This means that effective governance within the sector is crucial. But there is growing consensus that the challenges facing the water sector are largely matters of governance.[49] This should place governance and management at the forefront of discussions on the state of water services delivery.

47. Section 51 of the WSA.
48. Section 55(6) of the WSA.
49. Katko TS et al. (2013) "Water Services Management and Governance"; OECD (2011) "Water Governance in OECD Countries: A Multi-level Approach"; UNDP (2004) "Water Governance for Poverty Reduction".

C. ASPECTS OF WATER GOVERNANCE AND MANAGEMENT INFLUENCING THE DELIVERY OF WATER SERVICES

1. Effectively managing water resources

Effectively managing water resources affects key components of water services delivery – impacting not only the quantity of water available to consumers in an area but, oftentimes, also its quality. The Department is commissioned to ensure that the country's water resources are managed in a manner that safeguards its availability for current and future consumers while also sustaining its environmental obligations. In effect, therefore, the Department must undertake an integrated approach to water management – in view of South Africa's social, economic and environmental conditions and considerations. A comprehensive review of all the Department's obligations is not possible here, but an overview of the Department's administrative obligations relating to allocating water for use provides a glimpse of the complexities involved in the process.

1.1. Mechanisms to allocate water are complex and administratively onerous

A whole chapter of the NWA[50] is dedicated to regulating the use of water. In terms of the Act, water may not be used unless permitted by four entitlements established by the Act.[51] These include schedule 1 use, which involves only small volumes of water, existing lawful use, licensed use and general authorisations. The Department is in charge of administering most of these processes which entail complex and administratively onerous operations. Entitlements permitted under an existing lawful use, for example, require the user to register their use, validate the quantity used and verify the lawfulness of the use.[52] Validation and verification forms part of a highly technical process that is foundational to our knowledge and understanding of water use rights. Unfortunately, the process remains incomplete for many water resources.[53] This means that we have an unreliable sense of the quantity of water used and who lawfully owns the right to use it for productive purposes.

Once a licence has been issued, compliance with the conditions that accompany the licence must continuously be monitored and enforced. However, the Department is unable to cope given its current financial and operational challenges. A 2019 report by the Centre for Environmental Rights, for example, highlights a complete failure by the Department to monitor and enforce compliance with water use licences issued to coal mines in Mpumalanga.[54] To date, the Department has not published its own report on the results of its compliance monitoring and enforcement activities, nor does it oblige companies involved in water use activities to publish compliance data themselves. This makes it more difficult for civil society to monitor water use activities. A failure to monitor use and enforce licensing conditions aimed at protecting and conserving water resources, in turn, has implications for the protection, conservation, development and management of water resources.

1.2. Decentralising water resources management

Given the institutional and operational challenges that currently face the Department, together with the complexities of an integrated approach to managing water resources, the Department is struggling to fulfil its obligations effectively. While the NWA placed the Department as sole public trustee of the country's water resources, it did not require the Department to carry this burden alone. In fact, the Act envisions a decentralised approach to water management by permitting the establishment of catchment management agencies.[55]

The primary purpose of CMAs is to ensure that water resources are managed effectively at a regional or catchment level. It is intended that every water management area established by the Minister through the national water resources strategy will have a CMA.

CMAs are not only important for encouraging and facilitating more community involvement in the management of regional water resources, but they have the potential to lighten the burden placed on the Department – if appropriately capacitated. The NWA confers general powers and functions to a CMA once it is established.[56] Amongst these functions are investigating and advising interested persons on handling water resources in the area, developing a catchment management strategy, coordinating related activities of water users and institutions within the area and promoting community participation in water resources management. The catchment management strategy may set out principles for water allocation and use, and may consider issues relating to protecting, conserving, managing and controlling water resources within the catchment. However, powers to perform functions relating to water resources management must first be delegated or assigned to CMAs in terms of the NWA[57] before they are empowered to give effect to many of the principles set out in the strategy. These include the power to manage, monitor, conserve and protect water resources in their area, making rules to regulate water use, temporarily control and limit or prohibit the use of water during periods of water shortage. But even more, the Minister may assign powers to a CMA to administer existing lawful uses and licences in the area.[58]

50. Chapter 4 of the NWA.
51. Section 4 read with section 22 of the NWA.
52. Section 35 of the NWA and the regulations requiring that a water use be registered, GNR 1352 of GG No 20606 of 12 November 1999.
53. Breede-Gouritz CMA initiated its verification project in 2017. It was envisioned to run until November 2019. The IUCMA Annual Report 2017/2018 stipulates that the verification process in the Inkomati area is complete but it is still ongoing in the Usuthu area. Calls to start the engagement process into verification in the Olifants water management area were only published in 2017. This despite the Olifants river catchment being cited as one of the most stressed catchments from both a water quantity and quality catchment in South Africa. At the time of finalisation of this report, there had been no progress reported on this project.
54. CER (2019) "Full Disclosure: The Truth about Mpumalanga Coal Mines Failure to Comply with their Water Use Licences".
55. Chapter 7 of the NWA.
56. Section 80 of the NWA.
57. Section 73 read with Schedule 3 of the NWA.
58. Section 73 of the NWA.

Therefore, given their potential role, effectively managing water resources is significantly enhanced by decentralising management and establishing CMAs. However, South Africa only has two operational CMAs – the Breede-Gouritz CMA in the Western Cape and the Inkomati-Usuthu CMA in parts of Mpumalanga. Establishing, capacitating and operationalising CMAs to date has proven to be a lengthy affair.[59] It is a highly participatory process, engaging stakeholders, ensuring labour relations and administrative structures are developed and securing the necessary financial and human resources. Given the considerable delay in establishing CMAs [60] and ensuring that they fulfil their mandate as regional water management institutions, some critics have questioned whether establishing CMAs is a viable model for South Africa, particularly in view of the considerable challenges facing the Department. If decentralised governance through CMAs is not the appropriate vehicle for better water resources management, however, it is unclear what the alternative model should look like.

Making use of regional or provincial Departmental offices is not working. Provinces do not have the competence in terms of the Constitution to influence the functioning of water governance or management – apart from their shared responsibility with national government to oversee and support local government in delivering water services.[61] Nor is it an effective model. The remaining seven CMAs, for example, are in the process of being established and are managed by the relevant provincial Department offices. Herein lies a significant challenge for the Department and the effective management of water resources: boundaries for water resource management are not aligned to provincial ones. Catchments may span multiple provinces. The Department therefore has to work with more than one province to resolve issues affecting one catchment. The difficulties of liaising with a number of provincial offices on a single issue may be overcome, or at least notably reduced, through functional and fully capacitated CMAs.

Significant challenges in the establishment of CMAs can be overcome, but given the complex nature of water management within different catchments, there is no one size fits all solution. The potential of CMAs remains significant and largely untapped, and it might take time. But the NWA allows the Minister to appoint advisory committees to develop the capacity as a first step toward establishing functional CMAs.[62] Given the NWA's design of decentralised water governance, it envisions the role of CMAs to be far more substantial than they are at present.

Bellair dam

59. WRC (2018) "Lessons learnt from the Establishment of Catchment Management Agencies in South Africa" WRC Report No 2320/1/18.
60. Brown J (2011) "Assuming too much? Participatory water resource governance in South Africa" Geographical Journal 177(2), 171-185.
61. While the Constitution affords provincial and national government the shared legislative competence over the environment, the NWA – which was enacted to give effect in part to the constitutional right of access to sufficient water – places the ultimate responsibility of managing water resources solely in the hands of the Department. This does not mean that provinces do not play a role in managing water resources through their environmental mandate, but it is limited.
62. Chapter 7 read with Chapter 9 of the NWA.

2. Water services at local level

2.1. Institutional support for the delivery of water services

From an institutional perspective, water services authorities and water boards are identified as key role players in the delivery of water services. Established in terms of the WSA, they are mandated respectively to ensure the delivery of bulk, commercial and household water supply.

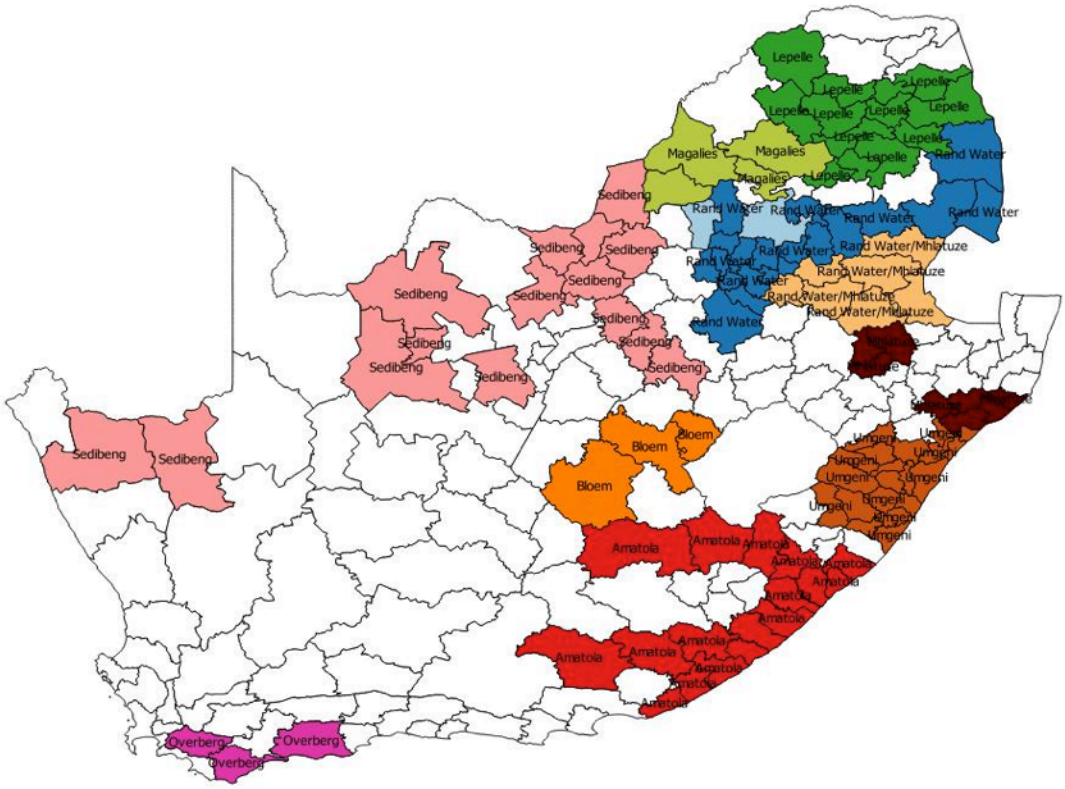
Water services authorities are either local municipalities[63] or district municipalities within which local municipalities are located. They are responsible for the distribution of water within their jurisdictions. Five provinces (Free State, Gauteng, Mpumalanga, Northern Cape and Western Cape) have only local municipal water services authorities, whereas the other four have a mixture of local and district municipal water services authorities. In 89 local municipalities, the water services authority is a district municipality (21 district municipalities are water services authorities) and in the remaining 124 local municipalities are themselves the water services authorities. There are 145 water services authorities in all.[64]

The supply of bulk water to water services authorities may be provided by water boards, which themselves obtain water from nationally regulated water sources. The areas of supply of water boards do not cover the whole country. Some water services authorities obtain water from local sources under a system of water abstraction rights registered with the Department of Water and Sanitation. 110 local municipalities are supplied through water boards, and 103 are not. The map below shows the extent of water board supply.[65]

Accordingly, local municipalities can be classified in two ways:

i. whether the WSA serving them is the local municipality itself or a district municipality; or
ii. whether the municipality is within the area of supply of a water board.

Figure 2 – Municipalities supplied by Water Boards



63. Metropolitan municipalities are here regarded as local municipalities.
64. The list of WSAs is taken from the Department's National Water Services Knowledge System.
65. Information provided by the Department of Human Settlements, Water and Sanitation.

2.1.1 Financial standing of water services authorities

The 2016/17 Auditor-General's report classifies MFMA audit outcomes into six categories. Table 1 indicates the distribution of WSAs across them:

TABLE 1

Audit outcomes	Local municipality WSAs	District municipality WSAs
Financially unqualified with no findings	21	1
Financially unqualified with findings	44	7
Financially qualified with findings	33	8
Adverse with findings		2
Disclaimed with findings	12	3
Audit not finalised at legislated date	14	
TOTAL	**124**	**21**

Note: Findings relate to non-financial aspects of local government management. Their presence indicates material defects in these aspects. Financially unqualified means that the Auditor-General has found no grounds for a negative evaluation of the accounts submitted for audit.

The National Treasury's *The State of Local Government Finances and Financial Management* as at 30 June 2017 report calculated a financial stress indicator. Municipalities with scores of 16 or above are regarded as financially distressed. The distribution of stress scores across local and district municipalities is set out in Table 2.

