



Water Security Perspective for the Gauteng City-Region

Securing water for continued growth and well being

Final Draft, August 2019



EXECUTIVE SUMMARY

Gauteng must never take its water security for granted. The Province lies high on the divide between South Africa's two great rivers, with very limited local water resources. It depends on supplies from a large, highly engineered system and a few local sources that draw water from five different river basins across six provinces. The climate that supports these supplies is extremely variable with a history of unpredictable multi-year droughts. The threat of climate change compounds this uncertainty and adds further long term risks.

The water crisis in Cape Town over the past three years demonstrates the need for permanent vigilance in such circumstances. As Gauteng's population expands and the economy grows, we must continually review the security of our city region's water supply if it is to continue to sustain its people and their economic growth. Cape Town has shown how quickly a large city can enter a crisis if it is not prepared.

The Provincial Government of Gauteng and its municipalities resolved to work together to ensure water security for all in Gauteng. This Gauteng City-Region Water Security Perspective (GWSP) outlines what each organisation must do and how they will work

together to achieve this goal. It will bring together all the Departments and Agencies of the Gauteng Provincial Government, the municipalities as well as business and civil society organisations and the people of the province.

Water is everybody's business and water security must be a collective effort and that involves all the Gauteng City-Region's (GCR) people. Their lives and livelihoods depends on a common system and their behaviour and actions will determine whether it can meet their needs. But any water security strategy must also involve the many institutions beyond the Province's boundaries who use the system and keep it working. This includes regional utilities such as Rand Water, municipal entities such as Joburg Water and ERWAT, as well as national government and its agencies.

Immediate priorities include ensuring that Polihali Dam, the next phase of the Lesotho Highlands Water Project (LHWP) is completed on time. Until that is done, the province will be at risk of supply shortages if there is a prolonged dry period. So, in the meanwhile, Gauteng must ensure that water consumption is kept at sustainable limits. And it must be

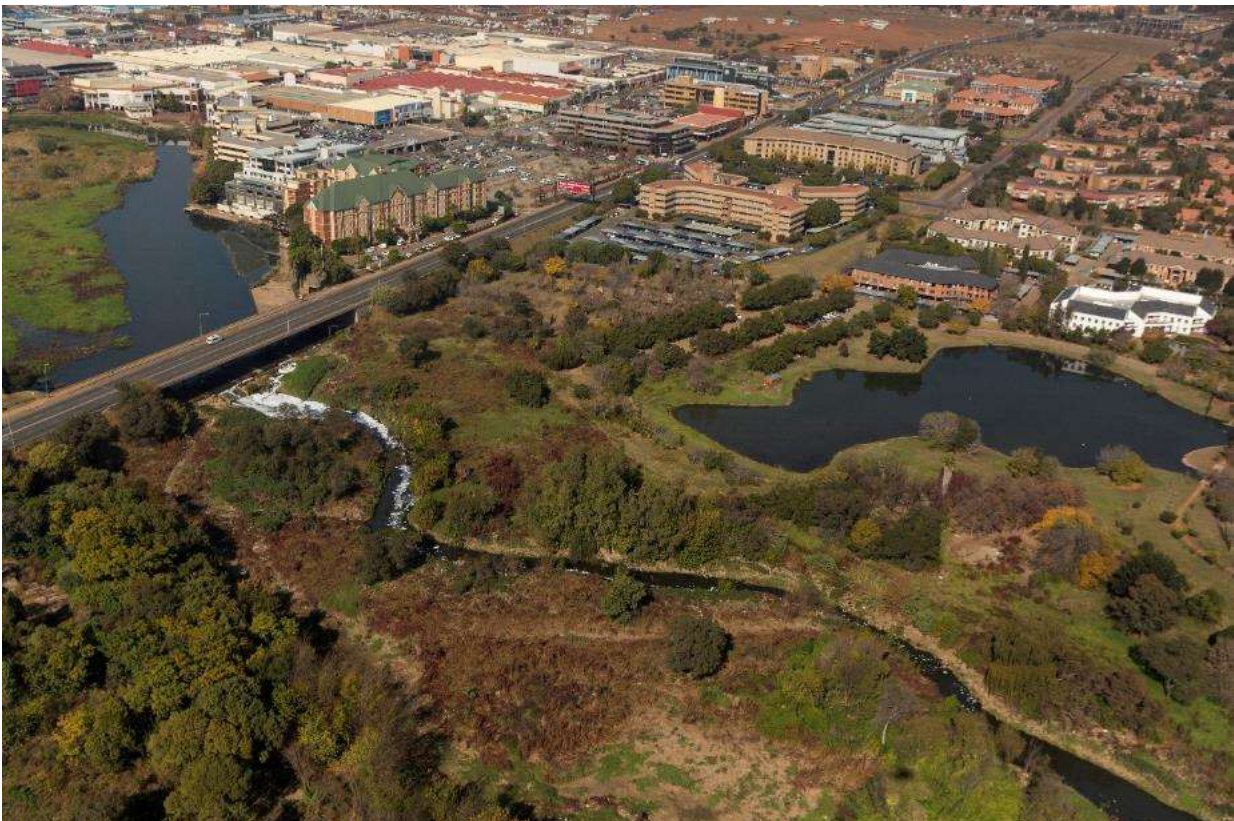
ready to restrict water use as soon as drought risks become evident.

In the longer term, this urban province must work to build a more resilient community that can live comfortably with its available water resources and manage the risks that it faces. This requires action well beyond the water sector. Settlement planning and housing design can dramatically change peoples' water needs – for better or worse. Careful consideration of how peoples' built environment interacts with natural ecosystems can reduce risks of natural disasters and contribute to a safe and productive environment. Critically, the people of Gauteng need to understand how their water reaches their homes and workplaces, where their wastewater goes to and how their behaviour can keep that cycle working.

Gauteng can only claim to be water secure when all its residents have affordable access to safe and reliable water supplies as well as to safely managed and dignified sanitation services. This will not be achieved by action in the water sector alone. Informal settlements, where it is often physically impossible to provide adequate sanitation, present a particularly difficult challenge, as do the problems faced by people with disabilities.

THIS PERSPECTIVE thus outlines the sources of the Province's water and the systems on which it depends. It considers how the Province's wastes are managed and the implications for the surrounding region.

It then considers at the current performance of the key institutions in the sector and identifies some of the emerging challenges that face the Gauteng community if it is to achieve and then sustain its water security.



A SUMMARY OF CRITICAL ISSUES

The achievement of water security is a never-ending challenge that requires continued focus and effort. **Gauteng must manage growing supply risks in the short term while laying a foundation for long-term water security** that is financially and environmentally sustainable. Due to delays in the Lesotho Highlands Water Project Phase 2, it is currently a challenge of particular urgency. **Neither demand-side or supply-side measures will be sufficient; both must be pursued in an interconnected manner by effective and interconnected institutions.**

Supply and demand

Gauteng's per-capita water use is too high and must be reduced in the short and long term.

Municipalities must reduce physical losses from their distribution systems as well as unauthorised use that is not paid for. Social institutions and businesses should reduce their water consumption by introducing efficiency measures and many households must also be encouraged to reduce their water use. All water users must be prepared for restrictions at times of drought while urban planning must drive towards water efficient cities.

A sufficient reliable supply of water must also be secured to meet the region's needs. Gauteng and the surrounding region depend almost entirely on an inter-connected system of rivers, dams, canals and pipelines, which enables sufficient water to be made available for people, the economy and environment. **This Integrated Vaal River System (IVRS) must be effectively monitored, operated and maintained** to sustain reliable bulk water supplies.

In addition, **the IVRS infrastructure must be further developed**, in a timely manner, to meet the needs of a growing population and economy. This requires long-term planning and investment. Updating the Vaal River Reconciliation Strategy must be prioritised to guide this process, taking climate variability and change into account.

The water mix must be diversified where possible. Groundwater, wastewater re-use, treated acid mine drainage, and rainwater harvesting are potential sources of water that can improve water security in the province.

Institutions

Effective institutions are essential to keep the system running. **Water security is threatened by institutional weakness** and possible failure at all levels. There are serious shortcomings in the management of the IVRS; Rand Water has experienced operational problems which revealed a lack of contingency planning; while the many challenges faced by municipalities are well documented.

Gauteng is dependent on Rand Water's performance which must be monitored to ensure that there is no 'slow-onset' institutional failure that would put the province at risk.

Almost all households, business, industries and public institutions (hospitals, schools, etc.) are dependent on the **performance of the municipalities** which provide their water services.

Under the Constitution, municipalities must ensure access for all residents to water supply and sanitation services, and, as **water services providers, must operate in a financially sustainable manner**. This requires the management of extensive infrastructure networks and the associated technical and financial accounting systems.

National and provincial government must support and regulate municipalities for the provision of water supply and sanitation services.

In South Africa's highly unequal society, the GCR is experiencing rapid population growth, accelerated by in-migration. This poses difficult challenges and Gauteng's **municipalities must ensure that even their poorest residents, including in informal settlements, have access to basic water services.**

Stormwater

The management of stormwater – and subsequent risk of flooding - is a municipal responsibility, often assigned to their roads divisions. **Urban planning and development must take account of the management of stormwater** to reduce flooding risks and health hazards as well as water supply and wastewater disposal requirements. In the long term, the goal must be to make Gauteng's cities greener and more sustainable.

Water quality

Cities are a major source of water pollution, much of which is due to improperly managed wastewater infrastructure. Municipalities have a responsibility to manage their wastewater systems to minimise pollution of streams and rivers.

While **the four largest municipalities will have to make 95% of the water savings** to balance supply and demand, **smaller municipalities must focus on improving their wastewater treatment** which is a disproportionately large source of pollution.

The way forward

The Action Plan proposes to address these challenges in a structured manner to ensure that all institutions know what they responsible for and what immediate actions should be taken. The immediate actions that are needed will provide the foundation for a more structured programme that will address the longer term goals and 5 programmatic areas of intervention are put forward. **Effective coordination** will be a critical success factor. It will also be necessary to prioritise actions, to make the best possible use of limited institutional, technical and financial resources.

5 PROGRAMMATIC AREAS OF INTERVENTION

This perspective for a water secure Gauteng City-Region covers a range of interconnected issues that need to be dealt with in integrated manner. There are 5 priority areas of intervention that will specifically require cooperation across institutions and partners in the GCR. These areas require action in the short term and will need continued support and effort.

1. Reduce water demand

Gauteng's water use is substantially above global averages and much too high for a region with limited water resources. In the short term, as the region's population and economy grows but water supplies remain the same, water use per person must be reduced. To achieve this, available water must be allocated between municipalities and other users and programmes put in place to keep consumption within these limits. The initiative of Rand Water through its Project 1600 to set water allocation ceilings for each municipality in Gauteng must be supported and implemented. Municipalities will then be responsible to keep consumption within the limits set. They must be supported to make investments in water conservation, more efficient water use and to encourage and support households and other users to undertake interventions to reduce demand.

2. Manage variability to prepare for drought and /or water scarcity

Water resource management aims to maintain reliable supplies even during periods of drought. The population and economic growth in the GCR means that demand for water is likely to exceed supply in the short term so water scarcity may happen outside of periods of extended drought. The goal is to monitor water availability and use so that, if there is a threat of scarcity, users can be alerted and take action.

The Integrated Vaal River System operating model can give water managers and users to get early warning of potential shortages in the Rand Water supply area. If this functions effectively and its warnings are acted upon, the impact of droughts can be dramatically reduced. The model must be maintained and updated.

There will be periods of water shortage which may require additional measures. To prepare for these, operating rules and plans for managing water during periods of water scarcity need to be put in place and agreed to by all water institutions, before they are needed. The disaster management and risk reduction function of provincial government should ensure that these arrangements are in place. Planning for water security should set the rules to guide the GCR both into, as well as out of water scarcity conditions in a manner that responds to changing conditions and water availability.

3. Invest in alternative water sources and tools for water conservation

Given the short term constraints on water supply to the Province from the IVRS, efforts must be made to increase water availability and to diversify sources of supply to reduce risks. Alternative water sources may include groundwater, rainwater, stormwater and reuse of wastewater and treated AMD. Many of these will best be promoted through initiatives at household or local municipality level. Innovations to reduce water use should also be promoted at this level.

4. Manage water quality to limit pollution and achieve environmental goals

Poor water quality in the river systems that flow from and through Gauteng put its people and downstream users at risk and may influence water availability. At present, Gauteng's primary water quality problems are the result of human activity, the poor management of sanitation systems, dumping and littering. This is contributing to the eutrophication of the province's dams, reducing their value for recreational purposes. While chemical pollution from mining and industry is declining, it needs to be monitored and controlled. Meanwhile, although poorly managed waste water treatment works are problematic, they may offer an opportunity to increase water reuse and mitigate supply constraints. Updated water quality modelling is required to guide policy interventions as well as to guide wastewater disposal strategies to reduce and increase the volumes of reusable water.

5. Effective institutions for water security

Many of the challenges to creating water security in the GCR relate to the performance and capability of the complex set of institutions with water related mandates. This Perspective sets out a programme of action that municipalities, water boards and water utilities should take to build strong institutions that will ensure water security.

In the area of water resource management, some institutional review is needed. Catchment Management Agencies (CMAs) are to be established to devolve many resource management functions from national to regional level and increase user participation in water decision making. Currently, the CMAs are defined by river basin boundaries which split the GCR and its users between the Upper Vaal, Crocodile-Marico West and Olifants catchments. Which makes coordination and cooperation difficult. It is proposed that a Vaal CMA should cover the areas supported by the IVRS so that major water users can participate in the development of strategy and systems operation. This would strengthen water resource management in the region and contribute significantly to water security in the GCR.

Many of the actions necessary to create a water secure GCR requires strong coordination across government. Existing cooperative governance structures, notably the Premier's Coordinating Forum, provide an appropriate overall structure for provincial level coordination with municipalities and other local organisations. Given the risks facing the province, it may be appropriate for the Provincial Disaster Management function to coordinate water security activities.

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LIST OF ABBREVIATIONS AND ACRONYMS

AGSA	Auditor General of South Africa
AMD	Acid Mine Drainage
BUSA	Business Unity South Africa
CAIA	Chemical and Allied Industries Association
CMA	Catchment Management Agency
COGTA	Department of Cooperative Government and Traditional Affairs
CVRSS	Continuation of the Vaal River System Reconciliation Strategy Study (Phase 2)
DoRA	(Annual) Division of Revenue Act
DWA	Department of Water Affairs (2009-2014)
DWAF	Department of Water Affairs and Forestry (up to April 2009)
DWS	Department of Water and Sanitation (from 2014 onwards)
ERWAT	East Rand Water Care Company
ESKOM	Electricity Supply Commission
FBW	Free Basic Water
FSC	Full Supply Capacity
GCR	Gauteng City Region
GCRO	Gauteng City-Region Observatory
GDP	Gross Domestic Product
GHS	General Household Survey
GPG	Gauteng Provincial Governments
GWS	Government Water Schemes
GWSP	Gauteng Province Water Security Plan
IVRS	Integrated Vaal River System
LHWP	Lesotho Highlands Water Project
MuSSA	Municipal Services Strategic Assessment
NGO	Non-Governmental Organisation
NRW	Non Revenue Water
NT	National Treasury
NWRS1	National Water Resources Strategy first edition, 2004
NWRS2	National Water Resources Strategy second edition, 2013

NW&SMP	National Water and Sanitation Master Plan
O&M	Operation and Maintenance
PCF	(Gauteng) Premier’s Coordinating Forum
PFMA	Public Finance Management Act
RBO	River Basin Organisation
SALGA	South African Local Government Association
SASOL	South African Synthetic Oil Limited
SCOPA	Standing Committee on Public Accounts
SDGs	Sustainable Development Goals
SSC	Staff Selection Commission
STATSSA	Statistics South Africa
TCTA	Trans Caledon Tunnel Authority
WCWDM	Water Conservation and Water Demand Management
WCWSS	Western Cape Water Supply System
WMA	Water Management Area
WRC	Water Research Commission
WSP	Water Services Provider
WSS	Water Supply System
WWTW	Waste Water Treatment Works

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1 INTRODUCTION

Situated on a high plateau far from any large rivers, the people and economy of Gauteng Province and surrounding regions must survive and thrive in an extremely variable and uncertain climate. Over the past century, they have regularly had to cope with severe droughts. Five times, the flow in the Vaal River on which they have depended has fallen to less than half its average for three years in a row¹.