TABLE 2

Financial stress scores	Local municipality WSAs	District municipality WSAs
8-10	5	1
11-13	23	3
14-15	27	6
16-17	22	4
18-19	29	6
20+	18	1
TOTAL	**124**	**21**

69 local municipality WSAs and 11 district municipality WSAs were financially distressed, representing just over half all WSAs.

2.1.2 Water supply capacity

The Department's National Water Service Knowledge System supplies information on four key variables bearing on the capacity of WSAs, as self-assessed, in 2017/18. These are:

i. Water services planning
ii. Technical staff capacity
iii. Water conservation and water demand management
iv. Infrastructure asset management

Each variable is represented by a score between zero and 100. The average score across these variables is taken as an indicator of water supply capacity.

2.1.3 Relationship between the variables

The question then arises: what are the effects of (a) conditions leading to poor audit outcomes and (b) financial stress on water supply capacity?

We have three variables:

Auditor-General audit outcomes (excluding the unfinalised category: the higher the score, the worse the situation.

Financial stress scores: the higher the score, the worse the situation.

The capacity score: the higher the score, the better the situation.

The correlations between the variables are significantly different from zero and have the expected sign, but they are weak. This means that there are WSAs with poor audit outcomes and high levels of financial distress that assess their water supply capacity as relatively good and there are WSAs with good audit outcomes and low levels of financial distress that assess their water supply capacity as relatively poor.

The results suggest the following interpretation. A poor audit outcome indicates disorganisation, incompetence and/or corruption within a WSA. Financial stress indicates lack of resources within a WSA. The association suggests that these factors are related, but not strongly: lack of resources, occasioned by weak local fiscal conditions do not necessarily entail disorganisation, incompetence and corruption, nor is disorganisation, incompetence and corruption confined to WSAs with a poor fiscal base. Moreover, while poor audit outcomes and financial stress have an adverse effect on self-assessed water supply capacity, the relationship is limited. A major limitation of this finding, however, is that self-assessed water supply capacity is not necessarily perfectly correlated with actual water supply performance.

2.2 Important aspects of governance at water services authorities influencing the delivery of water

Water services authorities are those municipalities that have been authorised to deliver water services to consumers in a designated area. Therefore, the regulatory framework governing local government equally applies to water services authorities.

The Constitution establishes local government as an autonomous sphere, giving municipalities the right to govern the local affairs of their communities quite independently and on their own initiative.[66] It places the legislative and executive authority of each municipality in its municipal council, which consists of democratically elected representatives. The council exercises its legislative power by passing by-laws, passing a budget and imposing rates, levies, taxes, service fees and surcharges; and, importantly, performing oversight of the municipality's executive and administrative functions. The rest of the council's functions can be characterised as largely executive in nature.

Parliament has recognised the need to separate, at least in part, legislative and executive municipal functions by establishing five different executive systems within which municipalities operate.[67] Each allows for varied levels of council oversight, accountability and transparency.

2.2.1 Executive systems of governance at water services authorities

Of the five executive systems available to municipalities, two are most common – the collective executive system and the mayoral executive system.

The collective executive system allows the municipal council to elect an executive committee from amongst its councillors. The effect is that the municipality's executive authority is collectively vested in this committee – which must be composed in such a way that the parties and interests represented are substantially the same as those represented in the council. The municipal council then also elects a member from this committee to serve as the municipality's mayor. The function of a mayor, different from the executive mayor discussed in more detail later, is more ceremonial in nature. She presides over meetings held by the executive committee, performs other duties which may include any ceremonial functions, and exercises the powers delegated by the municipal council or the executive committee.

Where a municipality opts for a mayoral executive system, the council elects from amongst its members an executive mayor in whom executive authority is vested. The executive mayor is assisted by a mayoral committee, solely appointed by the executive mayor from amongst the municipal councillors.[68] A significant difficulty lies in how the mayoral committee is defined. In *Democratic Alliance v Masondo NO*, [69] the Constitutional Court held that a mayoral committee is not regarded as a committee of the council. This has a couple of implications. First, unlike an executive committee, a mayoral committee does not need to be constituted in a manner that proportionally represents the parties and interests found in the municipal council. In practice, this means that mayoral committees often consist only of majority party representatives. Secondly, meetings of mayoral committees need not be open to the public. [70] The same is sometimes true for an executive committee within a collective executive system. But in this case, the executive committee is a committee of the council which means it is barred from closing a meeting to the public when considering draft by-laws, budgets, draft integrated development plans, draft performance management systems, or certain service delivery agreements.[71] A mayoral committee is not subject to the same legislative constraints.

66. Section 151(3) of the Constitution.
67. Section 7 of the Municipal Structures Act.
68. Appointed in terms of section 60 of the Municipal Structures Act.
69. Democratic Alliance and Another v Masondo NO and Another [2002] ZACC 28; 2003 (2) BCLR 128 (CC); 2003 (2) SA 413 (CC)..
70. Section 20(3) of the Municipal Systems Act.
71. Section 20(2) of the Municipal Systems Act. Also see Dullah Omar Institute (2008) "Holding the Municipal Elective to Account".

Functions and powers given to executive committees and executive mayors are virtually identical.[72] An executive committee, however, is structured in a manner that seeks to promote greater transparency and accountability within the executive. As it proportionately reflects the interests and parties represented in council, important policy and strategic planning considerations are open to a more robust debate than would be possible in a mayoral committee – where members often belong solely to the majority party. This creates the space for internal accountability within the executive. Participation from ordinary community members is also enhanced as executive committees are obliged to hold open meetings when considering important issues like draft by-laws.

2.2.2 Mechanisms of accountability and oversight in water services authorities

Public administration must be accountable.[73] As the legislative authority in municipalities, municipal councils must hold the administration and, more specifically, the municipal manager – as both the accounting officer of a water services authority as well as its head of administration – accountable for the municipality's performance and financial management.[74]

Therefore, the municipal manager performs key roles to ensure the municipality performs efficiently and delivers services to its community. First, as the head of administration, the municipal manager must ensure that the municipality's administration implements its IDP and operates within the performance management system. Both instruments are statutorily prescribed and designed to enable the municipal council to exercise oversight of administrative functioning, amongst other things. Additionally, the municipal manager is responsible and accountable for ensuring that water services are managed and provided in a sustainable and equitable manner. Secondly, as the accounting officer, the municipal manager is accountable for the municipality's financial performance and legislative compliance.

While the municipal council of a water services authority exercises the ultimate oversight role, oversight functions are often funnelled through two important committees within municipal structures before it reaches the council.[75] These include municipal audit committees[76] and municipal public accounts committees[77] (MPACs). Both committees serve similar roles. While audit committees are mandatory and serve as independent advisory bodies to councils on financial accountability and oversight, establishing MPACs is left to the discretion of the council and are usually created in an effort to assist the council in performing its functions more effectively and efficiently, including its oversight function.

Municipal councils rely heavily on these committees for reliable and credible information, insight and advice in order to exercise effectively their oversight role. Effective oversight and accountability within municipalities, therefore, requires:

i. Oversight and accountability mechanisms to be sufficiently independent;
ii. Committees must be sufficiently capacitated to perform oversight functions;
iii. Adequate access to information; and
iv. Effective consequence management or sanctions.

Cape Town, South Africa: Burst water pipe causes major damage to road in residential area.

72. Compare sections 44 and 56 of the Municipal Structures Act.
73. Section 195(f) of the Constitution.
74. Section 55 of the Municipal Systems Act.
75. Other structures exist that perform important oversight functions and inform the municipal council, including internal audit units and section 79 oversight and governance committees, which are not discussed, as information from these committees is eventually channelled to MPACs and municipal audit committees.
76. Section 166 of the MFMA. The committee performs five important functions: (i) advising the council, the executive authority and the municipality's management staff on internal financial controls and internal audits, risk and performance management, accounting policies, the adequacy, reliability and accuracy of financial reporting information, legislative compliance and performance management; (ii) reviewing the municipality's annual financial statements to provide the council with an authoritative and credible view of the municipality's financial position, its efficiency and effectiveness and its overall level of compliance; (iii) responding to the council on any issues raised by the Auditor-General; (iv) investigating the financial affairs of the municipality when requested by the council; and (v) performing any other functions that may be prescribed.
77. Established in terms of section 79 of the Municipal Structures Act.

Independence: The structural independence of municipal audit committees is statutorily protected, at least in part, by ensuring that (i) the majority of its committee members and the chairperson are external appointments, not employed by the municipality in any capacity; (ii) no councillor occupies a seat as a member of the committee; and (iii) at least three members have the appropriate experience.[78]

MPACs, on the other hand, are structurally less independent. Committee members are appointed by the council from amongst its councillors, and members may be removed by the council at any time. As committees of the council, MPACs must be constituted in a manner that fairly represents the parties and interests reflected in council itself.[79] While national government and the South African Local Government Association (SALGA) have issued guidelines for the establishment and functioning of MPACs, no further constitutional or statutory provisions currently regulate MPACs other than those applicable to section 79 committees. This means that the council appoints members to the MPAC from amongst its councillors, and while National Treasury and SALGA advise against the appointment of any executive councillors or municipal office bearers to avoid obvious conflicting interests, appointment remains at the discretion of council. The council is also able to dismiss MPAC members or dissolve the MPAC at any time. Therefore, councils have significant discretionary power to influence the structural integrity of their MPAC. External advisors, who are not councillors, may be brought in to assist the committee where its members lack the technical knowledge and capacity necessary to perform its functions.

Capacity to perform oversight functions: Although municipal audit committees comprise external members with "appropriate experience", legislatively defining the experience needed in concrete terms will ensure the committee's capacity to effectively perform its function is notably strengthened. As it stands, "appropriate experience" is too vague. While MPACs consist only of councillors, councils that do not have the resources to co-opt external expertise, particularly at the local municipality level, may consider a shared services MPAC model at district level.[80] While this has the potential to strengthen oversight as committee members may possibly be more objective, MPACs may become over-burdened. Therefore, the process must be tightly managed between participating local municipalities and roles must be clearly defined. Aligned with their constitutional duty to support and strengthen municipalities,[81] provincial and national governments may and should provide training to strengthen the knowledge and capacity of these committees to effectively perform their functions

Access to information: For oversight and accountability mechanisms to be effective, information must be available and adequately accessible. This entails two core components.

First, executive and administrative functionaries within a water services authority must be aware of the indicators, targets and standards that they are expected to achieve. A water services authority is clearly directed by several municipal instruments including its IDP, WSDP and performance management system. These instruments set out the municipality's objectives. Procedurally, therefore, municipal officials understand the objectives and performance expectations for which they must account.

The second aspect refers to the ability of audit committees and MPACs to accurately evaluate performance – which is strongly reliant on the information they are given by the municipality's administration. Neither MPACs nor audit committees have any subpoena or similar evidence bearing powers. As a result, requests for information by these committees may go unanswered, with little recourse. This severely affects their ability to accurately report to the council on financial and institutional performance, in turn hindering the council's ability to adequately perform its oversight function.

Consequence management: Recognising the relationship between effectively performing oversight and the quality of the instruments produced by municipal administrators to account for their actions, it is important to enforce consequences for non-compliance with the deadlines and standards for accountability measures. The Municipal Systems Act and the MFMA provide the avenues to enforce consequences but, as the Auditor-General has lamented, little action is taken for non-performance and non-compliance.[82]

78. Section 166(4)(a) read with section 166(5) of the MFMA.
79. Section 160(8) of the Constitution.
80. SALGA, Municipal Public Accounts Committees(MPAC) Guide and Toolkit, accessed at http://www.salga.org.za/event/mmf/Documents/Guide%20and%20Toolkit%20for%20Municipal%20Public%20Accounts%20Committees.pdf.
81. Section 154(1) of the Constitution.
82. Only 8% of municipalities in the country received a clean audit, while 92% of municipalities were reported to have disregarded compliance with key legislation. See AGSA, 2019, MFMA 2017/2018 Local Government Audit Outcomes Report.

2.3 Managing water scarcity at local government level

We are increasingly reminded that South Africa is a water-scarce country.[83] Population growth, increased urbanisation[84] and the effect of changes to temperature and rainfall patterns have placed significantly more pressure on water resources. Given these mounting demands on water there has been a global trend towards exploring local alternatives to conventional models of managing water, particularly in urban areas, in a manner that will enhance resilience and ensure sustainability.[85] This includes creating water sensitive cities. Simply put, the notion of water sensitive cities encourages local governments and communities to seek alternative means of sourcing, capturing, storing, treating and using water.[86] It diversifies the urban water management mix, improves environmental protection efforts and places community cooperation and participation at the forefront of managing water.