As Gauteng's population expands and the economy grows, the risk of drought presents a serious challenge to people and their prosperity. The experience of Cape Town has shown how quickly a large city can enter a crisis if it is not prepared. The people and government of Gauteng and its cities are determined that this should not happen to them.

To avoid this, they need to understand the context in which they live and work. South Africa is already a water-scarce country. Average annual rainfall is only 495 mm compared to a world average of 1 033 mm². The United Nations Economic Commission for Africa notes that since 1990 South Africa has shifted from being "water stressed" to be a country of water scarcity and that by 2025 the country will experience the 9th lowest levels of water availability per capita in Africa. Like the Vaal River system, the rest of South Africa is also prone to multi-year droughts as Cape Town's recent crisis has shown.

Despite this vulnerability, the average daily water use per capita in South Africa of 235 litres is substantially higher than the world average (173 litres)³. If action is not taken now, the country will face a significant gap between supply and demand by 2030. While there is still water available, it needs to be harnessed, which will be costly. The Gauteng City Region (GCR) is not immune to the water risks facing the country as a whole. At around 300 litres per person per day, its water use is even higher than the national average. And the risks that it faces are aggravated by rapid population growth, high water losses and degradation of the quality of water resources.

The goal of water management is to achieve water security. As described in more detail in section 3, the aim is to ensure that, even if there is a drought, people and businesses can access enough safe and reliable water to meet their needs, while taking care of their sanitation needs and protecting the environment. To achieve this, it is essential that the available supply of bulk water is adequate as well as measures taken to keep supply and demand into balance. And, since human and financial resources are always limited, the feasibility and cost-effectiveness of and proposed programmes of action must be confirmed.

Gauteng is dependent on a complex system of transfers that bring water from other river basins to reinforce the Vaal. This Integrated Vaal River System (IVRS), extends well beyond the Gauteng Province's administrative boundaries. It also supplies key strategic water users such as ESKOM and SASOL as well as communities in surrounding provinces.

¹Department of Water Affairs, (1986), Management of Water Resources of the Republic of South Africa. Department of Water Affairs. Cape Town. pp. 1.

² National Oceanic and Atmospheric Administration, (2015), Global Climate Report. (Accessed: June 2018), <https://www.ncdc.noaa.gov/sotc/global/201512>.

³ Department of Water and Sanitation, (2018), National Water and Sanitation Master Plan: Call to Action [Draft], Department of Water and Sanitation. Pretoria.

The IVRS will be expanded and strengthened by the construction of the Polihali dam on a tributary of the Orange-Senqu River in Lesotho as Phase 2 of the Lesotho Highlands Water Project (LHWP). The additional storage provided by this dam should ensure adequate water for the region until around 2030 and should have been completed by 2018. Delays in planning and construction mean that it will only be completed at the earliest in 2026 and, even then, will depend on good rains to fill it. During this period, Gauteng will be at increasing risk of restrictions if there is a dry period (which is likely).

Gauteng Province and the Municipalities have thus resolved to work together to ensure their water security. They have prepared and approved this Gauteng Province Water Security Perspective (GWSP) which outlines what each organisation must do and how they will work together.

A great deal has already been done. All the relevant⁴ Gauteng municipalities have, for instance, prepared statutory Water Services Development Plans, implemented investment plans to expand their water services and tried to reduce their water losses. Rand Water has convened municipalities to discuss the limits to what they can supply in the medium term. Civil society organisations and the media have focused on problems of water pollution and water waste. This document aims to support and coordinate actions that are already underway and to focus on the remaining gaps.

The immediate challenge facing Gauteng is to keep water consumption at sustainable limits until the LHWP Phase 2 project is complete. However, managing the water requirements of a growing and developing community like the GCR is an ongoing challenge that the GWSP also addresses. It is a plan for the region's long-term water security which reflects the Province's own development plans and perspectives and is aligned with the recent Water Master Plan of the Department of Water and Sanitation (DWS).

⁴ Gauteng's two District Municipalities do not have any formal water management functions since these are discharged by the Local Municipalities within them.

2 CONTEXT TO WATER SECURITY

2.1 Population dynamics

Gauteng Province is South Africa’s smallest province by land area but contains the largest urban area – known as the Gauteng City Region – in which an estimated 14.8 million people reside, 25,5% of the estimated national population⁵. Gauteng is the biggest contributor to the national gross domestic product (around 37%) and is the country’s financial, commercial, industrial and government hub. The Integrated Vaal River System, on which the Province depends, supports almost 50% of South Africa’s GDP since it also supplies a substantial proportion of the economic activity in the Crocodile-Marico and Upper Olifants catchments⁶– including many power stations, industries (e.g. SASOL 1 and 2 plants) and mines and associated urban settlements.

Gauteng is divided into three metropolitan municipalities (Ekurhuleni, Johannesburg and Tshwane), and two district municipalities, each divided into three local municipalities: Sedibeng District Municipality (Emfuleni, Lesedi and Midvaal) and West Rand District Municipality (Merafong, Mogale and Rand West City).

Rapid urbanisation, natural population growth and in-migration into Gauteng of 3 392 495 people between 2008 and 2018 has driven the highest growth in South Africa, placing pressure on housing and infrastructure delivery⁵. Between 2012 and 2017 Gauteng grew by a little over 1700 000 people (Table 1). To put this in context, Gauteng is adding an extra Soweto every 5 years (population of Soweto in 2016 was 1 480 000). This, as well as the densification of existing suburbs, and the spread of new formal housing developments present the province with serious water and sanitation services delivery challenges.

Table 1: StatsSA midyear population estimates for District and Metro Municipalities at 5 year intervals (2002 – 2017) ⁷

	2002	2007	2012	2017
Sedibeng	809 188	824 663	850 853	931 516
West Rand	764 970	807 789	862 622	932 708
Ekurhuleni	2 577 466	2 879 562	3 217 535	3 576 816
Johannesburg	3 379 888	3 968 317	4 652 597	5 396 564
Tshwane	2 232 789	2 563 398	2 955 463	3 440 748
TOTAL GAUTENG	9 764 301	11 043 730	12 539 071	14 278 351
5 Year population growth		1 279 428	1 495 341	1 739 281

⁵ StatsSA, (2018), Mid-year Population Estimates 2018, Statistical Release P0302. StatsSA. Pretoria.

⁶Department of Water Affairs and Forestry, (2004), National Water Resource Strategy. 1st Ed. Department of Water Affairs and Forestry. Pretoria.

⁷ StatsSA, (2018), Mid-year Population Estimates 2018, Statistical Release P0302. StatsSA. Pretoria

2.2 Gauteng catchments

Gauteng straddles the watershed that divides the Limpopo and Orange river basins with rain falling north of Johannesburg's Parktown ridge draining into the Limpopo river and Indian Ocean while rain falling south of the ridge drains into the Vaal River and eventually into the Atlantic Ocean. After use, much of the wastewater that has been supplied from the Vaal is discharged, after treatment, into the Crocodile and other tributaries of the Limpopo.

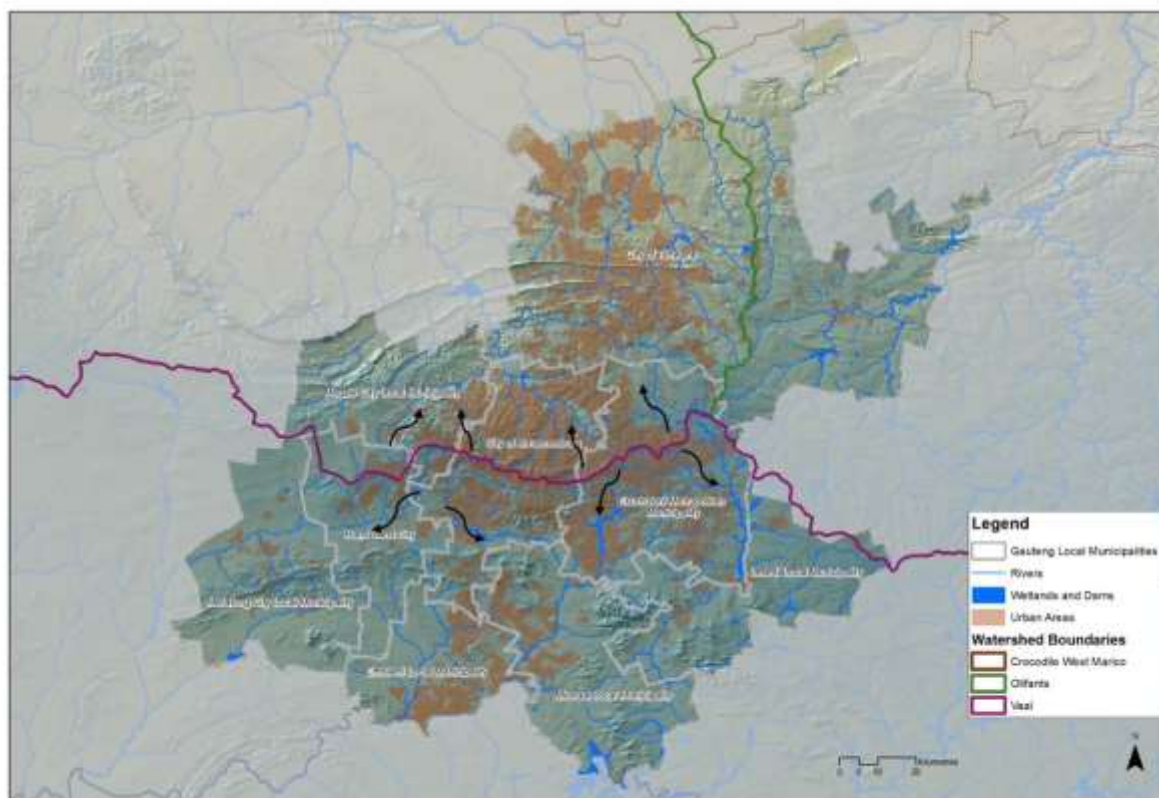


Figure 1: The catchment divide that runs through Gauteng⁸

Gauteng relies on water supplied from an engineered system known as the Integrated Vaal River System (IVRS) – see section 4. This system integrates ecological infrastructure (natural water bodies such as rivers) with major constructed infrastructure which transfers water from other catchments (Senqu, in Lesotho through the Lesotho Highland Water Project, uThukela and uSuthu) into the Vaal. It also includes the large dams from which stored water can be drawn during dry periods.

⁸ Map drawn by G Maree, data from DWA 1: 500 000 Rivers data, DWA Primary Catchment data

2.3 Climate variability

Droughts and floods are part of Southern Africa's climate variability and, with climate change, are predicted to increase in frequency and intensity. Integrated planning and management of water resources, infrastructure and human settlement is required to build resilience to these disasters.

The recent drought in the Western Cape demonstrates how vulnerable our major urban centres may be to droughts. Unless carefully managed, these can become slow onset disasters that, unlike floods, are not always immediately apparent to the general public. Gauteng – as the economic, financial and government hub of the country – must avoid any “day zero” scenario if it is to ensure the sustainability and inclusive growth of South Africa's national economy.

However, water security cannot be achieved in isolation from activities in the wider society. This Perspective for a Water Secure Gauteng thus reflects the approaches to be adopted in Gauteng Development Strategies generally and the Gauteng Infrastructure Master Plan specifically. It is also aligned to the DWS's National Water Resources Strategy second edition⁹ and the draft National Water and Sanitation Master Plan's Call to Action¹⁰ (see Box 1).

This document is structured as follows:

- Chapter 3 sets out the goal of water security that Gauteng seeks to achieve
- Chapter 4 describes how water in Gauteng is part of a greater system
- Chapter 5 describes the current performance in relation to these critical issues and challenges
- Chapter 6 describes the guiding principles to the challenges and critical issues, and
- Chapter 7 sets out a plan of the actions that are required to ensure water security for Gauteng.

⁹ Department of Water and Sanitation, (2013), National Water Resources Strategy. 2nd Ed. Department of Water and Sanitation. Pretoria.

¹⁰ Department of Water and Sanitation, (2018), National Water and Sanitation Master Plan: Call to Action. Department of Water and Sanitation. Pretoria.

Box 1: National Water and Sanitation Master Plan

DWS has developed a National Water and Sanitation Master Plan, setting out the critical actions that must be taken to ensure water security across the country as a whole. The key elements of this plan are set out in Figure 2. This perspective for a Water Secure Gauteng is aligned to the key elements of the national Master Plan.



Figure 2: Key elements of the National Water and Sanitation Master Plan 2018

3 GAUTENG'S GOAL FOR WATER SECURITY

The goal of the Gauteng Water Security Perspective is captured in a widely used definition of water security which is achieved when there is:

*"...the reliable availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies."*¹¹

This definition includes natural water resources as well as the services that are derived from them. It includes the entire water cycle from the rain that feeds rivers, dams and underground reserves through to household taps and toilets and the treatment plants that purify used water before it is returned to the rivers or the ocean. It also addresses water-related risks such as floods and droughts as well as water quality and environmental protection.

Some people may have water security while others in the same community remain vulnerable. It is important to recognise this since many of Gauteng's poor residents still experience some elements of water insecurity daily, particularly those living in informal settlements. Household water security can be defined as 'the reliable availability of safe water in the home for all domestic purposes'.¹² And in Gauteng, even more people still lack access to the safe and dignified sanitation, which forms part of the broader definition of water security.

So, the scope of water security covers the needs of individuals and single households, communities and their activities as well as the state of the whole province. To achieve water security both natural and human challenges must be addressed. And since activities upstream of the province can affect its residents, and their activities can impact on downstream communities, a water security plan for Gauteng must consider its relation with our neighbours.

This approach to water security is consistent with the United Nation's Sustainable Development Goals (SDGs) which South Africa has committed to achieve by 2030. The SDGs (Goal 6) for water supply and sanitation emphasise that both can only be achieved if the services are safely and reliably managed, can be accessed by everyone in the community and support sustainable use of the natural environment. The approach also reflects the perspective of the National Development Plan, which is that water is an enabler of social and economic development. We thus need to manage water in a manner that keeps down the cost of living and doing business¹³ while providing an acceptable level of environmental protection. Management must also be guided by agreed standards of reliability and safety that are set as a matter of national policy.

The achievement of water security involves a wide range of people and organisations: Farmers in the catchment areas of the dams that supply bulk water can affect its quality; municipal technicians determine the reliability of the distribution networks that bring water to household taps and keep wastewater drains clear; water users themselves, in their homes and places of work, decide whether scarce water resource is wasted or polluted. A failure anywhere in the system can interrupt services and compromise water security; poor communities are particularly vulnerable to operation and

¹¹ Grey, D and Sadoff, C.W (2007) "Sink or swim? Water security for growth and development", *Water Policy*, vol 9, no 6, pp 545-571

¹² World Health Organisation (2003) WHD Brochure, Part IV: The priorities and solutions for creating healthy places. WHO, Geneva.

¹³ National Planning Commission, (2012), National Development Plan 2030, The Presidency. Pretoria: p.116.

maintenance

failures.

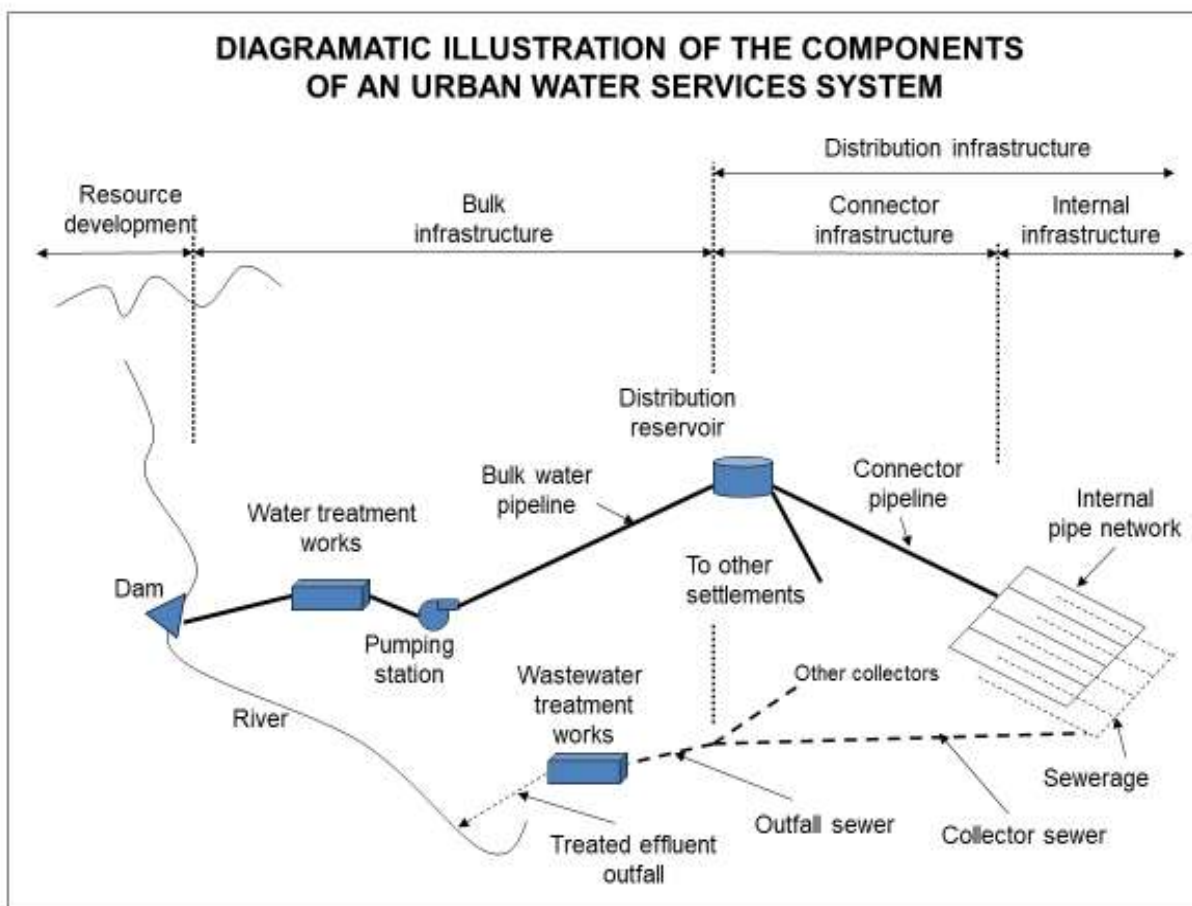


Figure 3: Diagrammatic illustration of the components of an urban water services system¹⁴

Finally, it is important to recognise that the water sector cannot, by itself, ensure water security. It cannot resolve the challenges of informal settlements where it is often physically impossible to provide adequate sanitation, for example. Nor can it address the problems faced by disabled people, or other groups with special needs. Without the support of urban planners, it cannot prevent houses from being built on floodplains which puts whole communities at risk of disaster. Therefore, water security requires coordinated action across a range of sectors and institutions as well as the mobilisation of support from civil society and the wider community. The approach of this Action Plan is to promote such coordinated action.

¹⁴ Presidential Infrastructure Coordinating Commission, (2013), A Summary of the South African National Infrastructure Plan. (Accessed June 2018), https://www.gov.za/sites/default/files/PICC_Final.pdf

4 GAUTENG'S WATER: PART OF A LARGER SYSTEM

4.1 Water in the Gauteng City Region

South Africa's limited water resources and extremely variable climate make it difficult to provide a reliable supply to large communities directly from natural resources. In response, substantial infrastructure has been constructed to ensure water security for the country, including for Gauteng. In addition, understanding and managing the impact of climate variability and the slower process of climate change on water availability is a complex process that requires appropriately capacitated institutions and systems.

Gauteng is situated on the watershed that divides the Limpopo and Orange Rivers. Rain falling north of Johannesburg's Parktown ridge runs to the Limpopo River and Indian Ocean in Mozambique; rain falling south of the ridge runs into the Vaal River, feeding into the Orange and running between Namibia and South Africa into the Atlantic Ocean.



Figure 4: Gauteng lies on the watershed between two catchments with very limited natural streams¹⁵

Due to Gauteng's location at the top of the divide between its river catchments, it has limited natural streams and rivers. These are insufficient to meet the needs of the Province's estimated 15 million people for water for domestic purposes, to support economic and social activities and to sustain functioning aquatic ecosystems. In addition, the climate is highly variable, with regular but unpredictable periods of drought which may last for several years as well as occasional periods of heavy rain, which often leads to localised flooding.

¹⁵ Maree et al. (2017), 'Watershed boundaries of the GCR', GCRO Map of the Month August 2017, <http://www.gcro.ac.za/outputs/map-of-the-month/detail/watershed-boundaries-of-the-gcr/>

The geology of Gauteng is characterised by hard rock, which means that there are some reserves of groundwater available – rock formations containing water are known as aquifers. Some large aquifers are found in dolomitic limestone formations but the exploitation of these can lead to subsidence and sinkholes. Other artificial aquifers, linked to old mine workings, contain significant amounts of water polluted by mining operations, which can be used, but only after expensive treatment (see sections 6.4.2 and 6.6).

In these circumstances, to provide a reliable and economic supply through the dry season (winter) and in case of drought, water must be stored in dams. Figure 5 indicates total storage levels in the IVRS between 1990 and 2017 and reveals three multi-year periods of low water levels due to drought, during that period. What is not shown is that the ongoing development of two major dams in the system ensured that there was sufficient water despite the droughts. This inherent resilience in the system is now under threat due to the delay in construction of LHWP2's Polihali Dam.

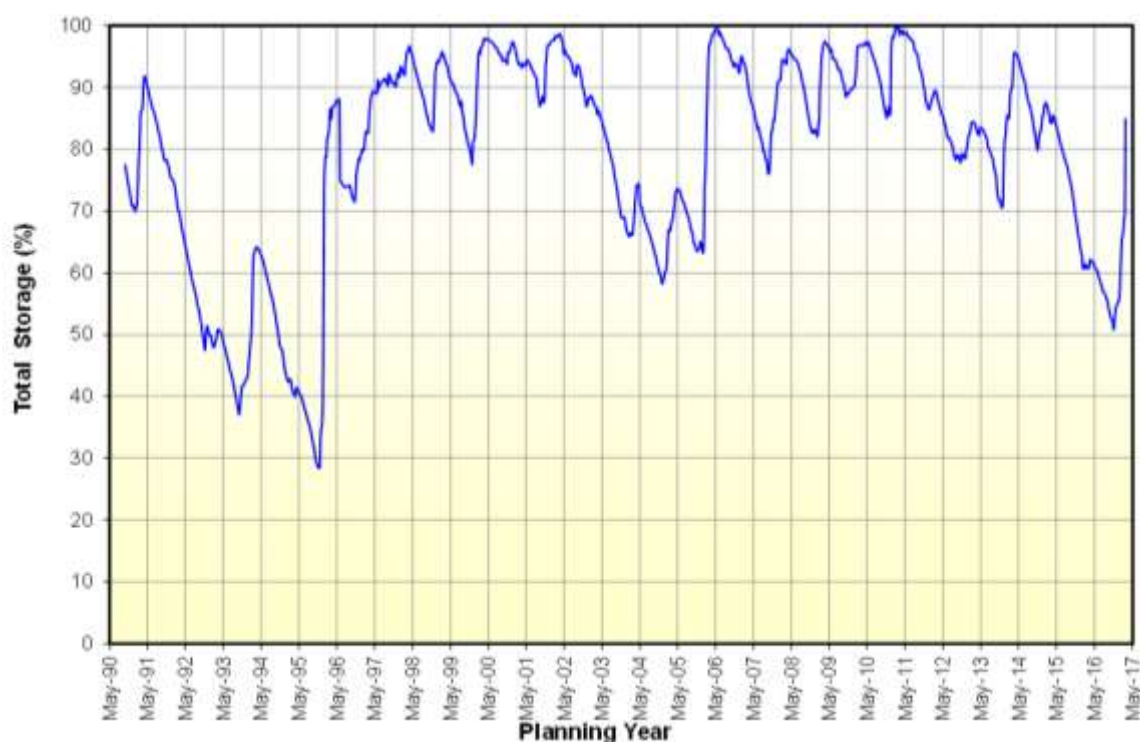


Figure 5: Total Vaal River System storage as a percentage of total 1990 - 2017¹⁶

The average annual flow in the Vaal River at Vaal Dam is just 1900 Mm³/annum, which is barely enough to meet even Gauteng's annual needs, let alone those of the many other upstream and downstream users in the river's catchment¹⁷. So, to ensure that there is enough, more water is brought from beyond the catchment of the Vaal River, notably from the uThukela in KwaZulu Natal (which is stored in the Sterkfontein Dam), the upper uSuthu in Mpumalanga and the Senqu (a tributary of the Orange) river in Lesotho (through the LHWP - Figure 6). This collection of fourteen dams, linked by rivers, canals and pipelines is operated as a single Integrated Vaal River System (IVRS) by the national Department

¹⁶ Department of Water and Sanitation, (2016), State of the Vaal River System. Provincial Office presentation [PowerPoint Presentation]. (Accessed June 2018)

¹⁷ Department of Water and Sanitation, (2018), Continuation of the Integrated Vaal River system Reconciliation Strategy (Phase 2). Department of Water and Sanitation. Pretoria.

of Water and Sanitation (Figure 7). The amount of water stored in the IVRS dams (excluding Bloemhof, which is downstream of Gauteng) is over 9300 Mm³/a, equivalent to nearly 5 years of the average flow in the river and six times the volume used annually within Gauteng¹⁸.

A further advantage of this large system is that it reduces climatic risks since it covers a very large area - over 40 000 square kilometres. The variability of rainfall across the region means that it is unlikely that all parts of the system will be equally affected during a dry period. The importance of this has been seen in Cape Town where the Western Cape System stores less than two years of average flows with a catchment area of just 803 square kilometres.

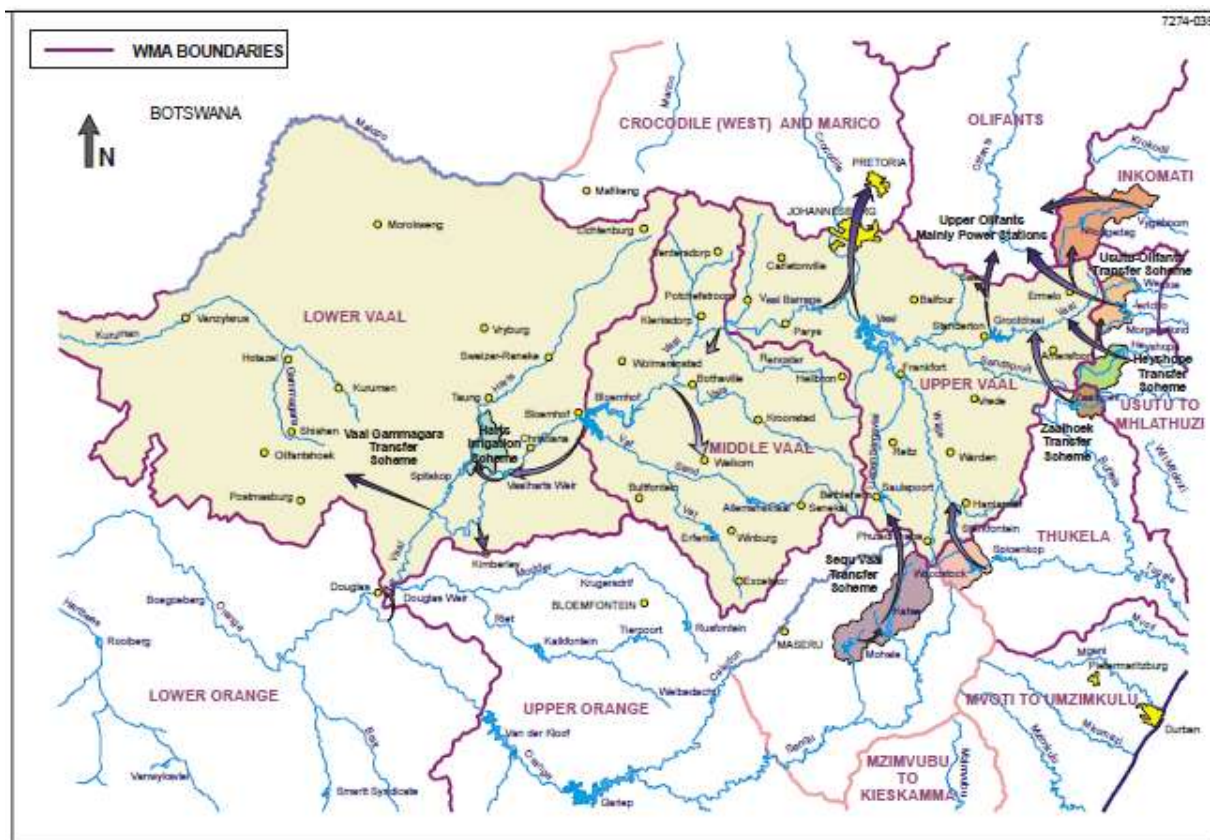


Figure 6: Vaal Water Management Area, showing transfers to and from other rivers¹⁹

¹⁸ Department of Water and Sanitation, (2018), Continuation of the Integrated Vaal River system Reconciliation Strategy (Phase 2). Department of Water and Sanitation. Pretoria.