Countries have adopted different approaches to water sensitivity according to their conditions, needs and resources. One aspect of sustainable urban water management commonly embraced is water sensitive urban design (WSUD) – a multi-disciplinary approach that focuses on integrating urban design (and the built environment) with the urban water cycle through alternative planning and management practices.[87] The water cycle in a region is given prominence in urban planning, design and development. This often finds practical expression in managing storm water quality, harvesting rainwater for reuse and greening the urban environment.[88] Integrated WSUD models aim to promote sustainable urban water management by taking into account three components of the water cycle: water supply (alternative sources of potable water), sanitation (alternative wastewater management mechanisms) and drainage (alternative storm water management mechanisms). As implementing WSUD often starts as a transitional process, countries often focus on one or two components.[89] To the limited extent that South Africa has integrated WSUD principles into its urban planning, it has done so primarily by focusing on drainage through more sustainable storm water management practices.

2.3.1 Water sensitive urban design in South Africa

A project was commissioned by the Water Research Commission (WRC) to provide a strategic framework for reconceptualising urban water management – through a water sensitivity and sustainability lens – in South African settlements (Framework).[90] WSUD was identified as an important component in this process. The Framework broadly introduces the vision and application of WSUD within South Africa's historical context. It advocates a more inclusive policy approach that incorporates water sensitive settlements, extending the application of WSUD principles to include rural areas. It envisions the transition to water sensitivity in formal brownfield developments (through retrofitting), greenfield areas (through implementing WSUD from the outset) and informal settlements (through redevelopment).

The Framework serves as an important baseline for further research on an array of aspects relating to WSUD, and certainly assists in understanding the concept, its enablers and its challenges contextually. But formal arrangements to integrate WSUD into spatial planning and land use management more generally have been slower than one would hope, particularly given its potential to mitigate the effect of climate change on local water resources and management. There may be several reasons inhibiting the widespread adoption of WSUD in South Africa.[91] Water supply and sanitation is often managed within a different municipal department to water drainage. This not only separates the urban water cycle into different management silos – making it more difficult to develop an integrated management approach – it also influences the financial capacity within each department as storm water tariffs, for example, are rarely imposed on residents. The feasibility of WSUD within the South African context also has to take into account the need to service households that remain without access to sufficient water.

83. Muller M. et al. (2009) "Water Security in South Africa", Development Bank of Southern Africa, Development Planning Division Working Paper Series No. 12.
84. According to the World Bank, 66% of South Africa's population lived in urban areas in 2018, up from 57% in 2000. See the World Bank's urban population chart.
85. Armitage N. et al. (2014) "Water Sensitive Urban Design (WSUD) for South Africa: Framework and Guidelines Framework", WRC Report No. TT 588/14, p. 7 (WSUD Framework).
86. To understand the basic principles guiding water sensitive cities see Wong and Brown (2009) "The water sensitive city: principles for practice", Water Science and Technology, 60(3) p. 673-682.
87. Ibid.
88. Radcliffe J.C. (2019) "History of Water Sensitive Urban Design / Low Impact Development Adoption in Australia and Internationally" in Sharma A. et al. (eds) Approaches to Water Sensitive Urban Design: Potential, Design, Ecological Health, Urban Greening, Economics and Community Perceptions, p. 2.
89. WSUD Framework above note 85, p. 7.
90. Ibid.
91. There has been some localised application of WSUD practices in South Africa, but no widespread uptake. Examples include the Green Point Urban Park in Cape Town, permeable paving at the City of Cape Town's Grand Parade, the Qala Phelang Tala Canaan water recycling project in Bloemfontein, greenbelts in Tshwane, green roof initiatives in eThekwini and Johannesburg's Eco City initiative, to name a few. For more details see Cilliers E.J. & Rohr H.E. (2019) "Integrating WSUD and Mainstream Spatial Planning Approaches: Lessons from South Africa" in Sharma A. et al. (eds) Approaches to Water Sensitive Urban Design: Potential, Design, Ecological Health, Urban Greening, Economics and Community Perceptions, p. 358-62.

Moreover, the regulatory framework in South Africa remains too fragmented to promote widespread uptake of WSUD planning practices.[92] Essentially, it has been developed to address water servicing needs through conventional planning mechanisms and infrastructure designs. Given the need to develop sustainable water management practices, there has been some movement towards incorporating alternative approaches, like WSUD, into urban water management. From an environmental policy perspective, national government's climate change approach provides the strongest support for integrating water sensitive designs into development planning. This is because WSUD remains an attractive adaptive mechanism available to cities in response to the adverse effects of climate change on water resources. From a planning policy perspective, the National Development Plan, Integrated Urban Development Framework and the Spatial Planning and Land Use Management Act[93] recognise the need for integrated urban planning and management, which also generally aligns to the WSUD ethos.[94]

However, experience abroad has shown that creating an enabling environment to support local government has been an essential component for ensuring that WSUD principles are adopted and implemented locally.[95] South Africa's regulatory instruments do not provide sufficient support to guide local government action in particular (as primary implementers of WSUD). And while general support may be inferred from national policy and legislative frameworks, it remains too distant to offer a sustained defence of WSUD as a viable approach to urban water management. Enhanced uptake of water sensitive designs will require national government to endorse it by developing guidelines to support implementation. One response is to incorporate water sensitive design into municipal planning.

At a local level, each municipality has the ability to implement aspects of water sensitive design according to their respective means and circumstances, with the support of and in cooperation with national and provincial departments. Municipal IDPs and Spatial Development Frameworks offer the optimal means of ensuring water sensitive designs are promoted in medium-term strategic planning.

2.3.2 Implementing water sensitive urban design in two metropolitan cities: A case study

Implementing water sensitive urban designs requires an understanding of the unique environmental, social, political and economic circumstances of each municipality. One size does not fit all.

I. City of Cape Town

The City of Cape Town has been severely impacted by protracted drought conditions. As a result, the City has placed significantly more emphasis on enforcing water conservation and demand management practices and securing alternative sources of water. It has developed an extensive policy outlook that actively facilitates the transition towards a water sensitive city. Its IDP and SDF – two documents encompassing the City's medium-term strategic vision for development – provide the foundation for water sensitive designs.

The City's IDP recognises resilience and sustainability as two of six principles guiding its strategic vision of delivering quality services to all its residents.[96] It places resource efficiency and security as a priority in the City's strategic framework and aims to achieve this by diversifying resource consumption and sourcing, managing and protecting green infrastructure and restoring key ecosystem services.[97] Implementing resource efficiency and security is envisioned through three programmes: energy efficiency, climate change and city resilience. While all three programmes promote water sensitivity, the climate change programme offers the strongest support for developing green infrastructure, by recognising the need to adapt generally and calling for environmental concerns, including water scarcity, to be incorporated into development projects.[98]

This is supported by the City's SDF which translates the vision framed by its IDP into a form that directs its spatial development. Its SDF identifies the balance between urban development and environmental protection as a priority in which (i) biodiversity and water resources must be taken into account when planning new developments and (ii) the negative impacts of development on the environment must be mitigated.[99]

92. Ibid, p. 354-5.
93. 16 of 2013.
94. See "Developing water sensitive cities II: Is there support in South Africa's regulatory framework?" for an overview South Africa's regulatory framework in support of the concept of water sensitive cities more generally, and water sensitive urban design tools in particular.
95. Tjandraatmatja G. (2019) "The Role of Policy and Implementation in WSUD implementation" in Sharma A. et al. (eds) Approaches to Water Sensitive Urban Design: Potential, Design, Ecological Health, Urban Greening, Economics and Community Perceptions, p. 111-2.
96. CoCT, Five Year Integrated Development Plan: July 2017 to June 2022 (as amended for 2019/20), p. 34.
97. CoCT IDP, p. 41.
98. CoCT IDP, p. 92-4.
99. CoCT, Spatial Development Framework, p. 57.

The City reinforces this general support of water sensitivity principles – included in the IDP and SDF – by developing policy that addresses the transition to a water sensitive city directly. Its Storm Water Impacts Policy[100] was developed to minimise the negative effects of storm water runoff within the City by introducing water sensitive urban design principles to urban planning and storm water management. The Policy introduces best practice criteria for achieving sustainable urban drainage objectives in various development scenarios and requires all storm water management systems to be planned and designed in accordance with these criteria. WSUD principles must not only be incorporated into new development planning and designs but also implemented in existing developed areas through retrofitting.

In addition to its storm water management policy, the City of Cape Town has also recently developed a Water Strategy.[101] In large part spawned by the effects of severe drought conditions on water resources in the area, the Strategy sets out five commitments to ensuring sufficient water for all and developing a City that is more resilient to climate (and other) shocks. It specifically commits to facilitating the transition of Cape Town to a water sensitive city by 2040 "with diverse water resources, diversified infrastructure and one that makes optimal use of storm water and urban waterways for the purposes of flood control, aquifer recharge, water reuse and recreation, and that is based on sound ecological principles."[102] It aims to achieve this through incentive and regulatory mechanisms and new investment initiatives. The City has recognised the need to integrate water supply and storm water management and has, as a result, transferred the responsibility of storm water management from the roads department to Cape Town Water.[103]

Katse Dam, Lesotho

II. City of Johannesburg

Johannesburg is one of the few major cities that was not developed near a water source. As one of South Africa's major economic hubs, it remains heavily reliant on significant water supplies from inter-basin transfers channelled primarily through the Vaal River System. The Lesotho Highlands Water Project was developed to supplement water supply from Lesotho to the tributaries of the Vaal River. In addition, return flows from Johannesburg's water consumption is directed downstream. Given its reliance on water imports, on the one hand, and its impact on the quality of downstream water resources, on the other, the efficient and sustainable management and use of water poses significant challenges for the City of Johannesburg.

To address these challenges, the City's strategic planning recognises the increased strain placed on natural resources in the area. It is identified as one of five major issues in Johannesburg that the City's SDF seeks to address, also in relation to climate change. To do this, the City has focused on building resilience, which is directly linked to strengthening its climate change response.[104] Key spatial opportunities identified include protecting and enhancing natural resources by using them as structural elements in urbanisation and ecosystem services such as storm water regulation, natural purification systems and open public spaces. It integrates this into its spatial framework by providing for a critical biodiversity layer – or green infrastructure – that provides crucial infrastructure services. In addition, the

100. CoCT, Management of Urban Stormwater Impacts Policy, 2009.
101. CoCT, Cape Town Water Strategy: Our shared water future, April 2019 (CT Water Strategy).
102. CT Water Strategy, p. 21 (commitment 5).
103. CT Water Strategy, p. 25.
104. CoJ, Spatial Development Framework 2040, p. 80.

City's SDF proposes that development applications should show how the development will minimise its adverse impact on natural resources. Viewed as a whole, therefore, the SDF reflects basic principles necessary for supporting a water sensitive city.

While water sensitive planning and design enjoys less attention in the City's IDP than in its SDF, the IDP still identifies the need to provide enhanced, quality services and sustainable environmental practices as fundamental to implementing its strategic development priorities.[105] The Climate Change Strategic Framework[106] is one instrument the City relies on to achieve this outcome. The Framework focuses on the organisational aspects necessary to improve the City's response to climate change. In addition, the City's Integrated Environmental Management Policy[107] identifies environmental concerns and links them to relevant City programmes for implementation. Water sensitive principles are included in water resource conservation and planning by promoting responsible land use planning practices, including storm water attenuation, the implementation of urban greening programmes, and the inclusion of environmental and sustainability concerns in development applications.

The City's long-term Growth and Development Strategy[108] (G&D Strategy) emphasises the need to secure sustainable water management practices to ensure water security.[109] It promotes the creation of localised opportunities to save water, which includes developing mechanisms to reduce water resource contamination, incorporating more strategic water recycling and institutionalising the urban water cycle of waste water, potable water, storm water, and grey water re-use into the City's water management system.[110]

The strongest support for water sensitivity and WSUD principles is found in the City's climate change policies. Its Adaptation Plan[111] identifies contaminated water, particularly from storm water runoff, as a serious threat to the quality of its surface water sources and the environmental integrity of natural watercourses. Given the effects of climate change – including increased risk of urban flooding, particularly in informal settlements – the Adaptation Plan reinforces the need to adopt adequate storm water infrastructure and incorporate other adaptation measures into low cost housing. It identifies sustainable urban drainage systems – which form part of WSUD and include permeable pavements in open spaces – as a potential adaptive action to minimise urban flooding.[112] But this is only proposed in trial form to determine the benefits, costs and maintenance requirements. It also proposes storm water recycling initiatives to enhance water supply management and promote water security in the City.[113] The City's Storm Water By-law[114] is aligned to the traditional linear approach to storm water management and provides little support for WSUD mechanisms. Responsibility for these storm water management practices remains with the Johannesburg Road Agency (JRA), detaching it from the management of water more generally.

III. Some observations

Both the City of Cape Town and the City of Johannesburg provide support for water sensitive principles in their strategic development planning. This is central to implementing WSUD locally, particularly given the significance of municipal IDPs and SDFs in determining the development trajectory within municipalities.

By prioritising resilience, sustainability, resource efficiency and security within the strategic framework of its IDP – supported by its SDF – the City of Cape Town sets the tone for developing further policy direction directly relating to water sensitivity. In this sense, the IDP and SDF are properly aligned to enhance implementation. But the City goes further by confronting water scarcity directly by recognising the need to develop policy that facilitates the transition to a water sensitive city. Its newly developed Water Strategy in particular provides strategic direction for the WSUD implementation.

In contrast, the City of Johannesburg has taken a less active approach to sustainable water practices. This despite its G&D Strategy indicating that its projected water demand will outstrip supply even after the Lesotho Water Highlands Project is completed, requiring aggressive water demand management measures implemented and reduction of unlawful abstraction of water.[115] Although its SDF focuses on building resilience and integrates the protection of environmental resources into its spatial framework, the City does not actively promote water sensitive design or WSUD in specific policy positions which flow from the IDP and SDF. The Climate Change Adaptation Plan does propose sustainable urban drainage systems but only on a trial basis. More needs to be done to implement WSUD as a permanent strategy. Despite this, the City of Johannesburg's longer-term G&D Strategy provides some hope that future local policy will actively direct sustainable water management and design.

105. CoJ, Integrated Development Plan 2019/20 Review, p. 34.
106. CoJ, Climate Change Strategic Framework, 2015.
107. CoJ, Integrated Environmental Management Policy, 2005.
108. CoJ, Joburg 2040: Growth and Development Strategy, 2011 (G&D Strategy).
109. G&D Strategy p. 54.
110. G&D Strategy, p. 58.
111. CoJ, Climate Change Adaptation Plan, 2009 (CoJ Adaptation Plan).
112. CoJ Adaptation Plan, p. 77.
113. CoJ Adaptation Plan, p. 80.
114. CoJ, Stormwater Management Bylaws, 2010.
115. G&D Strategy, p. 56.

D. THE ADEQUACY OF WATER SUPPLY

1. Introduction

The WSA and the NWA require the Minister responsible for the Department to establish a monitoring system and to provide information on the state of the country's water resources. Chapter 10 of the WSA expressly provides for the following:

Section 67: establishment of national information system

Section 69: provision of information

Section 70: funding of national information system

Similarly, Chapter 14 of the NWA places a duty on the Minister to establish water resources information systems for the monitoring, recording, assessing and dissemination of water resources information. These systems are intended to facilitate continued and co-ordinated monitoring of various aspects of water resources by collecting relevant information and data, through established procedures and mechanisms, from a variety of sources including organs of state, water management institutions and water users. The Department is currently operating several water resources monitoring and information systems and more information is available from Statistics South Africa.

TABLE 3: DRINKING WATER DATA AND INFORMATION DISSEMINATION PLATFORMS

System	Data/Information	Operating institution
Water Services Knowledge System	See Table 2	DWS
National Integrated Water Information System	Appendix 1	DWS
Integrated Regulatory Information System	Water quality: Potable and effluent	DWS
Blue and green drop report.	**Blue drop**: provides information on the quality of drinking water, as per the SANS 241: 1 (Appendix 2). **Green drop:** is a status is given to municipalities that comply with good wastewater discharge standards.	DWS/
Population census	Statistics on access to water service	Statistics South Africa
General Household Surveys	Statistics on access to water service	Statistics South Africa

Cape Town, South Africa: lines of people waiting to collect natural spring water

2. Description of information sources and assessment of their adequacy

2.1 National Water Services Knowledge System

The WSKS is a DWS operated online data dissemination tool. The WSKS captures and disseminates water resources information on selected water sector themes.

TABLE 4: INFORMATION DISSEMINATED BY THE NATIONAL WATER SERVICES KNOWLEDGE SYSTEM

Theme	Sub-theme (s)
Access to basic services	Access to infrastructure data
Census 2011 results	
Demography	
Financials	Water tariffs
Hotspots	Protests
Institutional effectiveness	Municipal strategic self-assessment
Water conservation and demand management	Municipal non-revenue
Water quality management	Drinking water quality
Wastewater quality	
Water boards	
Water scheme related data	Accelerated community infrastructure programme
Municipal infrastructure grant	
Regional infrastructure grant	
Water services infrastructure grant	
Media Monitor	Public relations responses to newspaper articles

2.2 National Integrated Water Information System and Integrated Regulatory Information System

NIWIS was developed with the purpose of providing information products to the general public. These take the form of dashboards to facilitate efficient analysis and reporting across the water value chain. A data dashboard is an information management tool that tracks, analyses and displays indicators, metrics and data points to monitor a process. NIWIS is a consolidation of ten water management themes run by the DWS. These are subdivided into 27 information systems, which include reporting on drinking water quality per WSAs (see Appendix 1).

IRIS provides, at a glance, prevailing conditions for potable water (drinking water quality conditions per the WSA). The IRIS platform disseminates water quality information for potable and effluent water.

Both the NIWIS and IRIS are free online graphical user interface platforms. They provide a summarised state of water supplied by WSAs through a drinking water compliance index. This makes it easy for the average consumer to access (and understand) the state of drinking water in a centralised website as opposed to tracking compliance for individual WSAs in South Africa.

2.3 Annual Blue Drop Reports

In 2008, the DHSWS initiated an incentive-based regulation programme called the Blue Drop (BD) Certification Programme. According to the DWA, the objectives were to incentivise good performance by WSAs, promote transparency and accountability and provide reliable and consistent information to the public. The report provides information on the following:

- Audit on drinking water quality compliance with the SANS 241 (Appendix 2);
- Assessment of water safety planning, which is a risk-based approach in drinking water quality management dealing with associated risks and mitigation;
- Asset management (operation and maintenance, design capacity, budgeting);
- Technical skills availability for operation of the plants; and
- Management support.

Findings were expected to be communicated through annual BD reports. These were meant to provide the sector and its stakeholders with current, accurate, verified and relevant information on the performance of water supply systems annually.

The Department has not been able to adhere to the set publishing timelines. As a result, the Parliamentary Portfolio Committee on Water and Sanitation on 24 October 2018, reproached the Department for failure to release the reports post 2014. The inability for the Department to publish the annual BD reports within stipulated time intervals reflects poorly on the reporting approaches and national drinking water aspirations.

2.4 Population Censuses and Community Surveys

Statistics South Africa (Stats SA) independently collects, compiles and publishes data and information on the state of the country's water supply and sanitation services as part of its assessment of the state of service delivery. Data collected by Stats SA is disseminated through the population censuses, community surveys and General Household Survey (GHS) reports. The most recent population census was held in 2011. Community surveys are conducted in the middle of inter-censal periods and the most recent was conducted in 2016.

2.5 General Household Survey

The GHS is an instrument Stats SA has used since 2002 for tracking development progress. The GHS collects data on education, health, and social development, housing, access to services (including water and sanitation) and facilities, food security, and agriculture. Stats SA documents track the water supply service by paying attention to these variables:

- Main and alternative sources of drinking water;
- Distances travelled to the water source;
- Household perceptions on drinking water;
- Access to piped municipal water supplies;
- Reliability of the service/interruptions;
- Demographic profile of people with access to improved water sources; and
- Payment of municipal water

2.6 Accessibility of reporting

In addition to establishing the information systems, section 145 of the NWA requires that water resources information be made available to the public. Conventional water resources reports are highly technical and therefore rarely accessible or easily comprehensible to the general public. In response, section 145 (1) of the NWA posits an additional requirement. This is that the information disseminated to the public should be in an appropriate manner or format.

Is the DWS reporting of drinking water quality and compliance accessible? This may depend on the user's technical and quantitative skills. The Department presents the state of drinking water supplied by WSAs in an index format, expressed through percentage compliance. A water quality index is a means by which water

Water provision in Informal Settlements in South Africa

quality data is summarised for reporting to the public in an accessible and consistent manner. Traditional and technical water quality reporting is generally replete with technical jargon emanating from water chemistry, toxicology and microbiology. Indexing water quality data and information at least offers an improvement on this. Indexing water quality helps in simplifying large quantities of complex and technical data which could prove overwhelming for nontechnical users, policy makers and the general public. What most users would primarily seek is concise, accurate information about the state of their drinking water.

The NIWIS and IRIS are consumer-friendly information dissemination platforms. Thus, they classify drinking water quality using a four-level grading scale. These are described by colour codes and descriptor words. "Red" represents water of bad quality, "yellow" water of poor quality; "green" represents water of good quality and "blue" water of excellent quality. Understanding this does not require technical training.

Indexing water quality is an approach adopted and used globally in many water quality jurisdictions. But water quality indexing is obviously not a panacea. No matter how informative the tool may be, indices have limitations for water quality reporting purposes. An instance is the SANS 241-2: 2015; 13-14 drinking water compliance indexing function adopted by the DWS.

$$\text{Compliancy} = \left(\frac{\text{number of compliant results}}{\text{total number of results}} \right) * 100$$

This function has the ability to transform large drinking water quality data (bulk reduction) into information that is free from technical jargon. However, the transformation of the data leads to loss of valuable information about the original data. For example, it classifies data into a binary set (compliant versus non-compliant data), and provides no further details on the original data.

Neither the IRIS nor NIWIS platforms present the original water quality data for public viewing. To compensate for this loss, it may be useful for the drinking water quality databases to present original laboratory analysis data. An alternative – for users with further queries about water quality – would be for the Department to further modify the indexing tools to reflect the degree of compliance of each water quality variable. Disaggregation of this kind is particularly useful because aggregation without disclosure of primary data tends to obscure valuable information about initial laboratory analysis values.

2.7 Missing drinking water quality values

While efforts have been dedicated towards ensuring that water supplied by municipalities and WSAs is of good quality (in other words, compliant with national drinking water quality standards), it emerges that some WSAs do not share their analytical data with the Department.

The absence of data fields in the online water quality data dissemination platforms is not acceptable. This is particularly because the Department offers no readily available explanations for the data missing in the online platforms. Without reasons explaining mysterious data gaps in the water quality information dissemination platforms (i.e. IRIS and NIWIS), public doubts about the quality of water supplied by some WSAs would be well-warranted.

DWS's water services regulations specialists have suggested that the absence of water quality information on the DWS reporting platforms does not mean the WSAs in question do not monitor the water quality. Instead, failure to upload data is attributed to:

1. Insufficiently skilled process controllers;
2. Inconsistent reporting and non-adherence to the monitoring programmes; and
3. Where a WSA outsources laboratory analysis for water quality, and, for example, fails to pay for the service, the laboratory may withhold the results. This particular mishap leaves significant gaps in the information chain, rendering the entire quality assurance regime unsound and contentious.

The first two weaknesses in the system, gleaned from interviews with the DWS water services regulations specialists, seem to negatively affect internal confidence in the quality assurance process. This raises the question, if internal (WSAs) confidence is lacking, how can external (consumer) confidence be claimed?

Sections 68 of the Water Services Act and 145 of the NWA place a duty on WSAs to make water resources information available to the public. Failure by some WSAs to upload water quality data onto online water quality platforms represents failure to conform to plain statutory obligations. This deprives not only researchers and policy-makers but the public of knowledge about the quality of the water supplied for drinking purposes by their municipalities and WSAs.

In addition, failure by WSAs and municipalities to adhere to statutory requirements may reflect poorly on national and provincial governments. This is because the Constitution obliges national and provincial governments to support and strengthen the capacity of municipalities to manage their own affairs, to exercise their powers and to perform their functions.[116]

116. Section 154 of the Constitution.

3. Water infrastructure

3.1 Progress since 1994

According to the Strategic Framework for Water Services, it is the responsibility of a WSA to ensure that adequate and appropriate investments are made to ensure the progressive realisation of the right of all people in its area of jurisdiction to receive at least a basic level of water and sanitation services. This reflects the provision in the Bill of Rights affording the right of access to sufficient water.

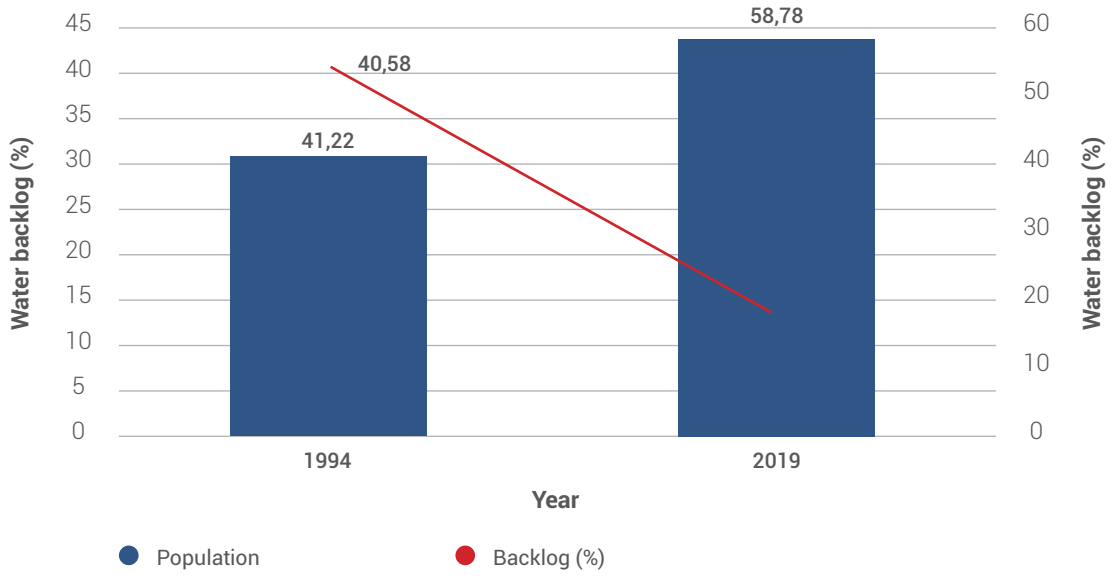
Since the establishment of our constitutional democracy in 1994, the country has achieved remarkable improvements in the provision of water infrastructure. The result has been reduction of the water infrastructure backlog by 27.57% (based on population as a unit of measure) over the past 25 years (Figure 3). The current national water infrastructure backlog is 13.01%.