¹⁹ Department of Water Affairs and Forestry, (2006), Guidelines for Water Supply Systems Operation and Management Plans During Normal and Drought Conditions. Department of Water Affairs and Forestry. Pretoria

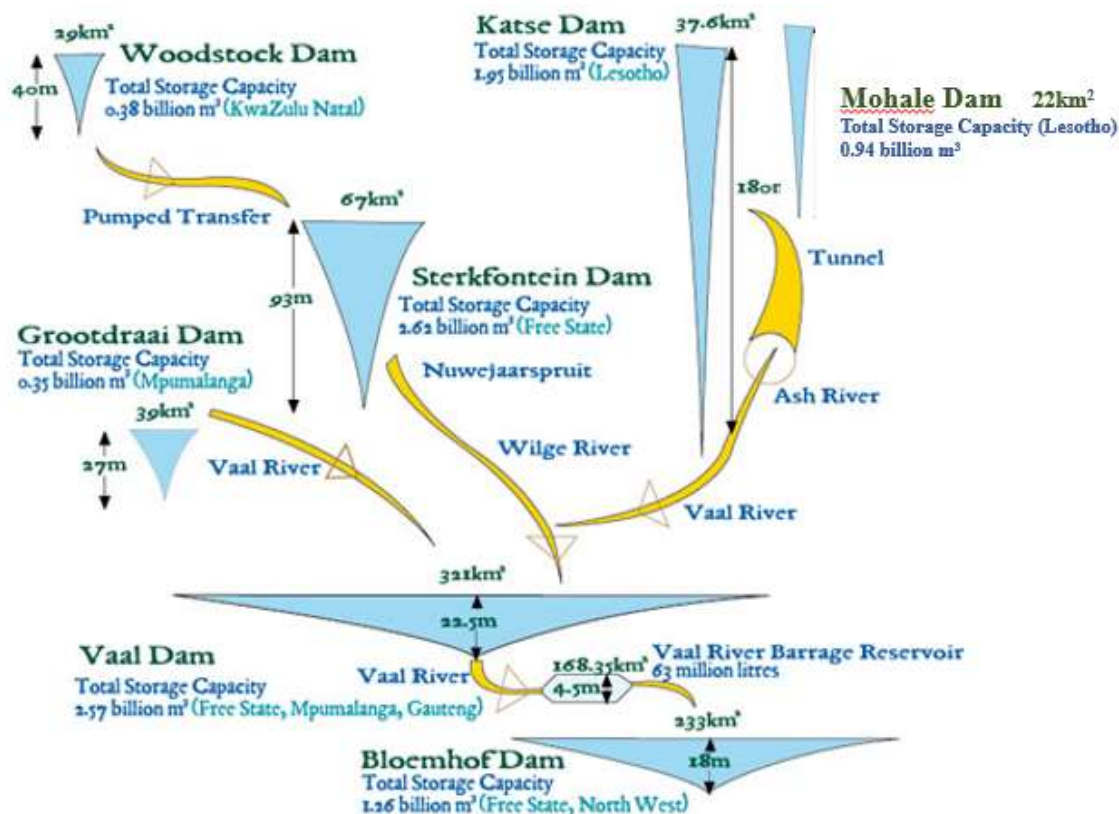


Figure 7: Major dams in the Integrated Vaal River System (IVRS) (note: their surface areas determine evaporation losses²⁰)

The bulk water supply for Gauteng water users is provided mainly by Rand Water, first established as a private utility in 1903 but now overseen by the Minister of Water and Sanitation in terms of the Water Services Act (Act 108 of 1997) and regulated as a ‘National Government Business Enterprise’ under the Public Finance Management Act (Act 1 of 1999), (PFMA). Rand Water takes its water from the Vaal Dam and transports it through a network of 3 500km of pipes to 58 reservoirs around Gauteng as well as to parts of Free State, North West and Mpumalanga provinces. It supplies municipalities, which then use it to provide water supply and sanitation services, and also supplies some large industrial and mining water users directly.

Smaller quantities of water are provided to Tshwane and surrounding areas of Gauteng by Magalies Water. Some Gauteng municipalities also have other smaller sources that augment their supplies including municipal dams such as Rietvlei and ground water in Tshwane, for example, which supplies about 30% of its water from its own sources.

Of Rand Water’s potable water supplied taken from the IVRS, 36% is supplied to Johannesburg, 23% to Ekurhuleni, 17% to Tshwane and 6% to Emfuleni municipalities; 4% is supplied direct to large users and the remaining 20% to twelve smaller municipalities (Figure 8).

²⁰ Randwater, (n.d), Where does our water come from? (Accessed July 2018), <http://www.waterwise.co.za/site/water/purification/index.html>

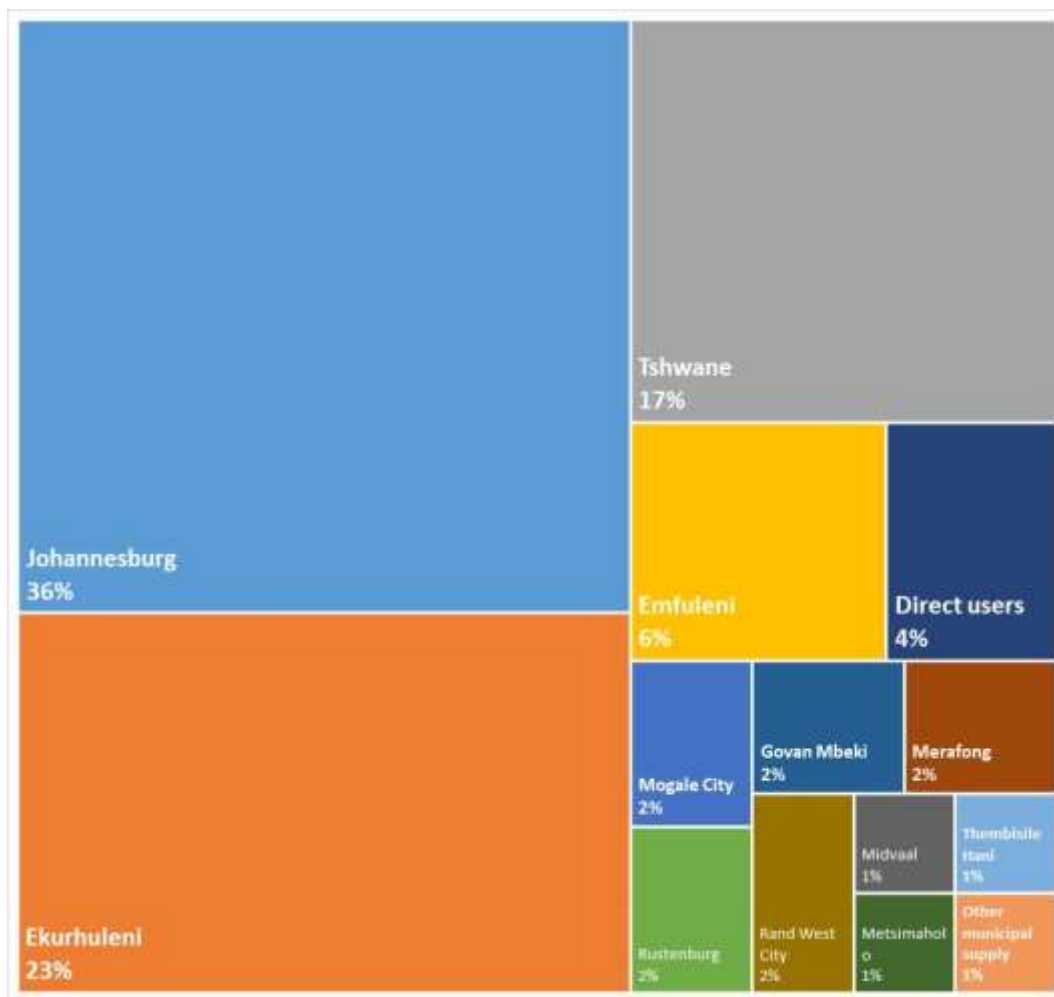


Figure 8: Distribution of water by Rand Water per municipality in 2016²¹

While priority is often given to ensuring adequate water supplies, water security also depends on protecting the environment and ensuring that the quality of the water resources remains fit for purpose. For this reason, the management of wastewater is an equally important part of the water cycle.

Wastewater from municipalities and industries is treated and discharged back into the river system. These are known as return flows and are an important source of water for downstream users. However, the quality of water that flows out of Gauteng is a concern for all users downstream (municipal, agricultural and industrial). Resource Water Quality objectives (RWQOs) have been set to limit the concentration of pollutants and, in the past, it has sometimes been necessary to release freshwater from Vaal Dam to dilute the pollution to acceptable limits. This is an undesirable use of scarce high quality (and hence value) water and would best be controlled by reducing pollution from wastewater plants and other sources.

Since many of Gauteng’s metropolitan municipalities’ large waste water treatment are situated north of the watershed (including the City of Joburg’s major Northern Works), the treated waste water is discharged into the Limpopo Basin (mostly the Crocodile West - Marico catchment). This is a substantial water transfer from the Vaal to the Limpopo and ensures that flows in the Upper Crocodile,

²¹ Taken from Shuntelle Gow: “Driving the demand: A bulk water supplier’s perspective”, Presentation at the 7th Regional African Water Leakage Summit, DBSA Vulendhela Auditorium, Midrand, 22-23 August 2017

below Hartbeespoort Dam are amongst the most reliable in the country although they are also very polluted by sewage, stormwater runoff and mining effluents. However, since wastewater transport and treatment are managed processes, informed decisions need to be taken about how much water is discharged into each river system. This is becoming increasingly important since wastewater reuse also has a significant potential as a future source of additional water for Gauteng.

While most of the water consumed in Gauteng is for domestic, institutional, commercial and industrial purposes, there are other important users of the IVRS that must be considered. In particular, water for a substantial proportion of the generation capacity of ESKOM (power stations situated on the Mpumalanga Highveld in the upper Olifants Catchment) and the synthetic fuel and chemical production of SASOL is supplied from the IVRS. Both of these are considered to be strategic users that must be provided with water at a high level of assurance and reliability and their use takes precedence over most other users. There is also some agricultural water use in the IVRS region and, because of the high demand and limited supply, the construction of new farm dams is prohibited. (Most of agricultural use is on the Vaalharts irrigation scheme, downstream of Gauteng, which is allocated 357Mm³/a, 3.8% of the IVRS total of 9300 Mm³/a²². Even this small proportion is not provided at the same level of reliability as is specified for urban and industrial supplies.)

4.2 Institutions and Stakeholders

The water sector involves many institutions and stakeholders, which complicates its governance and management. This section outlines the key institutions who have a role to play in water secure Gauteng. Figure 9 aims to demonstrate the general institutional complexity in the water sector.

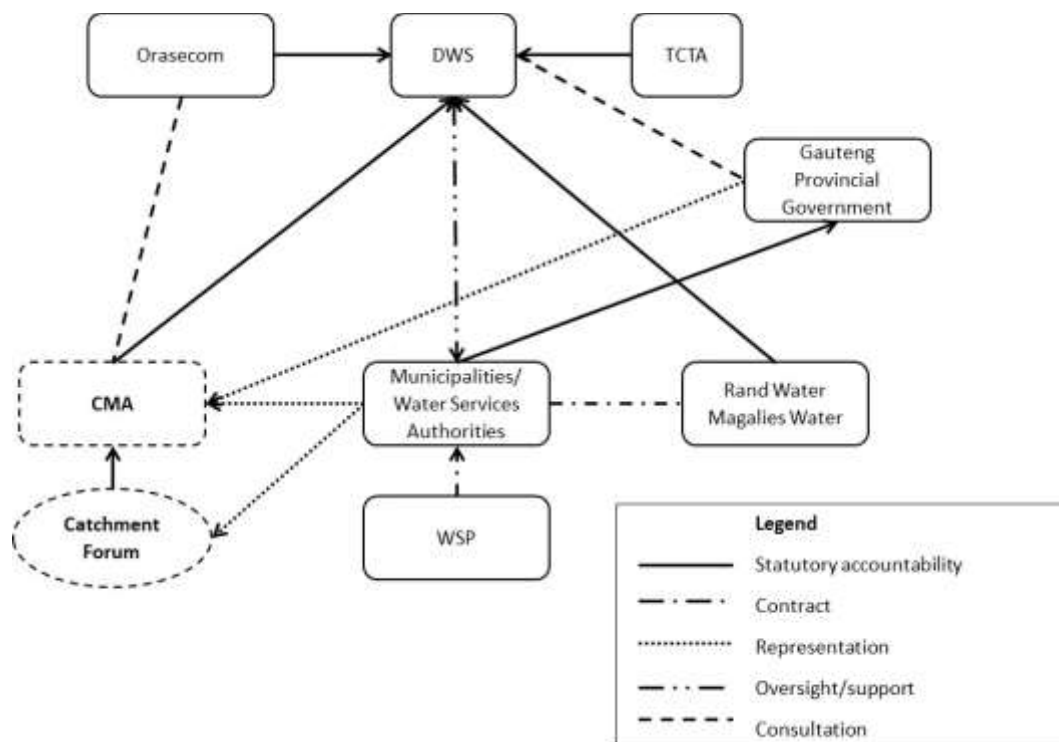


Figure 9: Institutional arrangements in the water sector in Gauteng

²² Department of Water and Sanitation, (2018), Continuation of the Integrated Vaal River system Reconciliation Strategy (Phase 2). Department of Water and Sanitation. Pretoria.

The Gauteng Provincial Government (GPG) has a mandate to engage in policy, strategy and management of water resources and water services which derives from its concurrent responsibility for, amongst other functions: -

- Agriculture
- Disaster management
- Environment
- Housing
- Local government (oversight of municipalities)
- Regional planning and development
- Urban and rural development.

The Premier has responsibilities for coordination with national government and municipalities in terms of the Intergovernmental Relations Framework Act (Act 13 of 2005). The location of disaster management and risk reduction functions within the department responsible for local government provides a ready-made structure through which the province can exercise its oversight over responses to the emerging challenges of water security.

Department of Water and Sanitation (DWS) is responsible for the development, operation and maintenance of national water resources infrastructure, and various other government water schemes (GWS) including some irrigation schemes. It provides the regulatory framework as well as financial and technical support to and regulation of municipalities for the performance of water services functions in terms of the Water Services Act (Act 108 of 1997).

In terms of the 1998 National Water Act (Act 36 of 1998), DWS is also responsible for the regulation and management of water resources, including the development of bulk water supplies from systems that extend beyond municipal boundaries. It is also responsible for the allocation of bulk water supplies and the regulation of water resource protection and use.

DWS is further responsible for planning, developing and operating the major water supply systems that cross municipal and provincial boundaries. Critically, in this context, it is responsible for the IVRS and must ensure that its planning framework is coordinated with that of other sectors and institutions.