One of the major challenges for infrastructure provision is population growth. Countries like South Africa have little choice but to consider innovative approaches to ensure that they eliminate water infrastructure backlogs.[117] For South Africa to overcome the current national water infrastructure backlog, it is essential that infrastructure investment and delivery outpace current and projected national population growth.

3.2 Water infrastructure backlog data

South Africa's history of apartheid geospatial planning has resulted in many rural areas not having access to basic water supply and sanitation services.[118] In eradicating the historical geospatial inequalities and socio-economic disparities, numerous programs have been initiated since 1994. Even so, overt inequalities in water infrastructure delivery between rural and urban areas remain. Predominantly rural provinces and small towns are characterised by relatively high water-infrastructure backlog.

Figure 3



By 2019, the investment disparities had not changed since predominantly rural provinces still lag behind. This subjects rural households disproportionately to water scarcity. The Parliamentary Monitoring Group[119] points out gross inequalities in access to safe water. For instance, highly urbanised provinces such as Gauteng and the Western Cape have over the past 25 years managed to reduce the water infrastructure backlog to less than 2% of the population. Despite major overall national improvement, water backlog remains relatively high in predominantly rural provinces. These include Eastern Cape (EC), KwaZulu-Natal (KZN), Limpopo (LP), Mpumalanga (MP) and the North West (NW).

117. Ruiters "Funding models for financing water infrastructure in South Africa: Framework and critical analysis of alternatives" (2013), Vol 39 No 2 Water SA.
118. Masindi & Duncker State of Water and Sanitation in South Africa (2016), available at https://www.researchgate.net/publication/311451788_State_of_Water_and_Sanitation_in_South_Africa
119. Parliamentary Monitoring Group (2017), available at https://pmg.org.za/committee-meeting/23868/

TABLE 5: INHERITED AND RECENTLY ACHIEVED WATER INFRASTRUCTURE BACKLOG - POPULATION

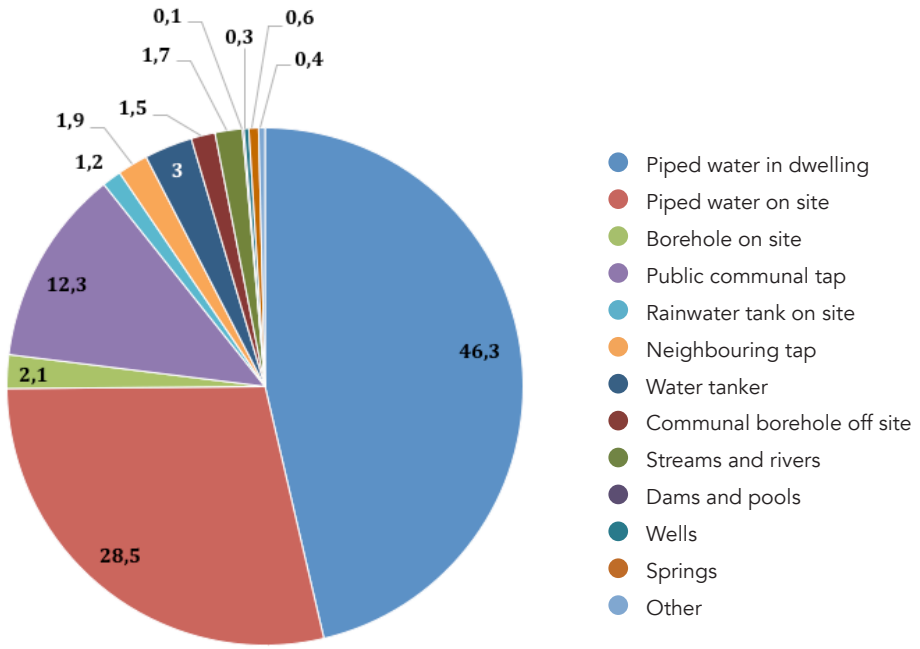
Province	1994 Pop Backlog %	2019 Pop Backlog %	Population Backlog Reduction
EC	61,55	31,23	30,32
FS	24,00	2,78	21,22
GT	17,18	1,62	15,56
KZ	46,51	20,19	26,32
LP	51,96	25,80	26,16
MP	42,39	14,71	27,68
NW	40,08	16,57	23,51
NC	39,03	6,43	32,60
WC	38,48	0,73	37,75
RSA	40,58	13,01	27,57

The geospatial disparities in infrastructure provision run counter to indigent-support policies and pro-poor national aspirations. Since the Reconstruction and Development Programme of the President Mandela era, these have prioritised poor and rural communities through implementation of indigent policies.

However, uneven distribution of water supply infrastructure exposes vulnerable communities to unimproved and contaminated sources of drinking water. For example, the 2018 GHS revealed household dependency on streams/ rivers (279 households), pools/dams (23 households), wells (42 households) springs (104 households).

Figure 4 displays the distribution of different water sources across households.

Figure 4 Main sources of water used by households in 2018



Absence of appropriate water infrastructure compels thousands of households (mainly women and children) to travel long distances to access drinking water. This has multiple detrimental effects on their wellbeing such as:

- Physical water-carrying may produce musculoskeletal disorders and related disabilities;[120] and
- Women around the world spend collective 200 million hours a day collecting water.[121] Time spent fetching water and fuel reduces the time that can be devoted to generating livelihoods or in remunerated work.[122]

To reduce geospatial disparities in infrastructure delivery, it is therefore necessary that national water infrastructure investments and policies prioritise rural provinces and areas.

4. Drinking water quality

4.1 The South African National Standards

The management, treatment and monitoring of water from the source to the distribution points to consumers is conducted in accordance with the South African National Standards (SANS) 241:2015 (second edition, which replaced the 2011 first edition). The SANS 241: 2015 is a two-part set of standards.

SANS 241: 2015, Part 1 specifies the quality of acceptable drinking water, standard limits, defined in terms of four groups of 46 water quality determinands (Appendix 2).

SANS 241: 2015, Part 2 is focused on the application of the SANS 241: 2015, Part 1. This document is directed towards the evaluation of water quality risks, monitoring and verification of water quality to enable the management of the identified water quality risks.

The SANS documents are provided for and refereed in the following national regulations:

- Water Act, 1997 (Act No. 108 of 1997);
- Regulations relating to the compulsory national standards and measures to conserve water;
- The National Health Act, 2003 (Act No. 61 of 2003);
- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996); and
- The Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000).

4.2 Drinking water quality determinands

A water sample contains many constituents.[123] It is practically impossible to monitor all known contaminants in water. Hence a selected group of water quality constituents end up being prioritised in monitoring regimes. In South Africa, for drinking purposes, water is monitored for a total of 46 drinking water quality determinands. These are divided into microbiological, physical, aesthetic and chemical or six groups, namely; microbiological, physical and aesthetic determinands, chemical determinands (macro-determinands), chemical determinands (micro-determinands) and chemical determinands (organic determinands) (Appendix 2).

Water quality determinands are grouped as follows:

1. Chemical non-health (aesthetic): The aesthetics of drinking water are generally not health-related; but consumers can easily detect them, so they may significantly affect perceptions of water quality and acceptability.
2. Chemical-acute poses an immediate unacceptable health risk if present at concentration values exceeding the numerical limits specified by the SANS 241.
3. Chemical-chronic poses an unacceptable health risk if ingested over an extended period if present at concentration values exceeding the numerical limits specified by the SANS 241.
4. Microbiological: The monitoring and determination of diseases causing waterborne microorganisms (e.g. viruses, bacteria and protozoa) in drinking water. Most disease-causing organisms occur in ambient waters through faecal contamination, for example from runoff of faecal draining from land or from sewage discharges.[124] Therefore, microbiological water analysis is mainly based on the concept of faecal indicator bacteria. It is used as measure of water treatment operational efficacy.
5. Disinfectant residual: Disinfection refers to application of chemicals for the inactivation of microorganisms in drinking water. Inactivation means that the microorganism is rendered not capable of reproduction, that its DNA is damaged or other parts are damaged to the extent that it cannot replicate itself.[125] The presence of residual disinfectant (i.e. chlorine) in water means that a sufficient amount of the chlorine was added initially to the water to inactivate microorganisms.
6. Operational refers to water quality determinands that are essential for assessing the efficient operation of treatment systems and the risk of the water infrastructure.

120. Geere et al "Domestic water carrying and its implications for health: a review and mixed methods pilot study in Limpopo Province, South Africa" (2010) 9(1) Environmental Health 52.
121. Press Trust of India "Women, girls across the world spend 200 million hours daily collecting water– UNICEF" Social Story (31 August 2016), available at https://yourstory.com/2016/08/water-cisis-unicef
122. Geere and Cortobius "Who Carries the Weight of Water? Fetching Water in Rural and Urban Areas and the Implications for Water Security" (2017) 10(2) Water Alternatives 512.
123. Abbasi T and Abbasi SA Water Quality Indices (Elsevier, Amsterdam 2012)..
124. Hendricks Fundamentals of water treatment unit process: physical, chemical, and biological (CRC Press, 2010) at 607.
125. Ibid

5. Assessing drinking water quality

National drinking water quality data are gathered from two independent yet complementary methods:

i. From GHS on perceptions of drinking water supplied by municipalities and WSAs; and
ii. From analyses of water samples collected at different stages of the water supply chain.

5.1 Organoleptic or sensory water quality evaluation

The process of evaluating water quality using perceptions is known as organoleptic or sensory water quality evaluation. Organoleptic is defined as evaluating water based on smell, taste and colour. If the water has an unusual taste or smell (or is cloudy or coloured), it can be interpreted as a health risk and a problem in the water source, its treatment, or in the water network.[126]

Stats SA annually conducts general household surveys on the perceptions of water supplied by municipalities and WSAs. This process is organoleptic sensory evaluation of water quality.[127] Similarly in the Stats SA community survey, the drinking water is evaluated using four sensory indicators of drinking water:

i. **Taste:** Does the water taste good?
ii. **Clarity:** Is the water clear?
iii. **Smell:** Is the water free from bad smells?
iv. **Safety to drink:** Is the water safe to drink?

Sensory assessments of water quality can be correlated with (i) risk perception, (ii) familiarity with the specific drinking water supply/supplier and (iii) impersonal and interpersonal information including mass media.[128]

Numerous concerns have been raised about the quality of drinking water. News reports have suggested that some international tour advisors now warn tourists about the unsafe state of South African tap water.[129] Hammanskraal residents (north of Pretoria) have expressed discontent with the quality of their tap water. With the support of the Organisation Undoing Tax Abuse (OUTA), the SA Human Rights Commission and the Council for Scientific and Industrial Research (CSIR), the residents' claims have been substantiated. CSIR laboratory analysis results revealed that the drinking water had elevated concentrations of nitrites and nitrates (chemical macro-determinands) and Escherichia coli bacteria (microbiological). The concentrations of the three-drinking water quality determinands were found to be above the SANS 241 limits.[130]

Despite media concerns raised about the state of the country's drinking water, the 2018 GHS suggested that more than 90% of households were pleased with the quality of their drinking water. Additionally, the number of households displeased seems to be on a gradual decline from 2005 to 2018.

126. Gutierrez-Capitan et al. "Organoleptic Analysis of Drinking Water Using an Electronic Tongue Based on Electrochemical Microsensors" (2019) 19(6) Sensors 1435 available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6471140/
127. Ibid.
128. Doria"Factors influencing public perception of drinking water quality" (2010) 12(1) Water Policy 1-19.
129. Nair "SA tap water unsafe for tourists, warns global holiday company" TimesLive (12 March 2019), available at www.timeslive.co.za/news/south-africa/2019-03-12-sa-tap-water-unsafe-for-tourists-warns-global-holiday-company/.
130. News24 Wire "Water in Hammanskraal not fit for human consumption – SAHRC" The Citizen (21 August 2019), available at https://citizen.co.za/news/south-africa/health/2169538/water-in-hammanskraal-not-fit-for-human-consumption-sahrc/.

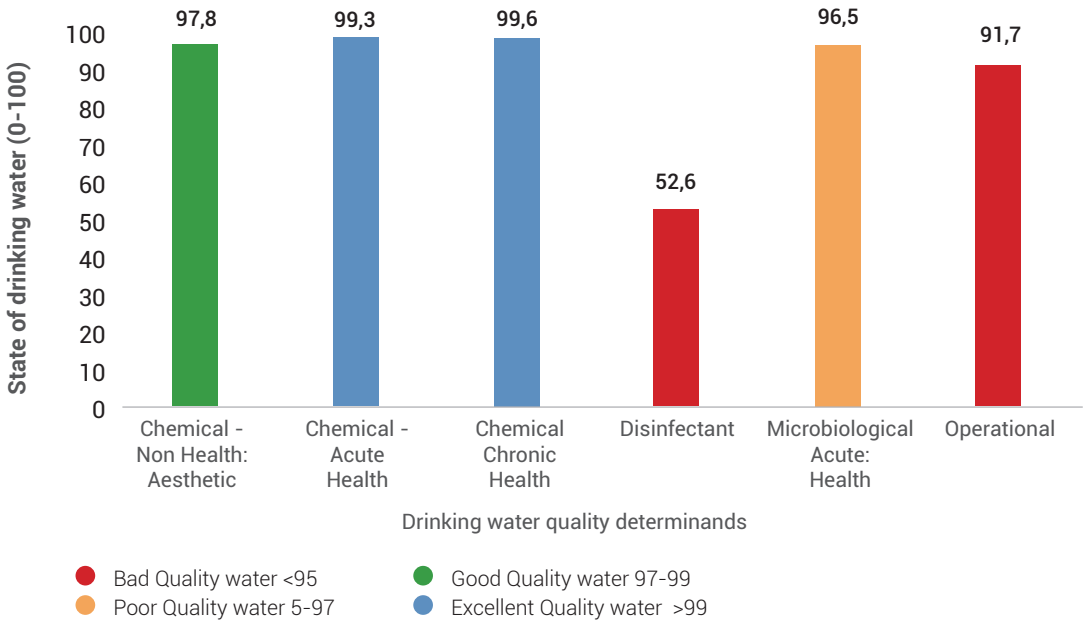
Nonetheless, a province-by-province assessment of household perceptions between 2005 and 2015 indicated that households in Eastern Cape and Mpumalanga have consistently been the most displeased with the quality of their drinking water. Assessment of households' perceptions based on the 2018 GHS data indicated that households in Eastern Cape, Mpumalanga and Northern Cape were most displeased. On the other hand, households in Gauteng Province appeared to be least displeased among the nine provinces.

5.2 Drinking water quality assessments using analytical techniques

These are conducted by chemical analyses of water samples collected at different stages of the water supply chain, following published protocols (i.e. SANS 241).

While stringent measures are in place to ensure compliance, drinking water quality information accessed from the IRIS platform indicates that some microbiological, disinfectant and operational drinking water quality determinands are in an unsatisfactory state.

Figure 5 represents the state of drinking water based on information gathered from the IRIS platform



Microbiological: Failure to comply with set microbial water quality standards warrants concern. Microbiological evaluation of the quality of drinking water is conducted for protection of consumers from illness resulting from ingestion of water containing pathogens. These include bacteria, viruses and protozoa. The objective is thus to preventing outbreaks of drinking-water related illness. The World Health Organization (WHO) states that infectious diseases caused by pathogenic bacteria, viruses and parasites are the most common and widespread health risk associated with drinking-water. Epidemiological studies suggest that, globally, consumption of contaminated drinking-water causes more than 500 000 diarrhoeal deaths each year.[131]

Disinfectants (including residuals): as shown in Figure 1, disinfectants are the least compliant determinands with a compliant score of 52,6%. Yet disinfection is an indispensable part of the treatment process. It offers partial protection against low-level microbiological contamination in treated water supply. As a result, the SANS 241 states that disinfection must be sustained at a level not less than a value defined by the water services institution or water services intermediary (or both) throughout the distribution system such that all bacteriological limits are achieved on a continuous basis. It is therefore necessary that municipalities and WSAs give extra attention to disinfection as an imperative for the control of microbes and hence water-borne diseases.

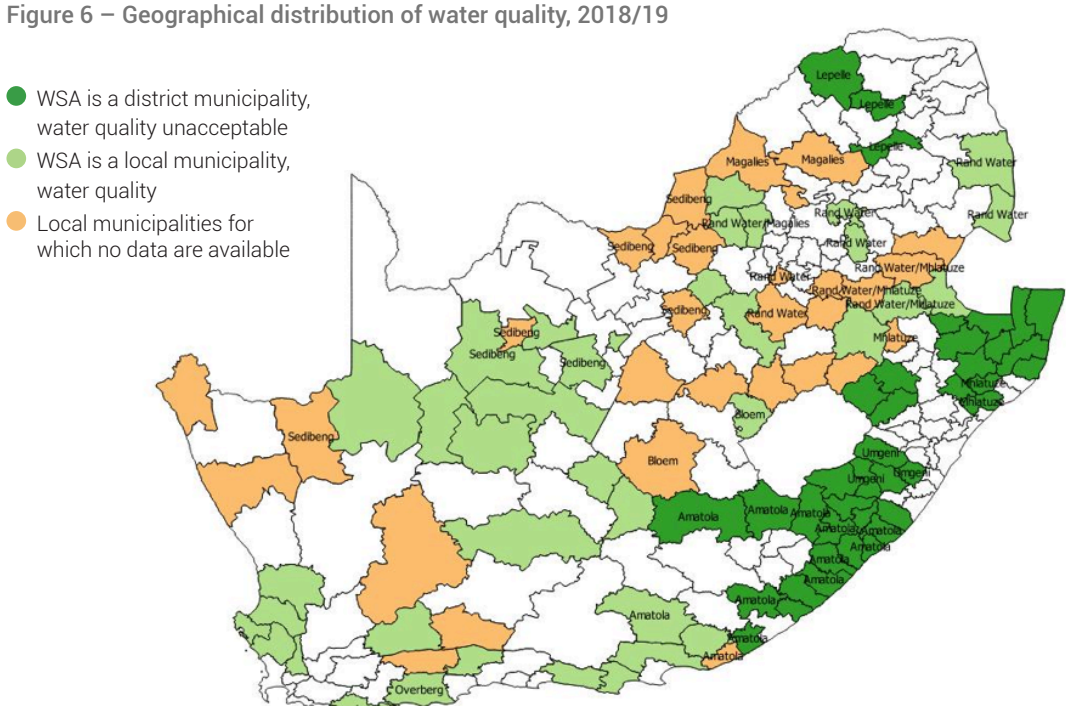
Operational water quality determinands: Operational water quality determinands are the second least compliant determinands. According to SANS 241-1, operational determinands are essential in assessing the efficient operation of drinking water treatment systems and risks to infrastructure. It is therefore necessary that water treatment systems are prioritised for appropriate improvements and upgrades.

131. WHO available at https://www.who.int/sustainable-development/cities/health-risks/water-sanitation/en/.

5.3 Geographical distribution of drinking water quality

Figure 6 displays the geographical distribution of drinking water quality in 2018/19. The DWS regards intervention as necessary if the percentage of ether chemistry tests meeting standards falls below 80%, or if the percentage of satisfactory microbiological tests falls below 95%, or if tests relating to operational standards falls below 70%. Accordingly, water quality in a WSA is regarded as unsatisfactory if the percentage in any dimension falls below the target standard over a twelve-month period.

Figure 6 – Geographical distribution of water quality, 2018/19



6. Reliability of the supply of drinking water

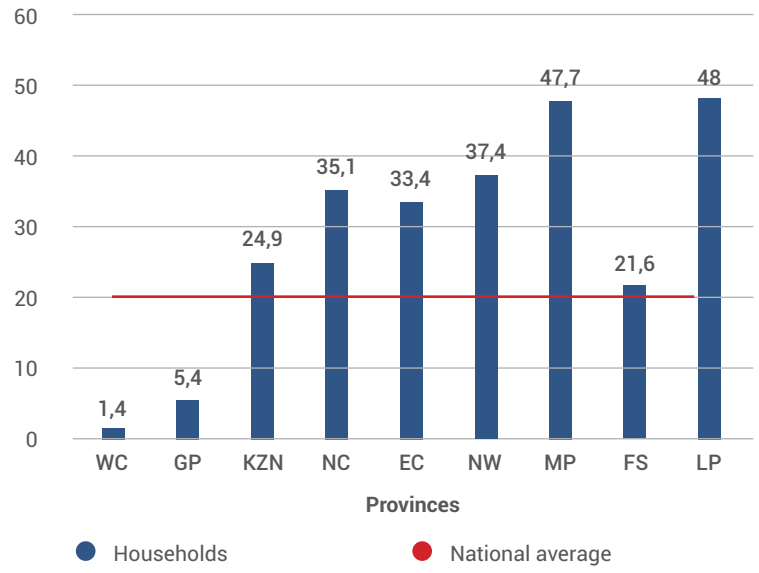
According to the Strategic Framework for Water Services the South African drinking water supply is underpinned by Universal Service Obligation (USO). Government's USO prioritises provision of water and sanitation services to all South Africans through the necessary infrastructure and providing free basic services.[132] Meeting the USO requires that all South Africans have access to:

- **A basic water supply facility or an improved source of water** – The infrastructure necessary to supply 25 litres of potable water per person per day supplied within 200 metres of a household, with a minimum of 10 litres per minute. This includes piped water in dwelling or in yard, and water from a neighbour's tap or public/communal tap, provided that the distance to the water source is less than 200 metres.
- **A basic water supply service** – the water shall be made available for at least 350 days per year, and not interrupted for longer than 48 consecutive hours.

The functionality of municipal water supply services remains, precarious, erratic and uneven across provinces (Figure 7). Functionality of municipal water supply service measures the extent to which households that received water from a municipality had reported, over the 12 months before the survey, interruptions that lasted more than 48 hours at a time, or more than 15 days in total, during the whole period.

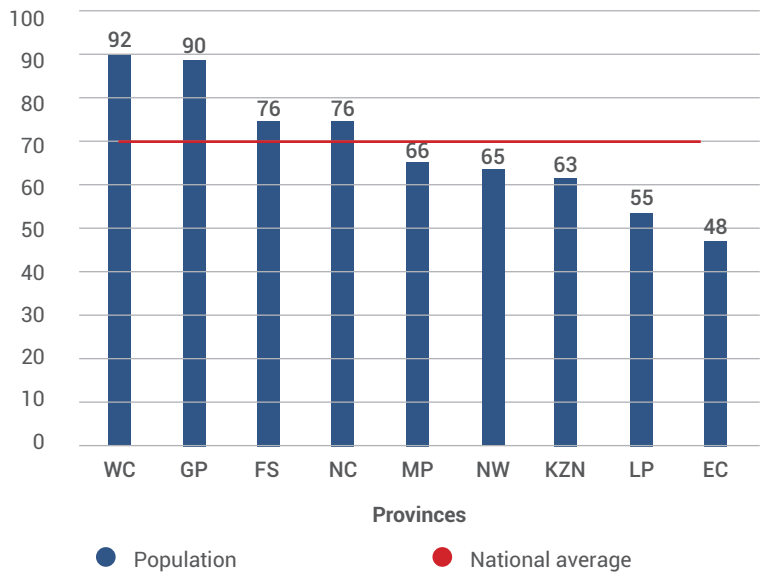
132. Stats SA "The state of basic service delivery in South Africa: In-depth analysis of the Community Survey 2016 data" (Pretoria, 2017), available at http://www.statssa.gov.za/publications/Report%2003-01-22/Report%2003-01-222016.pdf.

Figure 7 Percentage of households that reported water interruptions by province in 2018



Similarly, water supply reliability data obtained from the NIWIS platform indicated provincial disparities with respect to the reliability of water supply in the country (Figure 8). In both cases, Western Cape and Gauteng appear to be best serviced provinces, while Limpopo, Eastern Cape, Mpumalanga, North West and KwaZulu-Natal are the worst serviced.