Water Boards are statutory public utilities, classified as 'National Business Enterprises' under the PFMA and established and overseen by the Minister of Water and Sanitation who determines their areas of operation and can direct them to undertake specific functions. Their primary activity is to provide bulk water supply (and sometimes regional sanitation services) where this requires operations that cross municipal boundaries. Rand Water is by far the most important in the Gauteng context while Magalies Water provides some supplies to the Tshwane area. (ERWAT, a public regional wastewater treatment institution, is established under separate arrangements and now functions effectively as a municipal entity).

The **Trans Caledon Tunnel Authority (TCTA)** was established in 1996 by the Minister of Water Affairs as a Special Purpose Vehicle to implement the South African side of the Lesotho Highlands Water Project. As a 'Major Public Entity' in terms of the PFMA, it is overseen by the Minister of Water and Sanitation who is empowered to give it specific direction and instructions. Under a new Notice of Establishment (promulgated in terms of the National Water Act), the TCTA has evolved to function as a generic promotor, funder and implementer of large, limited recourse, water resource projects and

has successfully implemented a range of large projects. It remains responsible for raising and managing the finance for the various phases of the LHWP.

Catchment Management Agencies (CMAs) are institutions established by the Minister in terms of the National Water Act. The intention expressed in the Act was “to delegate water resource management to the regional or catchment level and to involve local communities, within the framework of the national water resource strategy”. In terms of the Act, a CMA “may be established for a specific water management area, after public consultation, on the initiative of the community and stakeholders concerned. In the absence of such a proposal the Minister may establish a catchment management agency on the Minister's own initiative.” Only a few CMAs have been established nationally, with none in the Vaal. In the interim, DWS undertakes all functions that a CMA might undertake. The establishment of a CMA for the (entire) Vaal catchment is underway but its mandate includes only the southern half of Gauteng while the remainder will fall into another CMA area.

Other National Government Departments

National Treasury (NT) provides grants to municipalities and regulates the financial conduct of municipalities. It also sets the parameters for procurement by public agencies and regulates some elements of the activities of state owned entities such as water boards and TCTA.

Department of Cooperative Government and Traditional Affairs (COGTA) is responsible for general oversight of and support to municipalities as well as the management of the overall Inter-Governmental Relations system. With National Treasury, it is responsible for the design, oversight and management of the municipal grant system through the Division of Revenue Acts that apportion revenue between municipalities and set conditions for additional specific grants. It also manages the national disaster management system of which provincial and local government units form part.

Metropolitan and Local Municipalities are responsible in Gauteng for the provision of water and sanitation services in terms of the Constitution and the Water Services Act (and nomination as Water Services Authorities by COGTA) as well as for a range of related infrastructure and urban planning and management functions. Municipalities are also responsible for overall municipal land use planning and development including issues pertaining to densification, new housing and industrial developments, and stormwater management.

Municipal entities are established by municipalities to provide certain services for or on behalf of municipalities. In Gauteng, Johannesburg Water was established as a water services provider owned by the municipality but operated under an independent Board while the East Rand Water Care Company (ERWAT) is a unique specialised utility which focuses on wastewater treatment on the east rand, now mainly within the Ekurhuleni municipality

Business enterprises (both private and public) are significant water users and depend on reliable and cost-effective water supplies to sustain their operations. In some cases, their operations impact on water resources and affect their quality. Some of these enterprises take water from municipal systems and some take their water directly from the resource. New private housing and building developments connect to municipal water and sanitation systems and are sometimes required to contribute to the funding of expansions to public infrastructure.

Public Institutions such as hospitals and clinics, educational facilities and public offices are also significant water users. Their operations are overseen by the relevant sectoral departments at local, provincial and national level.

Figure 10 describes the various plans and strategies across the three spheres of government that are relevant to this water security plan.

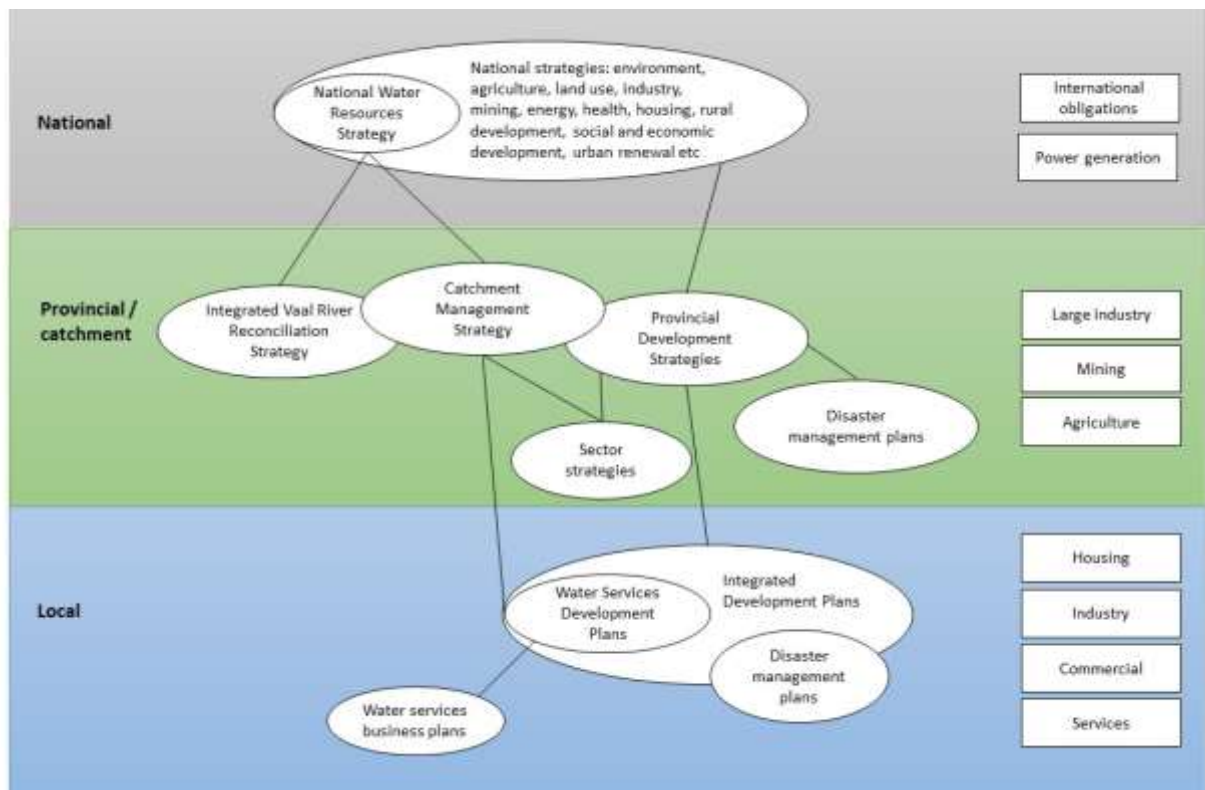


Figure 10: Water related plans across different spheres of government

5 CURRENT PERFORMANCE AND EMERGING CHALLENGES

5.1 Water Demand: trends and constraints

Overall water demand for the Rand Water supply area (which covers most of Gauteng) is currently around 1 600 Mm³/annum, approximately 300 litres per person per day (based on Rand Water's estimates of the total supply provided and the population served)²³. This is the limit that Rand Water is licenced by DWS to withdraw from the IVRS until the LHWP2 is complete.

This poses a substantial challenge. The population of Gauteng is currently growing at over 3% per year (see section 2.1). This means that, every year, water needs to be supplied over 400 000 additional people or to build a new water supply for a city the size of Soweto every 5 years!²⁴ The infrastructure challenge that this poses is substantial. 60% of this increase is due to the growth of the Province's own population and only 40% due to in-migration.²⁵

Per capita water use has been declining slightly over the past decade (Figure 11). This is likely due to a combination of three main factors: An influx of poorer residents (who use less water or do not have access to water); a process of densification in established suburbs (which reduces use of water for gardens); and increased efficiencies in both municipal distribution and actual water use. However, in the absence of new supplies, the rate at which consumption is reduced will have to increase if Rand Water's abstractions are to be maintained at their licence limits.

Without new supplies, this means that consumption per person will have to be reduced from 300 litres per person per day in 2018 to 220 l/c/d by 2028 to stay at a level that can safely be supplied.

Table 2: Gauteng population and per capita water consumption²⁶

	Population	Water supplied	Maximum per capita consumption
	Based on growth rate of 3.07%	Mm ³ /a	Litres per capita per day (lcd)
2018	14 717 040	1600 000 000	298
2019	15 16 8853	1600 000 000	289
2020	15 634 537	1600 000 000	280
2021	16 114 517	1600 000 000	272
2022	16 609 233	1600 000 000	264
2023	17 119 136	1600 000 000	256
2024	17 644 694	1600 000 000	248
2025	18 186 386	1600 000 000	241
2026	18 744 708	1600 000 000	234
2027	19 320 170	1600 000 000	227
2028	19 913 300	1600 000 000	220

²³ This considers all potable water **produced**, (including transmission and distribution losses as well as institutional, commercial, industrial and domestic use); total **consumption** is lower, although it is still relatively high for urban areas when compared with global averages.

²⁴&⁴&⁵ StatsSA, (2018), Mid-year Population Estimates 2018, Statistical Release P0302. StatsSA. Pretoria.

To achieve such a reduction will require an intensive water savings and demand management programme, likely supported by the imposition of formal restrictions. This programme will have to recognise that economic growth and improved living standards are likely to **increase** per capita consumption.

At a domestic level, while there is extensive data on metered supplies, information about numbers of people served is hard to obtain, particularly where one metered connection serves several households. In addition, many domestic users are not metered. Since domestic water use represents a high proportion (approximately 70%) of Rand water’s total supply, it is an important indicator of system performance and a focus for management interventions and better information is required.

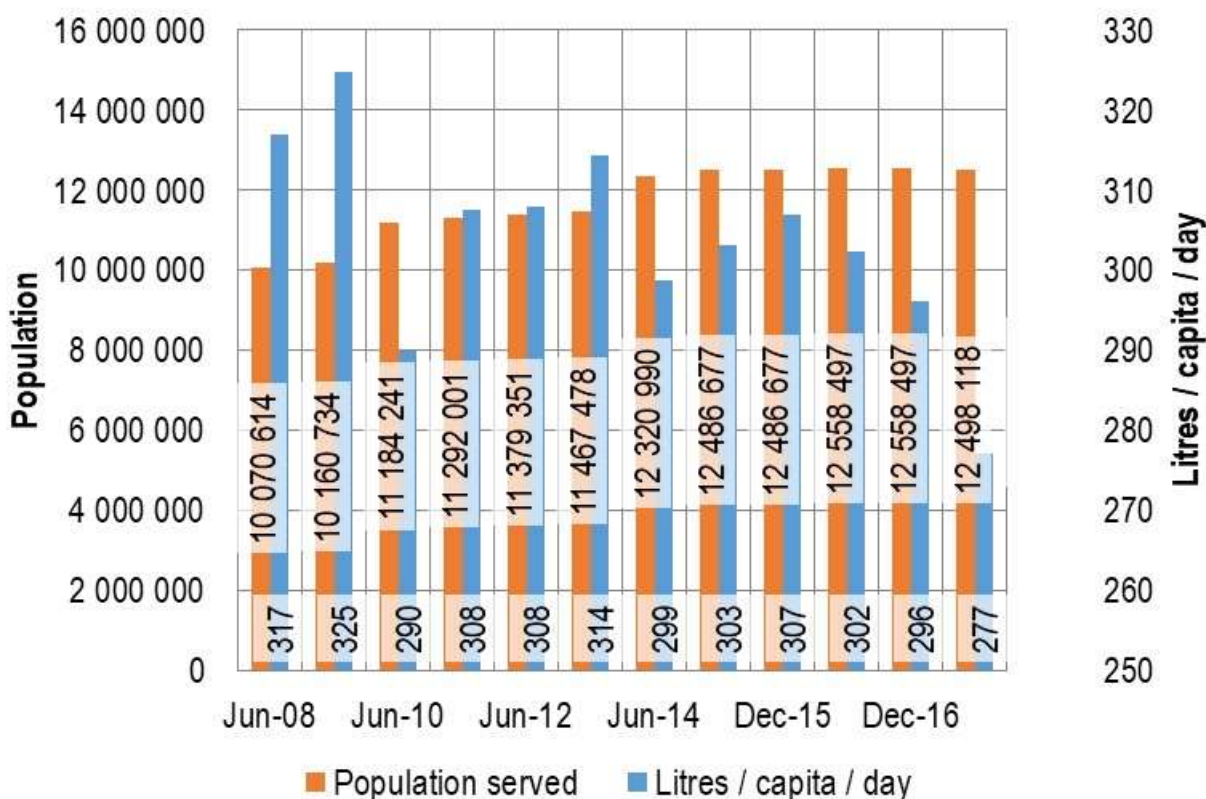


Figure 11: Water consumption has been falling in the IVRS²⁷

The Vaal River Catchment Reconciliation Strategy done by the DWS assessed the potential reduction in demand (and associated savings) for all municipalities in the IVRS and gave each municipality a savings target based on the individual assessments. The total potential saving for the Vaal River system amounted to about 200 million m³ or 15% of the system input volume to be achieved by 2015.

This study also indicated that about 95% of the potential savings would have to be achieved by the four biggest water users: - Johannesburg, Tshwane, Ekurhuleni and Emfuleni. While these and other Gauteng municipalities have put in place programmes to reduce consumption, they have not yet managed to reach the targets set by DWS.

²⁷ Department of Water and Sanitation, (2018), Continuation of the Integrated Vaal River system Reconciliation Strategy (Phase 2). Department of Water and Sanitation. Pretoria.

5.2 Bulk supply: availability, delays, restrictions, climate and other risks

The modelling and monitoring of the “Integrated Vaal River System”, which is Gauteng’s principal source of supply, enables DWS to plan and monitor the performance of the overall system. According to DWS’s plans, based on the model, implementation of Lesotho Highlands Water Project Phase 2, originally scheduled for completion by 2018, is 8 years late and - if implemented immediately can now only be expected to supply water in 2026. This puts the province and surrounding IVRS region at significant risk if a serious drought occurs before the project is completed (which is likely).

The IVRS model also provides essential early warnings to system operators and users of emerging shortages that could lead to system failure. To do this, it takes account of historical climate variability and has proven to be reasonably accurate over a period of almost 40 years. However, the model must be run regularly and the results presented to, and discussed with, water users to avoid delays in recognising and responding to the development of drought conditions and other operational problems.

While the most immediate impact of climate change is a generalised warming, weather patterns are changing and becoming more variable and less predictable. The IVRS model must therefore be regularly updated to reflect these dynamic changes and the hydrological data which the model uses to reflect changes in rainfall and runoff must be reliably captured and integrated. One current concern is that the modelling process and the operational forums that should meet twice a year to consider system status have been poorly supported due to budget and staffing constraints at DWS. The hydrology and climate data has not been updated for 15 years which means that it may not adequately reflect emerging climate change trends.

While climate change may exacerbate droughts (and floods) the primary challenge is to manage the ‘normal’ climatic variability. As the IVRS is used more intensively and if abstraction goes beyond what are considered to be sustainable levels, the Province will be at increasing risk in the event of a long duration multi-year drought. To address this ‘chronic risk’, supply restrictions will have to be applied even in ‘normal’ years.