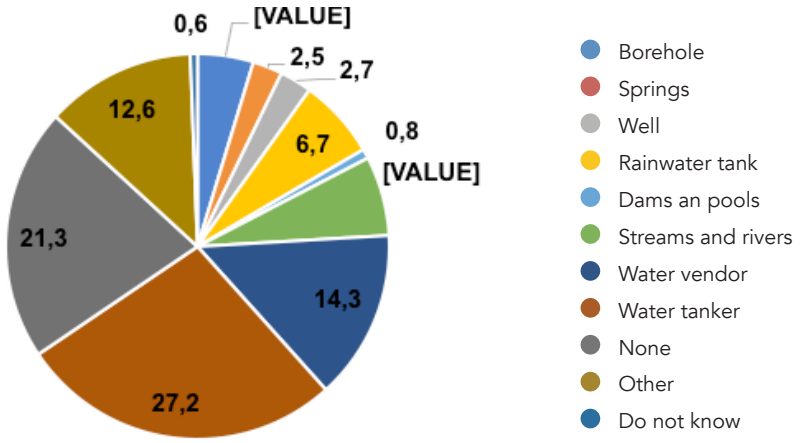
Figure 8 Reliability of drinking water supply in South Africa per province for data collected from 01 July 2018 to 30 June 2019



The implications of low reliability and interruptions of water supplies are adverse. As noted by Duncker (2015) unreliable water supply services may result in users reverting to contaminated sources of drinking water or to water storage practices that may lead to increased risk of transmission of water-borne diseases. Most obviously, this entails negative health implications for consumers.

The 2018 GHS indicated that water interruptions are high. The result is more than inconvenience. Often, there are no safe alternative sources of drinking water. Households are thus usually obliged to source their drinking water from unsafe or unimproved sources (Figure 9).

Figure 9 – Alternative sources of drinking water used by households (%) in South Africa in 2018 as a result of water supply interruptions



This exposes households that are dependent on municipal water supplies to contaminated water (e.g. dams, pools, rivers and streams), entailing exposure to contaminants and disease risks. Some typical examples include Tongaat and La Mercy residents who in August 2019 experienced severe water supply interruptions without provision of safe alternative sources during the outage.

Given the high level of water interruption it is imperative that municipalities and WSAs monitor the following:

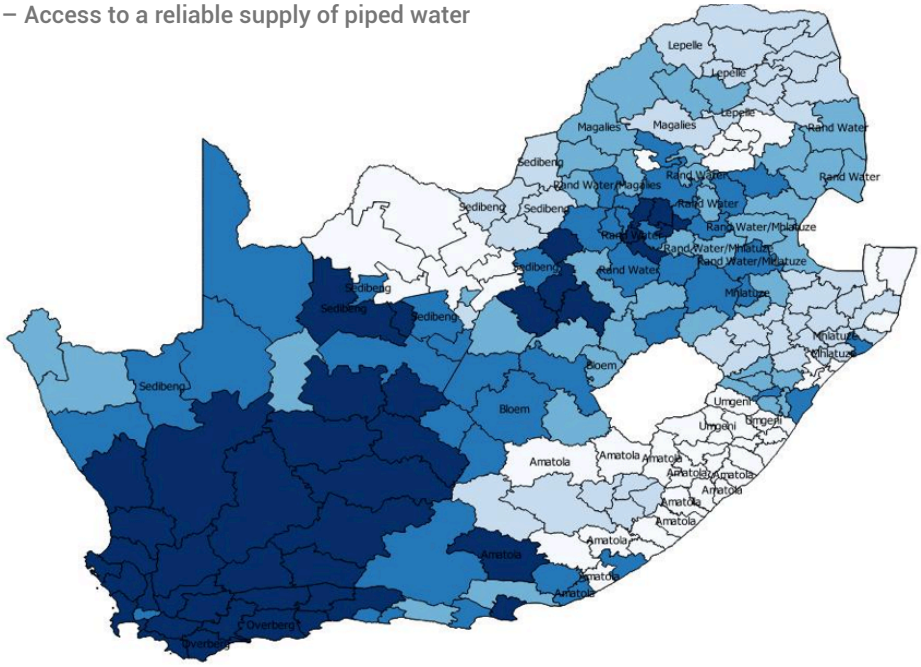
1. During extended periods of water interruptions, municipalities and WSAs supply affected communities with safe alternative sources of water, e.g. water tankers;
2. Conduct public awareness and educational programmes on safe storage of water to avoid secondary contamination; and
3. Regulation of water vendors by:
   i. conducting awareness programmes on drinking water standards and contamination; and
   ii. identifying appropriate sources of water for vendors can source their water.

In addition, action should be taken to control and limit interruptions of drinking water supply. Table 6 presents some of the suggested actions for limiting interruption and subsequent improved reliability of water supply.

TABLE 6 SOLUTIONS TO UNRELIABLE WATER SUPPLY SERVICE

Cause	Suggested action
AGEING INFRASTRUCTURE – leakages and maintenance work	• Replacement of old and deteriorating water supply infrastructure; • Improve leak detection; and • Reporting of leakages and prompt fixing of leakages.
VANDALISM – for financial gains through selling metal scraps	Theft and vandalism constitute criminal activities that could be curbed by the following interventions: • Reporting theft and vandalism to the police; • Imposing fines on offenders; • Employing water inspectors and security guards; • Discouraging illegal connections; and • Community educational and awareness programs
CORRUPT ACTIVITIES – municipal officials sabotage the water supply system to create business for their friends that own tankers or are in the water vending business	• Strengthening of water sector institutions; • Increased fight against corruption in the water sector; and • Increased government oversight, reform of regulations that stimulate performance, and increased accountability towards citizens.

Figure 10 – Access to a reliable supply of piped water



A composite indicator of access to piped water and its reliability can be used to assess the extent to which piped water is supplied on a reliable basis. Figure 10 divides municipalities into quintiles based on the indicator. The darker the shading, the greater is access to a reliable water supply.

7 The Water Balance

It is well known that South Africa is a water scarce country. However, we do not have a coherent set of water accounts which could underpin assessment of the geographical distribution of water stress. What would such a set look like?

7.1 Water Service Authority accounts

The International Water Association recommends the following template, which should be used in each water service authority. The system input volume would represent water purchased from the Water Trading Entity, water purchased from water boards, and water produced from own sources. The template provides a way of tracking revenue and expenditure on the water account as well as the flow of water to its ultimate destination. Of particular concern would be the real losses block, and opportunities for reducing its size. Each water service authority should be responsible for compiling and publishing water accounts each year. Technical assistance to water service authorities should be supplied where necessary.

Figure 11 – IWA water accounting template

System Input Volume	**AUTHORISED CONSUMPTION**	Billed Authorised Consumption	Billed Metered Consumption	**Revenue water**
			Billed Unmetered Consumption	
		Unbilled Authorised Consumption	Unbilled Metered consumption	**Non-Revenue Water**
			Unbilled Unmetered Consumption	
	WATER LOSSES	Apparent Losses	Unauthorised Consumption	
			Metering Inaccuracies and Data Handling Errors	
		Real Losses	Leakage on Transmission and/or Distribution Mains	
			Leakage and Overflows at Utility's Storage Tanks	
			Leakage and Overflows at Utility's Storage Tanks	

7.2 Water Board accounts

The template in Figure 11 should also be used by water boards, with reconciliation of sales to water authorities with purchases from water boards in each water service authority. Supply to water boards would consist of purchases from the Water Trading Entity and the Lesotho Highlands Water Scheme, and supply from own sources.

7.3 Catchment Management Agency accounts

It is desirable that CMAs be established in all water management areas. Once they are, each CMA should be required to identify:

- All water sources operated by the Water Trading Entity and all sales from them;
- All water sources owned by Water Boards and all water abstracted from them;
- All water sources owned by Water Services Authorities and all water abstracted from them;
- All rights to water owned by other users;
- All water transferred from other catchments; and
- All water transferred to other catchments.

These data would inform an assessment of the potential for further water source development within each catchment.

Johannesburg, South Africa: construction site of a water reservoir near completion

E. CONCLUSION AND RECOMMENDATIONS

Without an information system of the type described above, it will be impossible to define priorities for water source development, water sensitive design or improvements in the efficiency of use of water by water services authorities.

1. Conclusions

South Africa is a water-scarce country with a growing population. It will be stressed by climate change. It has substantial water supply deficits. In what state is it to cope with the challenges of the coming years?

1. ***The massive influence of the pre-1994 state on settlement patterns and the distribution of resources across them has shaped the distribution and adequacy of water services.*** The negative aspect of the development of water sources and services before 1994 is that it left many communities inadequately serviced or completely unserviced. The positive aspect was the development of water infrastructure on which the country continues to rely, even as its maintenance is often inadequate.

2. ***There has been considerable extension of water services since 1994. Nonetheless, deficits remain, and goal overload has often been accompanied by chaotic administration.*** There are parts of the water system which work well and parts which work poorly. One the one hand, we have the world of paper: a legislative framework; allocations of functions to institutions; a national water resources strategy; a water allocation reform programme; and integrated development plans and spatial development frameworks at the municipal level. A gleaming vision of how the production and use of water is supposed to work. On the other, we have a rickety and incomplete structure of state water institutions shaped by the state. It is through the iron gates of this legacy that the future of water services must pass.

   Problems start at the apex of the system. Responsibility for water at national government level has passed within the last ten years from the Department of Water Affairs and Forestry, to the Department of Water and Environmental Affairs. To this department, responsibility for sanitation was added, and the Ministry of Human Settlements, Water and Sanitation was created to supervise two separate departments: Human Settlements, and Water and Sanitation. More recently, the responsibility has been placed with the Ministry of Water and Sanitation. Administration has been in a constant state of flux and financial management has been very poor. High staff turnover, an ageing work force and a shortage of skilled engineers are constraints on performance and there are backlogs in the processing of applications for water use licenses. Water infrastructure is often at risk of failure. Reporting and accountability are poor. On 11 March 2020, the Department of Water and Sanitation had to explain to the National Assembly's Standing Committee on Public Accounts why it had not submitted its annual report on time. In the course of the discussion it emerged that there was a major problem with South Africa's participation in the Trans-Caledon Tunnel Authority and the Lesotho Highlands Water Commission, crucial to the supply of water to South Africa's economic heartland.

   Problems can be found all the way down the system. Chapter 7 of the NWA, passed more than twenty years ago, allows for the creation of Catchment Management Agencies. The country is divided into nine catchments, delineated by topography and hydrology. To date, only two CMAs have been established: the Breede-Gouritz CMA (BGCMA) in the Western Cape and the Inkomati-Usuthu CMA in parts of Mpumalanga. The BGCMA is working well and a detailed document setting out proposed classes of water resources and the proposed resource quality objectives for the Breede -Gouritz Water Management Area was gazetted for public comment on 23 October 2018.[133] At the same time, in the Berg-Olifants WMA, the Cape Town water crisis had just passed its peak. The crisis was caused by a drought regarded as extreme, though climate risks may well be rising because of climate change. Climate scientists predict that the Western Cape will become drier and experience moderate to strong warming over the next 100 years. Moreover, the spread of water-thirsty alien plants in crucial catchment areas have reduced water supply to the Theewaterskloof Dam, the main water source for Cape Town.[134] Government failure also contributed to the crisis. This contrast illustrates the general point: The administration of water services varies sharply across the country. It now appears that Nelson Mandela Bay is the next metro to experience a water crisis.

   Roughly half of Category A and C local authorities (metros and local municipalities) are supplied by water boards. There are two advantages to lying within the area of supply of a water board. The burden on a municipality is reduced to the extent that the responsibility of providing bulk water lies with the water board. And water boards can act as agencies for municipalities by developing new infrastructure for underserviced communities. Nonetheless, it is not necessary to have wall-to-wall water boards. They would add no value to self-sufficient water services authorities.

3. ***Water services are constrained by the state of water service authorities.*** WSAs are either individual local municipalities or district municipalities serving more than one local municipality. There have been financial problems and technical constraints in many municipalities ever since the current system

133. Government Gazette 42053, Notice 2918.
134. World Wild Life Fund "Agricultural Water File: Farming for a drier future" (19 July 2018), available at https://www.wwf.org.za/?25441/Agricultural-water-file-Farming-for-a-drier-future.

was introduced twenty years ago. Programme after programme has been introduced by the National Treasury and the Department of Co-operative Governance and Traditional Affairs to remedy this state of affairs, but currently over half the WSAs are in financial distress. Releasing the 2017/18 MFMA audit, the Auditor-General said that various local governments have been slow in implementing the audit office's recommendations, and in many instances the recommendations have been disregarded. As a result, the accountability for financial and performance management continues to worsen in most municipalities. He also pointed out that in some municipalities, pressure was placed on audit teams to change conclusions purely to avoid negative audit outcomes or the disclosure of irregular expenditure, without sufficient grounds. Instances of threats to and intimidation of auditors were also experienced in most of the provinces. Corruption is endemic in local authorities.

Poor WSA performance shows up in unacceptably lengthy periods of water service interruption, poor maintenance and operation, and inadequate testing of water quality as well as poor test results

4. ***Climate change is stressing the water system and the response is inadequate.*** The Institute for Security Studies found in a 2014 report[135] that South Africa is over-exploiting its freshwater resources. The authors' research finds that the gap between demand and supply is set to increase without additional, aggressive measures. At the least, this situation requires regularly updated estimations of water balances at both the national and the nine water management areas, as well as assessment of the likely impact climate change on these balances and risks to them. But formal arrangements to integrate water sensitive design into spatial planning and land use management more generally have been slow for several reasons.

5. ***Attention needs to be paid to improving technical information and communicating it to water service consumers.*** At present, information is scattered across a range of platforms, from which data disappear from time to time. Moreover, there is inadequate opportunity for consumer complaints to be lodged and attended to.

   The conclusion must be that maintenance of the present environment of inadequate information, poor planning and prioritisation, fiscal constraints, uneven and often poor institutional performance, climate change and slowness in reducing water losses and changing behavior will mean that crises in water services are bound to occur in the coming years.

2. Recommendations

By and large, the legislative framework for the delivery of water services is adequate. The key constraint is the absence or poor functioning of institutions.

Recommendation 1. The creation of a complete set of Catchment Management Agencies needs to be accelerated. These agencies need to compile an inventory of water resources in their water management areas, and identify priorities for water source development. They also need to monitor patterns of water use and identify areas of water stress. These are large responsibilities and they need to be adequately resourced.

Recommendation 2. The existing configuration of water boards needs to be reviewed. It is not necessary that the entire country be covered by water boards. Self-sufficient water service authorities do not need them. But a water board should be present wherever there are water sources which can be used by more than one water service authority. Water boards take pressure off water service authorities in two important ways. They reduce the attention that WSAs have to pay to management of water sources and they can act on behalf of water service authorities by providing new water reticulation.

It is well known that the country is relatively poorly endowed with water resources, that existing water use is pressing up against the limits of supply and that climate change is creating new hydrological risks. The informational framework for managing this situation is inadequate.

Recommendation 3. Every water service authority and every water board should be required to compile and publish an annual water balance in a standard format. The International Water Association's template is a useful starting point. The process of compilation will reveal stresses in the supply and use of water and serve to define water service development priorities.

Recommendation 4. Every water service authority should be required to report regularly on water quality and operation and maintenance of its water delivery system, and this information should be recorded in a single and easily accessible system. Our investigation has uncovered a number of information systems operated by the DWS, with a lot of down time and inadequate archiving. Even more alarming are the gaps in information from water service authorities. The DWS needs to establish itself more firmly as the agency to which water service authorities are accountable, improving its information system and establishing an inspectorate to see to it that WSAs collect and submit required information.

135. Hedden andCilliers "Parched prospects: the emerging water crisis in South Africa" (2014) African Futures Paper 11.

While substantial progress has been made in the past 25 years, there are still households with inadequate water services. While scattered populations are hard to reach, all densely settled areas without adequate water services should be identified and plans formulated to make the necessary improvements. National databases for this exercise are out of date, but these can be supplemented by local information, compiled into a register forming part of municipal spatial development plans.

Recommendation 5. The next population census, due in 2021, will have geographical information down to the enumerator area level, with information on water services. Aggregations of adjacent enumerator areas which are densely settled and an assessment of the state of water services in each is an analytical exercise which should be undertaken as soon as possible, and fed back to catchment management agencies, water boards and water services authorities.

The water crisis in Cape Town is being followed by one in Nelson Mandela Bay. Other metros may follow suit.

Recommendation 6. Given the importance of metros to the economy, the water security of each needs to be assessed and reported on. Each metro needs to use its water balance assessment to reduce water losses and to identify the possibilities of water sensitive urban design. Climate change means that the changing hydrological risks to its water sources need to be kept under constant review.

Recommendation 7. Section 27(1)(b) of the Constitution establishes the right of every person to sufficient water.

Standards have been created to give content to this right. A summary of these standards should be formulated and displayed in all local authority offices. Institutional mechanisms should be created for communities to claim their water rights, prompting a compulsory water services authority investigation when supply is deficient in quantity, quality or reliability.

Water spilling over the Midmar Dam

APPENDIX 1: NATIONAL INTEGRATED WATER INFORMATION SYSTEM

WATER MANAGEMENT THEMES	PURPOSE	DASHBOARD
Climate and weather	Relates to climate change indicators including changes in temperature, wet spells, dry spells, irrigation demand, potential evaporation, mean annual precipitation and streamflow	Climate change
Drought and disaster management	Provide regular overview and outlook of drought status in South Africa	Drought status, rainfall status, runoff status, dams' status, groundwater status, affected and settlements
Human resources	Provides an overview of the human resources in the DWS, with focus on age, gender and race	Human resources capital
Infrastructure	Provide an overview on Government Water Schemes (GWS), location of GWS and dam levels	Dam safety regulations
Monitoring networks	Provides overview on surface and groundwater monitoring points that are managed by the Department. In addition, it provides information on specified water quality monitoring points	Surface water, groundwater level and water quality
State of water	Gives information of the water state in different aspects of water business	Waste Water Quality Compliance, Waste Water Treatment Authorisation, Drinking Water Quality Compliance, Resource Water Quality Objectives, Health Risks related to using untreated water from Rivers and Dams and Eutrophicatio
Water ecosystems	Provides an overview on reserve determination	Ground water reserve
Water quality	Provides an overview on compliance levels related to drinking and waste water quality, authorisation for waste water treatment, resource water quality objectives, health risks related to using untreated water from rivers and dams, eutrophication, and groundwater quality	Waste Water Treatment authorisation, Resource Water Quality Objectives, Raw Water Quality, Eutrophication, and Groundwater Quality
Water quantity	Provides an overview on volume of water stored in dams, current river flows, status of groundwater availability, groundwater levels, and Water Transfers	Surface Water Storage, River Flows. Groundwater Availability Status, Groundwater Level Status, Water Transfers
Water services	Provides an overview on population access to available water infrastructure, the reliability of water supply, non-revenue water, and sanitation services	Access to Water Infrastructure Delivered, Water Supply Reliability, Non-Revenue Water and Sanitation Services
Water tariffs	Provides an overview on raw water tariffs and municipal water tariffs	Raw water tariffs and municipal water tariffs

APPENDIX 2: PHYSICAL, AESTHETIC AND CHEMICAL DRINKING WATER QUALITY DETERMINANDS

DETERMINAND	RISK	UNIT	STANDARD LIMIT
MICROBIOLOGICAL			
E. coli or fæcal coliform	Acute health	Count per 100 mL	Not detected
Protozoan parasites:			
• Cryptosporidium spp.	Acute health	Count per 10 L	Not detected
• Giardia spp.	Acute health	Count per 10 L	Not detected
Total coliforms	Operational	Count per 100 L	≤ 10
Heterotrophic plate count	Operational	Count per mL	≤ 1000
Somatic coliphages	Operational	Count per 10 mL	Not detected
PHYSICAL AND AESTHETIC			
Colour	Aesthetic	mg/L Pt-Co	≤15
Conductivity at 25 °C	Aesthetic	mS/m	≤170
Total Dissolved Solids	Aesthetic	mg/L	≤1200
Turbidity	Operational	NTU	≤1
	Aesthetic	NTU	≤5
pH at 25 °C	Aesthetic	pH units	≤5 to ≤9,7
CHEMICAL DETERMINANDS-MACRO-DETERMINANDS			
Free chlorine as Cl_2	Chronic health	mg/L	≤5
Monochloramine	Chronic health	mg/L	≤3
Nitrate as N	Acute health	mg/L	≤11
Nitrite as N	Acute health	mg/L	≤0,9
Combine nitrite plus nitrate	Acute health	mg/L	≤1
Sulfate as SO_4^{2-}	Acute health	mg/L	≤500
	Aesthetic	mg/L	≤250
Fluoride	Chronic health	mg/L	≤1,5
Ammonia as N	Aesthetic	mg/L	≤1,5
Chloride as Cl^-	Aesthetic	mg/L	≤300
Sodium as Na	Aesthetic	mg/L	≤200
Zinc as Zn	Aesthetic	mg/L	≤5
CHEMICAL DETERMINANDS			
Antimony as Sb	Chronic health	µg/L	≤20
Arsenic as As	Chronic health	µg/L	≤10
Barium as Ba	Chronic health	µg/L	≤700
Boron as B	Chronic health	µg/L	≤2400
Cadmium as Cd	Chronic health	µg/L	≤3
Total chromium as Cr	Chronic health	µg/L	≤50
Copper as Cu	Chronic health	µg/L	≤2000
Cyanide (recoverable) as CN^-	Acute health	µg/L	≤200
Iron as Fe	Chronic health	µg/L	≤2000
	Aesthetic	µg/L	≤300
Lead as Pb	Chronic health	µg/L	≤10
Manganese as Mn	Chronic health	µg/L	≤400
	Aesthetic	µg/L	≤100
Mercury as Hg	Chronic health	µg/L	≤6
Nickel as Ni	Chronic health	µg/L	≤70
Selenium as Se	Chronic health	µg/L	≤40
Uranium as U	Chronic health	µg/L	≤30
Aluminium	Operational	µg/L	≤300
CHEMICAL DETERMINANDS-ORGANIC DETERMINANDS			
Total organic carbon as C	Chronic health	µg/L	≤10
Trihalomethanes			
• Chloroform		µg/L	≤300
• Bromoform		µg/L	≤100
• Dibromochloromethane		µg/L	≤100
• Bromodichloromethane		µg/L	≤60
Combined trihalomethane	Chronic health	µg/L	≤1
Total microcystin	Chronic health	µg/L	≤1
Phenols	Aesthetic	µg/L	≤10

APPENDIX 3: LIST OF WATER BRIEFS

NO.	AUTHOR	TITLE	PUBLICATION DATE
1	Michelle Toxopeus	Water governance I: a broad outline of the legislative framework in South Africa	30 Jan 2019
2	Michelle Toxopeus	Water governance II: a broad outline of South Africa's international obligations	30 Jan 2019
3	Michelle Toxopeus	The institutional structure for delivering water service	5 Feb 2019
4	Michelle Toxopeus	The institutional structure of water resource management	5 Feb 2019
5	Michelle Toxopeus	The state of sanitation and waste water treatment services in South Africa	5 Feb 2019
6	Michelle Toxopeus	Understanding water issues and challenges I: Department of Water and Sanitation	6 Feb 2019
7	Michelle Toxopeus	Understanding water issues and challenges II: Municipalities and the delivery of water services	6 Feb 2019
8	Michelle Toxopeus	Understanding water issues and challenges III: Water boards and bulk water services	6 Feb 2019
9	Michelle Toxopeus	Understanding water issues and challenges IV: Water infrastructure assessment	6 Feb 2019
10	Michelle Toxopeus	Domestic strategies to address the impact of climate change on water resources	15 July 2019
11	Michelle Toxopeus	Municipalities I: Evaluating executive authority in municipalities	16 July 2019
12	Michelle Toxopeus	Municipalities II: Assessing mechanisms of municipal oversight	16 July 2019
13	Michelle Toxopeus	Municipalities III: Assessing provincial intervention in local government. Are provinces doing too little or too much?	16 July 2019
14	Michelle Toxopeus	Strengthening institutional capacity in water resources management to enhance performance	1 Oct 2019
15	Michelle Toxopeus	Do we need a Water Use Bill?	4 Oct 2019
16	Michelle Toxopeus	Developing water sensitive cities I: Rethinking how we manage urban water	30 Oct 2019
17	Michelle Toxopeus	Developing water sensitive cities II: Is there support in South Africa's regulatory framework?	30 Oct 2019
18	Michelle Toxopeus	Developing water sensitive cities III: A case study of two South African metros	30 Oct 2019
19	Nhlanhla Mnisi	Emerging contaminants: Crisis or manageable risk?	2 Dec 2019
20	Michelle Toxopeus	Waiting on water – drought management and its protracted timelines: An explainer	2 Dec 2019
21	Charles Simkins	Water quality, reliability and payment for services: Household perspectives I – Context and water quality	2 Dec 2019
22	Charles Simkins	Water quality, reliability and payment for services: Household perspectives II – Water supply interruptions and payment for water	2 Dec 2019
23	Nhlanhla Mnisi	Water infrastructure backlog and access to water infrastructure delivered	2 Dec 2019
24	Nhlanhla Mnisi	Water scarcity in South Africa: A result of physical or economic factors	15 Jan 2020
25	Nhlanhla Mnisi	Asbestos cement water pipes: A health hazard?	15 Jan 2020
26	Michelle Toxopeus	Financing water services infrastructure through private sector partnerships	28 Jan 2020
27	Michelle Toxopeus	Water boards and indicators of institutional integrity	28 Jan 2020
28	Michelle Toxopeus	Intergovernmental fiscal relations in the water services sector – Assessing oversight and accountability measures	28 Jan 2020
29	Nhlanhla Mnisi	National drinking water quality reporting for building consumer confidence: Part I	5 Feb 2020
30	Nhlanhla Mnisi	National drinking water quality reporting for building consumer confidence: Part II	5 Feb 2020
31	Charles Simkins	Institutional framework for water delivery	6 Feb 2020
32	Charles Simkins	Water quality	6 Feb 2020
33	Charles Simkins	Water supply infrastructure and reliability – definitions and information	6 Feb 2020