This point has now been reached. Rand Water used 1 543Mm³/a during the 2016/17 season. It has subsequently exceeded its licensed abstraction volumes. DWS had already indicated in 2012 that no increase in abstraction by Rand Water over the 1600Mm³/a level could be allowed until LHWP2 was commissioned. This means that, until the Lesotho project is completed, Rand Water users (and others supplied from the IVRS) will be at increasing risk of restrictions due to below average rainfall.

Gauteng must therefore plan to manage the increasing risk in the short term while establishing a framework that ensures water security and financial and environmental sustainability in the longer term.

This will be a difficult process because it can be expected that, as in Cape Town in the past decade, there will be periods of above average rainfall during which dams will be full and the prospect of a crisis will appear unlikely. Policy, planning and communication will have to anticipate this situation and even take advantage of periods of high rainfall to reinforce messages about the challenges of ensuring water security in South Africa’s variable climate.

Even when LHWP2 is complete, it will be necessary to continue monitoring the state of the IVRS and planning the future actions that are needed to sustain water security. There are still opportunities to increase surface water supply from uThukela river transfers, but these will be increasingly expensive. The same will apply to water reuse projects. The need careful present management to delay

investments that will increase the cost of water to users should be a focus for policy and communications.

Finally, as the climate warms, evaporation losses from the IVRS will grow. To minimise these losses, water should be stored in the deeper dams at higher altitudes, from which evaporation losses will be lower. Sterkfontein dam is already operated in this manner but, in terms of the LHWP Treaty with Lesotho, water is released from Katse and Mohale Dams even when the downstream dams are full. This results in greater evaporation from the system as well as to expensive, high-quality, Lesotho water being released downstream unnecessarily in high rainfall years. DWS should enter into discussions with Lesotho to amend the provisions to the Treaty to maximise the yield of the IVRS and minimise unnecessary losses and compensate Lesotho as appropriate.

5.3 Municipal performance

5.3.1 Overview

While present performance in the water services and sanitation sector in Gauteng is generally good, it is not without its challenges and risks and there is still a small but significant proportion of the population who do not have access to basic services. Unfortunately, the DWS stopped the Blue/Green/No Drop monitoring and reporting process in 2014 which has meant that there is limited objective data on municipalities' technical performance. However, the 2016/7 Municipal Services Self-Assessment programme of DWS has provided the perspective of municipalities themselves. Figure 12 shows the 'vulnerability rating' of the water services authorities in Gauteng over a period of three years. Only two show a low vulnerability and, while two show that they believe that they have improved significantly since 2013, three report that their vulnerability has increased.

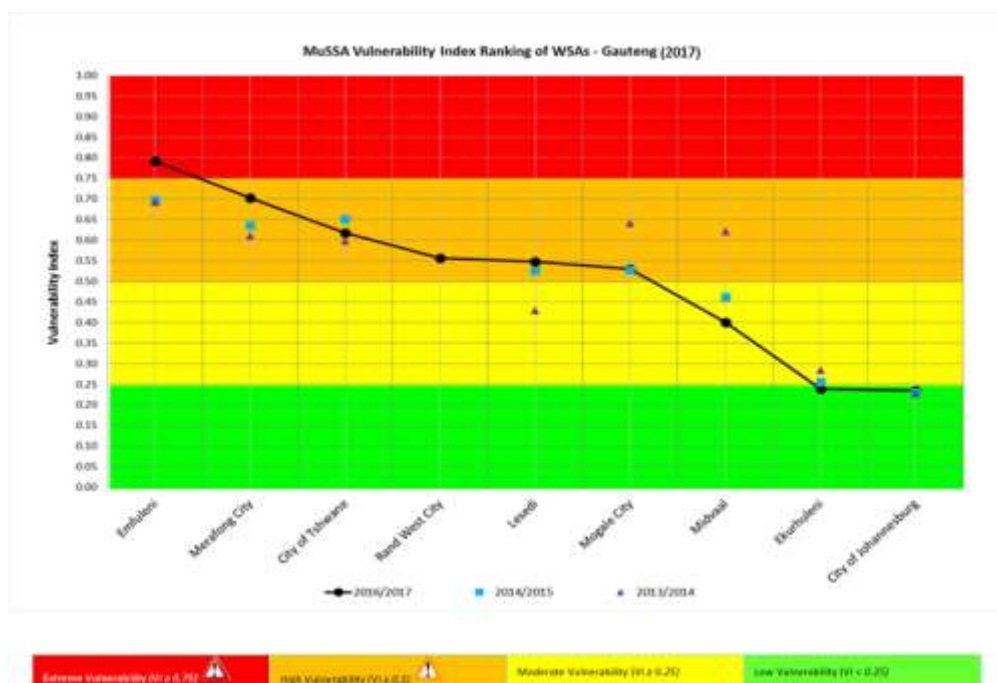


Figure 12: MuSSA Vulnerability Index Rating of WSAs in Gauteng²⁸

²⁸ Department of Water and Sanitation, (2018), Municipal Services Self-Assessment Programme 2016/7. [Unpublished].

5.3.2 Water supply services – Access and perceptions

Despite the emerging bulk water supply challenges, Gauteng has enjoyed a long period during which water supplies to most users have been adequate and reliable. Access to water infrastructure and services in Gauteng is generally good, even in informal settlements. Just 3.6% of residents get water from a piped source more than the 200m from their home. In 2017, only 7.8% of residents reported supply interruptions longer than 2 days, 79% of residents said that the quality of the water services was ‘good’²⁹ while water supply was given the highest approval rating of six services reviewed (GCRO 2018, Best rated services per municipality).

However, Gauteng can only claim to have achieved water security when all its residents have access to adequate, reliable supplies of safe water. At present, 3.3%, approximately 500 000 Gauteng residents, have a supply that does not meet minimum basic standards (StatsSA GHS 2017). The majority of these live in informal settlements or on private property. Of these, 1.5% depend on water tankers and 0.4% on unsafe surface water from streams and dams.

Affordable access to basic supplies for the 96.7% of residents who do have adequate infrastructure had been assured through the provision of ‘free basic water’. According to StatsSA, 38% of Gauteng’s 3 226 200 connections (‘consumer units’) reported receiving free basic water in 2016³⁰. However, free basic water is increasingly being targeted only to formally registered indigent households and only 20.8% of households were reported to have been registered as indigents³¹. This discrepancy may indicate a failure to manage consumption – specifically to meter, bill, collect and enforce compliance (see section 6.7.1) and/or a failure of indigent registers and their management.

In this situation, there may be challenges of access to water if restrictions become necessary but cannot effectively be implemented or enforced. Specifically, limiting free basic water to indigent households may aggravate these problems if punitive tariffs are to be used to reduce demand since these will only be effective if payment can be enforced. In practice, this has meant that the only mechanism that can be used to reduce demand is to physically restrict supply to an entire community. There is a risk that, when this is done, some residents may be left without any access to water for prolonged periods.

This problem has been observed when water supplies have suffered operational failures. Short incidents of supply restrictions have been experienced over the past few years. These have been associated with infrastructure failures affecting main supplies from Rand Water and within some municipalities. Failures have occurred in main pipes as well as in electro-mechanical equipment, raising questions about the institutions’ contingency planning and provision of backup capacity (plant and equipment). During a hot dry period in 2016, high consumption led to local reservoirs being emptied resulting in short-term, local supply interruptions. Restrictions were imposed in some areas as a precautionary measure due to concern about the risk of drought but were not vigorously enforced although in some municipalities, whole supply zones were cut off. Climate change is predicted to have an increase in the frequency and length of such hot periods.

²⁹ StatsSA, (2017), General Household Survey 2016, Statistical Release P0318. StatsSA. Pretoria.

³⁰ StatsSA, (2018), Non-financial Census of Municipalities for the Year ended 30 June 2017, Statistical Release P9115. StatsSA. Pretoria.

³¹ &⁹ StatsSA, (2017), General Household Survey 2016, Statistical Release P0318. StatsSA. Pretoria.

5.3.3 Sanitation and wastewater management

The performance of Gauteng's municipalities in relation to sanitation is not as good as it is for water supply. The proportion of households served with safe 'improved sanitation' was 90.5% in 2017, down from a high of 91.2% in 2010³². A significant number of households depend on shared sanitation facilities³³, particularly in informal settlements. Although shared 'chemical toilets' are considered to be 'improved' and acceptable sanitation, they are often inadequately maintained and unhygienic and do not provide a secure or dignified service. Indeed, they could be regarded as privatised 'bucket' toilets, since they have to be regularly emptied, without the convenience of having them close to the household. Sanitation provision is therefore often a contentious issue in poor communities. However, aside from their cost and increased water consumption, solutions such as subsidised waterborne sanitation are often impossible to install in informal areas because of poor planning and settlement control.

Sanitation is also problematic in formal areas. Some systems require pumping; since sewage pumps are vulnerable to blockage and breakdowns, failures are frequent and lead to sewage spills. In high density suburbs, poor management of buildings frequently causes blockages that also cause spills into stormwater systems and streams, contributing to high levels of pollution. This is aggravated when densification is allowed without adequate upgrades of sanitation infrastructure, whether in backyard shacks, high-rise buildings or expensive suburbs. Even small scale local spillages of sewage can cause significant health problems.

Overloading of municipal waste water treatment works (WWTWs) is sometimes aggravated inadequate alignment between provincial housing and municipal water services planning and development, which result in large new (mostly low cost housing) settlements being required to be serviced by municipal bulk sewers and waste water treatment when its augmentation is not implemented yet, causing some WWTWs overflows of raw sewage.

Finally, the treatment of the large volumes of wastewater produced in the region does not always meet the statutory standards. Consequently, areas downstream of Gauteng face problems of water quality. 81% of surface water samples showing unacceptable levels of E.Coli pollution³⁴ while dams in the northern part of the Province which are used for water supply and recreation frequently become eutrophic and suffer from algae blooms, restricting their use. This is aggravated by polluted water running off through stormwater systems.

Various factors contribute to this problem. Municipal assessments suggest that some treatment works, particularly in smaller municipalities, are not adequately staffed and operated. In addition, some treatment works are overloaded due both to expanding populations served but also to the discharge of stormwater into sewerage systems – some from normal storm water ingress into sewers, but sometimes also by purposeful connection of storm water drainage to sewers - in some cases on purpose by developers to reduce their costs. In addition to improved plant maintenance, better coordination of planning between provincial housing department and municipal water departments is required for new settlements and townships to ensure adequate bulk water and waste water treatment and conveyance capacity.

³³ StatsSA, (2018), Non-financial Census of Municipalities for the Year ended 30 June 2017, Statistical Release P9115. StatsSA. Pretoria

³⁴ Gauteng Provincial Government, (2017), Gauteng Province Environmental Outlook Report, Gauteng Department of Agriculture and Rural Development. Johannesburg.

5.3.4 Stormwater management and flooding

In many lower-income areas, provision for storm-water drainage is inadequate causing inconvenience and damage and, in extreme cases, risks to lives. Poor urban planning for new settlements often fails to take account of flood risks which can be life-threatening or the safe removal of storm-water from settlements which often leads to substantial property damage. Although it is a relatively straightforward and labour-intensive operation, there is often a widespread failure to manage and maintain stormwater systems. This is aggravated where there is limited rubbish collection and drains are blocked by litter and dumping. The result is that blocked drains overflow, causing significant local damage to roads as well as to private property. Poorly managed commercial operations also contribute to water pollution.

One consequence of poor or non-existent storm-water drainage is that residents often drain stormwater from their properties into sewers. This overloads wastewater treatment works and contributes to further pollution. This problem is exacerbated by inadequate urban planning for new settlements which does not coordinate settlement planning and housing development with the planning, implementation of water services infrastructure. Stricter enforcement by municipalities of environmental and building regulations is required to ensure that storm water and sewer systems are kept separate.

5.4 Water quality: the interaction between services and the natural resources

The quality of potable water provided by Gauteng's municipalities is generally recognised to be good. This is in large measure because most water is treated centrally and distributed by Rand Water. This reduces the operational burden for individual municipalities of managing water safety. Although risks remain, particularly in areas where local sources are used, and municipalities must still monitor quality, risks can be mitigated by proper maintenance and repair procedures.

However, Gauteng still faces significant challenges in terms of the environmental quality of the water in its rivers, streams and underground resources. These were summarised in the 2017 Gauteng Environmental Outlook report³⁵, which found that the chemical quality of surface water was generally good but that biological and microbiological quality was poor with extremely high levels of E.Coli, an indicator of sewage pollution. This finding was reinforced by the status of the smaller dams in Gauteng, five of which are at serious risk of 'eutrophication', characterised by extensive growth of algae which places constraints on water use for both recreation and water supply. Eutrophication is promoted by poor management of wastewater, both due to sewage overflows and inadequate sewage treatment.

The Environmental Outlook report also noted that levels of some key chemical pollutants have declined since 2011, which suggests that the current priority given to treating Acid Mine Drainage (AMD), identified as a significant source of chemical pollution, may be overstated (Box 2). Increasing salinity in the Vaal River has historically been a concern because of its potential impact on users downstream of Gauteng. As a result, good quality freshwater is regularly released from the Vaal dam to reduce the salinity.

³⁵ Gauteng Provincial Government, (2017), Gauteng Province Environmental Outlook Report, Gauteng Department of Agriculture and Rural Development. Johannesburg.

Given current information and trends, it would appear that the primary challenge at present is to improve the biological quality of water which requires a focus on the management of sanitation systems and wastewater treatment plants. It is not clear whether AMD and other chemical pollution is still a serious systemic concern and this needs to be further assessed. However, it will continue to be necessary to control individual local sources of pollution where it may still cause damage.

Box 2: Acid Mine Drainage (AMD)

Over the past two decades, much attention has been focused on the problems created by Acid Mine Drainage. This is water that emerges from the vast network of old mine workings that underlies the GCR. As it passes through the mines, the water reacts with minerals in the rocks and emerges acidic and polluted by metals and mineral salts.

The management of AMD came to the forefront in the late 1990s, a period during which many mines were closing. In order to keep working, the remaining mines had to pump out increasing volumes of water and treat it when it was discharged at the surface. This was very costly and threatened the financial viability of the mines, which sought government subsidies to pump and treat the water. In support of these proposals, they pointed out that, if they closed down, the water would seep to the surface and government would then have to treat it, although the volumes would be reduced.

After the mines closed, National Government (through DWS) established a short term programme to manage AMD. At present, this pumps water from the mines to keep it from spilling at the surface and neutralises its acidity before discharging it into local streams. An investigation is underway into a long term programme that would further desalinate the water to avoid an increase in the concentration of sulphate salts above recommended limits. The capital cost for this will be at least R15 billion with operating costs of around R2.5 billion annually³⁶. The volume of water produced would be small, around 200MI/day or just 5% of Rand Water's requirements raising the question of whether such funding could better be used for other interventions.

It also appears that this treatment may not be required. Although substantial quantities of neutralised (but not desalinated) AMD have been discharged into the Vaal since 2014, DWS monitoring of water quality at the Vaal Barrage shows a declining trend in the sulphate levels associated with AMD (Figure 13). This supports the finding of an improvement in water chemical quality between 2011 and 2016 reported in the Gauteng Environmental Outlook³⁷.

It is generally agreed by experts that pollution from old mines will decline over time. It may thus be more cost-effective to adopt interim measures and continue to monitor the situation. 'Ingress control', which aims to reduce the flow of water into the mines rather than to treat it after it passes through and is polluted, is currently supported as part of the long term programme.

³⁶ Department of Water and Sanitation, (2016), State of the Vaal River System. Provincial Office presentation [PowerPoint Presentation]. (Accessed June 2018).

³⁷ Gauteng Provincial Government, (2017), Gauteng Province Environmental Outlook Report, Gauteng Department of Agriculture and Rural Development. Johannesburg.

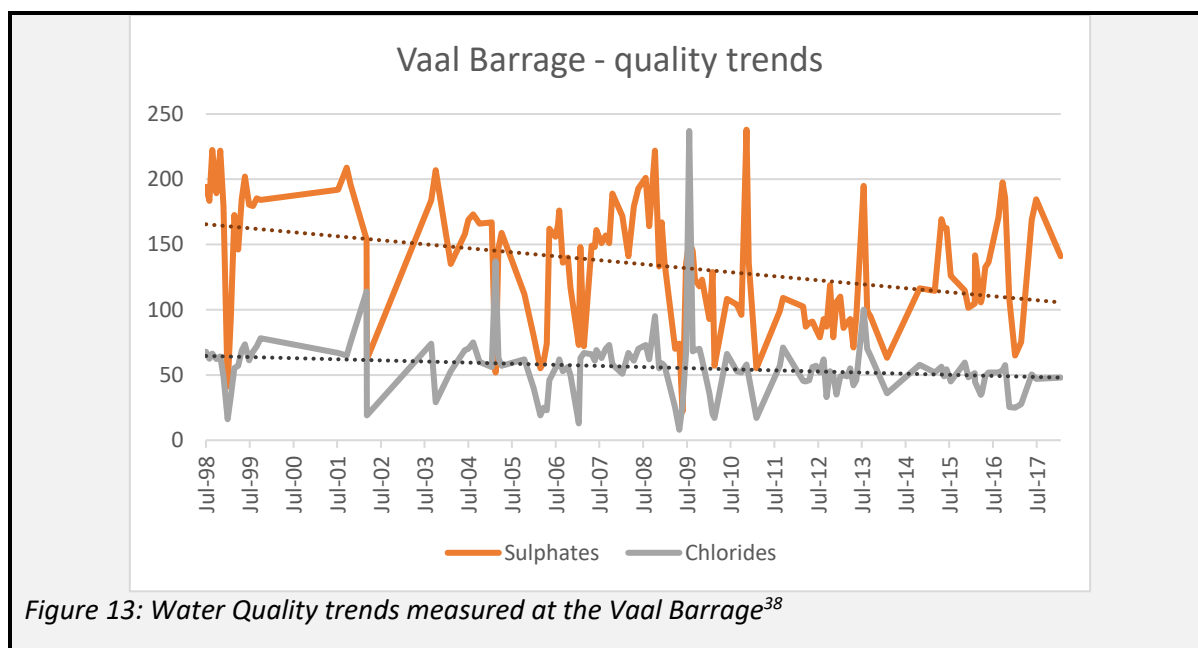


Figure 13: Water Quality trends measured at the Vaal Barrage³⁸

5.5 Water Institutions

5.5.1 Financial sustainability could limit access and threaten water security

Most institutions in the water sector face serious financial challenges, in both the bulk water resource component as well as in the provision of municipal water services. The most visible problems are at national and local rather than at provincial level.

At national level, the National Treasury and the Auditor General have reported extensively to Parliament about the serious challenges faced by the DWS and its Water Trading Entity in recent years (see, for instance, the “Report of the auditor-general to the joint committee of inquiry into the functioning of the Department of Water and Sanitation: Challenges facing the water and sanitation portfolio”³⁹). According to the Auditor General, DWS’s liabilities exceeded assets by almost R500 million in 2017/18, putting in question its ability to operate as a going concern. According to National Treasury, DWS had started the current year with an ‘overdraft’ of over R2.6 billion, which had only been reduced to R1.9 billion by year end. While much of DWS’s debt relates to payments due to them from municipalities (including Emfuleni), it appears that DWS also spent without adequate plans for debt recovery, hence much of the debt may have to be written off.

The total amount owed by municipalities for bulk water in December 2017 was reported to be R7.3 billion, mainly to water boards. There is now extensive ‘cross-debt’ with water boards unable to pay debt to DWS, which was owed R11 billion in total. A particular concern for Gauteng is that DWS has outstanding payments of R1.4 billion due to the TCTA, which is responsible for funding much of the IVRS infrastructure. The TCTA has been able to borrow funds for new projects at attractive rates based

³⁸ Department of Water and Sanitation, (2018), National Water Management System. Department of Water and Sanitation, Pretoria. (Accessed 21 May 2018)

³⁹ AGSA, 23 March 2018: http://pmg-assets.s3-website-eu-west-1.amazonaws.com/180327AGSA-Challenges_Water_Sanitation.pdf

on the financial undertakings of DWS. If these are questioned, the basis for funding new and existing development could be put at risk.

At the local level, the debt due by Gauteng municipalities to bulk water providers is significant but not the dominant challenge. In May 2018, it was reported that Emfuleni and Merafong City municipalities owe Rand Water R350 440 221 and R54 270 301 respectively⁴⁰. Despite this outstanding debt, the more general challenge is that, by their own admission, municipalities are not spending enough on the maintenance and refurbishment of existing infrastructure.

It is often suggested that this is because tariffs are not cost reflective. However, it also appears that a significant proportion of water bought or produced is lost or used and not paid for (excluding free basic water). Levels of water losses, measured as non-revenue water (unpaid and unmetered water supplied to users plus leakage from the supply system) vary across the province from reasonably good in Johannesburg (25%) and Tshwane (27.7%), concerning in Ekurhuleni (36.6%) and very poor in smaller municipalities such as Emfuleni (48.8%). (Some later figures are available but should be treated with caution since there is considerable variation between sources and some changes in definition). Once again, the decision of the previous Minister of Water and Sanitation to terminate the monitoring and reporting of non-revenue water makes it difficult to draw firm conclusions about the situation.

	Municipalities								
	Ekurhuleni	Johannesburg	Tshwane	Emfuleni	Lesedi	Merafong	Midvaal	Mogale City	Rand West City
Percentage Non-Revenue Water (NRW)	<40%	<40%	<30%	>50%	<30%	<50%	<40%	<40%	<30%

Figure 14: Levels of non-revenue water reported per municipality⁴¹

⁴⁰ National Treasury, (2018), Presentation to Parliament [PowerPoint Presentation]. (Accessed May 2018).

⁴¹ Department of Water and Sanitation, (2018), Municipal Services Self-Assessment Programme 2016/7. [Unpublished].

Figure 15 indicates the trends in water loss across the whole IVRS and indicates how much is due to commercial losses and how much is due to physical losses. The data shows greater portion of non-revenue water is due to physical losses.

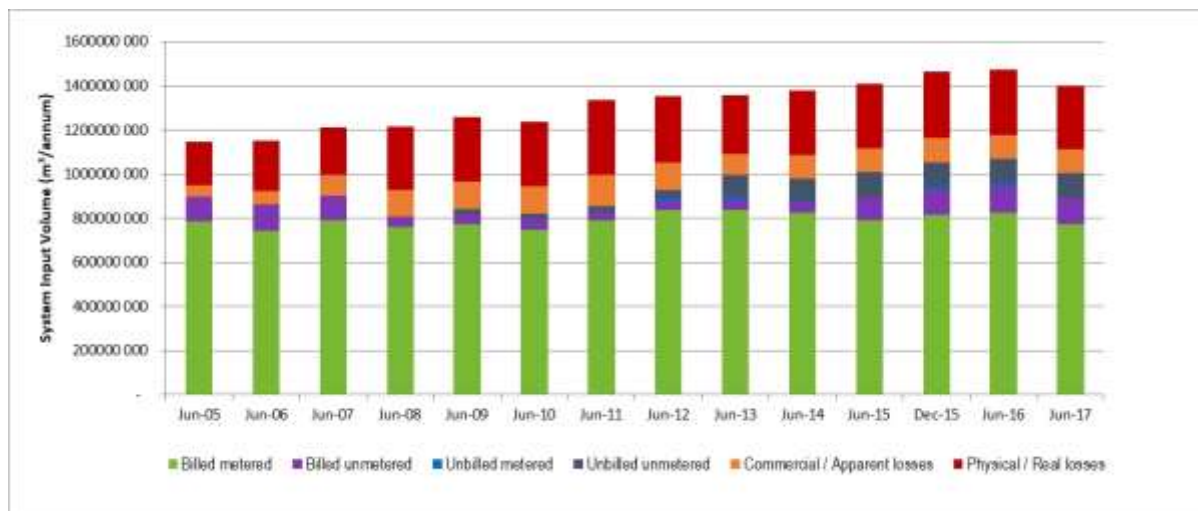


Figure 15: IVRS water loss trend⁴²

Given this background, it is important to note that, in addition to Non-Revenue Water, a significant problem may be that water that is metered and billed is not paid for - 58.5% of South African households reported that they did not pay for water in 2016⁴³. These non-payments may be recorded as ‘municipal debt’ rather than ‘non-revenue water’. National Treasury reports⁴⁴ that in 2017, the City of Johannesburg was owed R17.1 billion (the largest municipal debt in the country), City of Ekurhuleni R13.3 billion and City of Tshwane R9.5 billion; Tshwane and Ekurhuleni reported the highest growth in outstanding debtors, at 24.6% and 14.4% respectively. By comparison, National Treasury estimates that the value of water physically lost in the system that year was just R1 556 million.

These figures suggest that access to water in Gauteng’s Metropolitan Municipalities is sustained not only by formal Free Basic Water (FBW) policies but by more general not billing or enforcement of cost recovery for services, of which water is an important part. These challenges will be aggravated by a succession of higher than inflation tariff increases that are required to pay for new developments such as LHWP2 – the Rand Water tariff was increased by over 14% in 2018/19. Current proposals to invest R15 billion in long-term AMD treatment in addition to the R25 billion already committed for LHWP2 will add to the cost burden for IVRS users and must be closely interrogated.

At municipal level, there is some contribution to the financing of water supply and sanitation through allocations made in terms of the annual Division of Revenue Acts. While the equitable share and conditional grants are of limited importance to the metro municipalities, they are a significant resource for local municipalities to support the operation and maintenance of a basic level of services.

Inadequate revenues and growing debt will limit the ability of all institutions to raise the funding required to sustain and expand the bulk water supply infrastructure. In response, it is important to

⁴² Barnard, S. et al. (2016), Status Report on Water Losses within Eight Large Water Supply Systems. Department of Water and Sanitation. Pretoria.

⁴³ StatsSA, (2017), General Household Survey 2016, Statistical Release P0318. StatsSA. Pretoria

⁴⁴ National Treasury, (2018), State of Local Government Finances and Financial Management report. National Treasury. Pretoria. (Accessed August 2018)

<https://www.gov.za/sites/default/files/State%20of%20LG%20Finances%20Report%202016-17.pdf>

keep costs as low as possible by improving efficiencies, critically reviewing new investment proposals as well as service standards and associated tariff policies to ensure that service provision is sustainable in the medium to long term. Increased efficiency and reductions in consumption will delay the need for major new supply investments and contribute to keeping the cost of water down.

Box 3: Learning from the National War On Leaks Programme

The physical loss of water through leaks and other wastage in municipal systems often accounts for more than 25% of the water provided. Its reduction is thus an obvious and easily understood water management objective that can help to reduce overall water use and delay the need for investment in new supplies (although it will never be economical to eliminate all leakage in the systems).

A focus on reducing physical water losses is a strategic intervention since an effective programme requires sound operation of many dimensions of the water distribution network. It requires efficient organisation of the maintenance function, comprehensive monitoring of water volumes supplies into and supplied out of the system, including metering of consumption, as well as planned programmes of infrastructure rehabilitation and replacement.

Water leak reduction is thus widely supported as a national priority. A goal of halving water leaks was set by President Jacob Zuma in his first State of the Nation Address in 2010; this was adopted by successive Ministers of Water, reinforced by both the National Development Plan and a commitment of SALGA Mayors and supported through partnerships with the private sector. Yet despite public consensus and the allocation of large budgets, the programme has had limited impact. Lessons can be learned from this experience.

As has been widely discussed amongst water practitioners and demonstrated in the City of Cape Town, successful reduction in water losses requires a coherent set of interventions across municipal water supply operations. Municipalities need to know how much water they put into their systems and where it is used (or lost) for which an effective administration is required. The supply system must be divided and monitored in smaller zones, to allow problem areas to be identified and prioritised. To reduce losses, the public must be encouraged to report water leaks and their willingness to do so reinforced by rapid and effective action by the municipality to fix them.

Where water supply is not adequately monitored, water use not properly metered and networks not well mapped and maintained, it is difficult even to know how much water is lost. If repair teams are not adequately trained and equipped and customer service centres effectively run, little progress will be made. Progress by individual municipalities in water loss reduction should be monitored and reported, which the DWS has been increasingly reluctant to do in recent years, in part because of the political sensitivity of the information.

A final challenge has been inadequately considered actions, possibly with short term political benefits to the detriment of long term sustainability of services delivery. One element of this has been a focus in some municipalities on large and expensive pipe replacement projects, often not based on substantive evidence of need or benefit. Another element has been the declaration of a 'War on Leaks' by the Minister and President in 2015, focusing on the training and employment of 15 000 young people as plumbers, artisans and 'water agents' without clear thought as to how these people would be integrated in the day-to-day business of water supply.

The lessons of the efforts over the past decade are thus that, while leak reduction is an obvious and important goal of water services management, success is dependent on effective municipal management and needs a focussed and funded initiative to achieve results. Related to this, the reduction in that component of 'non-revenue water' which is consumed but not metered and billed requires the establishment of an efficient administration. This must enforce payments by users who are not entitled to be supplied with a free basic water allowance or who exceed their free allowance. Successful programmes thus require politically challenging decisions to be made and a focus to be placed on improved municipal performance.

5.5.2 Institutional weaknesses pose critical risks

Many of the challenges identified relate to institutional weakness – and, in some cases, frank failure – at all levels. These have been recognised and commented. The Auditor General has provided a detailed review of the failures in the national Department of Water and Sanitation, emphasising the contribution of leadership instability to poor performance, a conclusion strongly supported in Parliament by SCOPA. This was illustrated by the rapid turnover of Directors General over the past decade.

In this context, the risks to Gauteng's water security due to weaknesses at the **national level** are manifold. They include:-

- Failure of the TCTA to mobilise funding for LHWP2 due to non-payment by DWS for water and services supplied leading to delays of new development in the IVRS
- Failure to model and monitor IVRS performance, to convene operating forums and to implement the necessary actions, exposing Gauteng to drought risks
- Failure to maintain the planning system and update the hydrology data base used by the model with the result that changing climate trends will not be incorporated and responded to in IVRS operation and planning
- Failure to provide monitoring information on the performance of water services authorities, limiting the ability of other institutions of government in all three spheres as well as of civil society to identify emerging problems and intervene expeditiously.

Another set of critical risks lie at the **regional level**. Gauteng is almost completely dependent on supplies from Rand Water. Any failure that interrupts supply from that source would have devastating consequences for the Province's people and its economy. This vulnerability has been demonstrated during recent incidents when bulk transmission was interrupted as a result of infrastructure failures, power cuts and vandalism. As with drought, institutional failure can be a 'slow-onset' phenomenon that builds up gradually but creates disasters that take a long time to resolve.

In recent cases, the interruptions were resolved within a few days, but they did highlight the need for close attention to Rand Water's contingency and backup systems planning and readiness and a need for a continued focus on building its resilience. In addition, there is a need to ensure that Rand Water's long term planning for infrastructure management and expansion is aligned with the needs of the Province. It is also important that it is managed on a cost-effective basis since bulk water costs represent a significant component of the overall cost of water services. Given the critical role and specialised nature of the organisation, it is vital that its human resource capacity is sustained and developed.

At the ***municipal level***, the National Treasury and COGTA have produced many analyses of the challenges. The 2018 review of local government finances highlights the risks to services that could contribute to municipal financial crises which will very rapidly turn into service delivery crises. They include:

- A reduction in revenue collection due to the impact of the economic slowdown and the rising rates and tariffs which affect household budgets
- Emergencies and disasters such as floods and drought
- The cash flow time difference between paying for the increased cost of bulk electricity/water and the collection of revenues from customers
- Any major breakdown in service delivery resulting in non-supply (especially of water and electricity) and therefore loss of revenue
- A rate-payers/consumers boycott
- Ineffective cash flow management on a monthly basis
- Non-implementation of debt collection and credit control policies.

It is notable that most of these risks are institutional in nature. One common challenge across all institutions – from national to local levels – is that the lack of capability to operate and manage the infrastructure asset base for which they are responsible. Effective asset management is essential for service reliability and can also make a significant contribution to cost containment.

A particular challenge in the water sector is the loss of technical capacity. In response, there has been an increasing reliance on technical consultants to undertake even routine activities in sector institutions. This is having a systemic impact on the development and availability of human resources required to undertake the complex tasks inherent in water management. The public sector was historically the main source of bursary support and post-graduate training, but this is no longer undertaken at an appropriate scale. The consequence is that new technical graduates find it difficult to obtain the experience required to obtain professional qualifications and many are lost to the sector as a result. A rebuilding of the technical capacity of the municipal sector in particular will continue to be a priority in order to ensure Gauteng's water security. There remains a need to strengthen the technical capacities of Rand Water and DWS as well the municipalities. At all levels, technical professionals must be insulated from political pressures that might force them to deviate from optimal, technical approaches and supported to enable them to perform effectively.

Box 4: Lessons from other Cities

CAPE TOWN

Cape Town's recent water crisis highlights the challenges of water management in South Africa's difficult climate. Specifically, it demonstrates the importance of the system planning and operating modelling processes and the consequences of ignoring their recommendations. A unique feature of these models is that they consider the risks caused by climate variability and thus give early warning of possible supply shortfalls and the need for restrictions.

Despite population and economic growth, the City of Cape Town had decided to delay the implementation of new supply infrastructure. In 2008, models of the Western Cape Water Supply System (similar to those for the IVRS) suggested that, by 2015, they should build additional infrastructure to augment and diversify their supply; this message was reinforced by both the National Water Resource Strategy 2 and the National Development Plan. In 2013, however, municipal officials decided that the gains from their (excellent) water conservation and demand management programme meant that they could delay new investments until 2022 at the earliest. This position was not opposed by the representatives of the national DWS, which was managing the planning process.

It was unfortunate that a serious, but not unprecedented three year drought followed almost immediately after this decision was taken⁴⁵. The decision was influenced by the fact that there had been good rains in the two preceding seasons and the region's dams were full; these rains also contributed to reduced water use over the previous two years. These positive factors may have contributed to delays in introducing restrictions early in the drought cycle. Initially too, domestic users were restricted more heavily than agriculture, contrary to formal policy. While this was in part because the decision to introduce restrictions was only taken after farmers had already planned and started their summer cropping, some farmers failed to comply with restrictions and were not sanctioned.

However, the consequence of delays in announcing and enforcing restrictions was that the city later had to introduce extreme Level 6b supply restrictions, based on warnings of an imminent 'Day Zero'. Once again, the City's officials developed an excellent response and managed to achieve a reduction in overall consumption of almost 50%, without recourse to supply interruptions. But the extreme actions required, together with wrangling between and within the different spheres of government, have damaged the city's economy and reputation.

A simple analysis shows that attempts to save money by delaying investment have been very costly. The financing costs for the new infrastructure would have been about R70 million annually; over 7 years (2015-2022) this would have cost around R500 million⁴⁶. In the event, the financial and economic losses suffered are already estimated to exceed R2 500 million with the city losing R1 700 million directly, due to reduced water sales. This shows that investments in supply infrastructure should be regarded as value-for-money insurance.

A similar situation had arisen just 15 years earlier when objections to the construction of the Berg River Dam were only over-ruled when a drought in 2002/4 highlighted the system's vulnerability.

⁴⁵ It has been claimed that this was a 1 in a 1000 year drought event (or, as some commentators suggested, a 1 in 300 years event). However, these estimates are based on rainfall records from outside the catchment area of the WCWSS's main dams and do not take account of the local variability characteristic of South Africa's climate.

⁴⁶ Muller, M. (2018), Cape Town's Drought: don't blame climate change, *Nature*, vol 559, pp. 174-176

During the current crisis, the storage provided by that dam, eventually completed in 2009, has saved the City from suffering the threatened 'Day Zero'. Yet the Western Cape system remains particularly vulnerable with a total storage of less than two years of average consumption. By comparison, Gauteng's IVRS has over five years of storage and a catchment area fifty times larger, which reduces risks due to localised drought events.

Aside from the importance of timely investment in additional supply infrastructure, Cape Town's experience highlighted the importance of a rapid response to emerging drought signals, the need for clear plans to enforce restrictions and manage the financial implications as well as the importance of effective communications to all water users. It has also demonstrated that, while water conservation and demand management is important, it cannot by itself avoid the need for infrastructure development in a growing South African city.

A further important lesson is that water security measures must consider the interests of all users of a system, not just city dwellers. In the Western Cape, agriculture uses about a third of the system's water. But it is a high value activity, which provides many jobs and produces substantial export earnings. As important, the 'Winelands' are an important part of the region's 'brand'. As a result, farmers continued to receive (restricted) allocations even as the City's residents were contemplating 'Day Zero'.

Cape Town's response was also weakened by the limited role of the Catchment Management Agencies - with the Berg/Olifants CMA not established yet, and the functions with the DWS regional office - in the lead up to and management of the crisis instead of the central strategic and coordinating role that they might otherwise have performed. This was left, instead, to DWS's relatively weak Western Cape regional office, which compounded the weaknesses in coordination that arose due to political conflicts that were playing out across all three spheres of government at the time.

An important lesson from Cape Town is that the restrictions imposed were designed to maintain access to basic supplies for all residents. While severe restrictions were imposed on high consumption suburban households, supplies were maintained to low income households and informal settlements at the basic service level with a focus in those areas on reducing losses due to leakage etc.

As the city begins to recover from the crisis, the final challenge currently being managed is how to exit the restrictions. Good early rains saw calls for restrictions to be reduced. However, with the dams still only half full and no certainty that the rains would continue, this has been resisted. The city is now actively using the WCWSS model to evaluate the situation and manage the risks. Because of DWS budget constraints, the city has funded the updating and use of the model for this purpose.

SÃO PAULO

In 2015, nearly 30 million people in greater metropolitan São Paulo, Latin America's largest city region, faced acute water shortages following the worst drought in a century. Storage in two of the city's main reservoirs had fallen to just 6% and 9% of their capacity.

Though Brazil has an admirable water engineering tradition, their technicians work in a complicated political environment. So, although they have known for a decade that they need to build more infrastructure and improve efficiencies of water use in São Paulo, it has not been approved to proceed. A particular problem is that states have powers over the use of the rivers that flow through

them. Municipalities also have a range of powers over water. So in Brazil's multiparty democracy, water matters often need agreement between three different parties. That is particularly difficult when water users in one state are asked to cut consumption to help their neighbours. What this meant for São Paulo is that decisions taken in 2004 about new infrastructure to increase storage and interconnect different systems were not implemented by 2015 (as for Gauteng). To aggravate the situation, the drought coincided with a contested national election, which meant that introduction of restrictions was delayed at the beginning of the year due to the upcoming election. The deadlock between states – that prevented emergency transfers of water from one river to another - was broken by a Constitutional Court ruling, which directed the National Water Agency to decide what should be done.

The following lessons from São Paulo were identified for Brazil⁴⁷:

- **Managing water security is an ongoing task** - drought is socio-natural phenomenon and management requires action in different areas – public opinion, political-institutional, judicial as well as technical. Drought management requires different skills sets and expertise of sustainable solutions and co-ordination and integrated water management institutions to manage it. Actions of drought management must include supply management, demand management and conflict management, as well as drought monitoring including early warning.
- **Water systems are complex and should be analysed as an integrated whole** - operational management of require agile and continuous decision making with technical expertise being essential and water systems' vulnerabilities to droughts can be mitigated by relatively minor interventions in hydraulic structures, for example physical changes to intake structures. Consumption patterns and beliefs could be permanently changed though a drought – or not.
- **A drought governance system – including a drought management plan - is a critical requirement.** Drought management must take place in various arenas (technical, political, public opinion, legal) and requires technical expertise to address inherent complexity and uncertainty, institutional mechanisms for conflict arbitration, supply and demand management. Rules for allocation and restrictions / rationing - including public participation - should be defined before droughts occur – and implemented by relevant institutions. Drought monitoring is essential – including early warning. Public prosecution process should be institutionally centralised, e.g. for the public prosecutor to monitor decisions made with arbitration mechanisms for political disputes between regional interests defined within the water management process. Permissible risk for projects that promote water security must be defined social legitimacy for these established. A critical component of this is a communication plan to inform public opinion. Water policy (including roles and responsibilities of institutions) and grants must be clear to address droughts. Drought planning must include financial mechanisms for reduced income

Unlike South Africa:

- São Paulo's water system's operational oversight was **not** guided by appropriate models as operating models did not include hydrological variability

⁴⁷ Kotze, P. (2018), "Post day zero – Lessons in resilience from São Paulo", Water Wheel, May/June 2018, pp. 16-20.

- Inadequate early warning system was in place, although they were aware of increasing vulnerability.
- São Paulo therefor sad to implement emergency a drought management strategy rather than planned water resource management measures, which included implementation of multi-day supply cuts in many areas.
- Water law did not allow any national agency to enforce coordination or implement inter-state solutions, which eventually required a Constitutional Court order to implement

Like Cape Town:

- São Paulo failed to consider and provide for reduced income from water supply sales, which obviously had a severe impact
- The situation was greatly exacerbated by weak communication and poor political coordination.



6 STRATEGIC RESPONSES TO EMERGING CHALLENGES

6.1 Water Security, a never-ending challenge, is everyone's business

Establishing and then sustaining water security is a never-ending challenge that requires continued focus and effort. Yet it is essential to the life and economy of the Gauteng City Region. While when talking of the region's water security, the focus is often simply on the next big project, the nature of the emerging challenges demands a more strategic set of responses.

Those responses must be guided by a clear set of broader principles. Since access to safe and reliable water supply and sanitation is essential for peoples' health and dignity, the approach taken must be just, fair and pro-poor and ensure that no one is left out. This will be especially important if supply restrictions need to be introduced in the event of a drought or other supply interruption. In South Africa's unequal society, water users who in normal times enjoy high levels of service must be the first to make sacrifices in times of stress.

Economic activity must also be supported. The economy of the GCR creates millions of jobs and livelihood opportunities in the region and beyond. Reliable water supplies and the efficient management of wastewater are essential components of an environment that supports business and makes these opportunities possible. The effective and efficient management of water services must help the economy to grow and become more competitive. Choosing the right investments, implementing them efficiently and ensuring that services are properly operated and maintained will contribute to this goal.

The way in which water is managed and used must be sustainable. The goal is not just to ensure that the people of Gauteng live in a pleasant and environment but also that their activities do not prejudice

their neighbours. So wastewater must be managed in a manner that complies with regulations, which are designed to ensure that people downstream are protected from their neighbours' wastes.

The GCR will not achieve these goals unless the way in which it develops and the behaviour of its citizens is guided to become more resilient to water-related challenges. Greater water use efficiency will not only make it easier to serve the whole community; it will also bring direct economic benefits by delaying and reducing the costs of additional supply infrastructure.

Given the wide-ranging scope of water management and use, the final guiding principle for the achievement of water security is that water is everybody's business. This, in itself, requires a transformational approach in which organs of different spheres of the state cooperate and coordinate their work and can rely on the support of civil society and the population as a whole.

So, while this Action Plan must initially focus on urgent and important short-term actions, these must be guided by the long term goal of building a water resilient GCR. That goal will only be achieved through a strategic programme that coordinates the actions of all role-players. Just as water is everyone's business, water security will only be achieved through the coordinated efforts of all role-players and the objective of this Plan is to catalyse those efforts.

6.2 Plan to operate within constraints: reduce demand and plan for future

While current performance of Gauteng's water system is still reasonably good, the province is entering a period during which its overall water security is at risk.

In the short term, Gauteng must plan for drought. Specifically, it should avoid using more water than the IVRS can sustainably provide in a dry period. Since Rand Water has already reached the limits of its abstraction licence, this means that, until LHWP phase 2B is completed, the water supply needs of the growing population and economy can only reliably be met by reducing demand from 300 litres per person per day to 234 l/c/d by 2026 (see Table 2).

Action is required at the level of both water services providers and water users to achieve this challenging goal.

- Water services providers (municipalities and water boards and their agents) must reduce 'Non-Revenue Water' (including enforcing payment for services and reducing both physical losses in their distribution systems and unauthorised use) to targets set and agreed with Rand Water, GCR and DWS.
- Social institutions as well as businesses, including property owners, must be encouraged and incentivised to monitor and control their water consumption and to reduce it by introducing efficiency measures, especially, but not only in, new developments.
- Households must be encouraged through effective long-term communication and incentivised through tariff structures and other measures to monitor, control and reduce their water use.

In all cases, water users must be prepared to further reduce their use if restrictions are required in the event of drought or infrastructure failure and municipalities must inform them, in advance, of the different restriction levels that may be applied. When this happens, water services providers **must** impose and enforce restrictions according to pre-determined policies. To do this, they will need to have effective systems (infrastructural, operational, financial and communications) in place. Municipalities should also consider carefully the financial implications and ensure that tariff based

measures are designed to maintain water income as well as to encourage water saving. This may require prior tabling of new tariff regulations for periods of water restriction.

At a provincial level, available bulk supplies from Rand Water must be allocated between municipalities and other major users on an equitable basis to ensure that the Province as a whole does not exceed Rand Water's abstraction licence. The Organisation has initiated '**Project 1600**', a collaborative effort with its major customers to reduce water use to enable Rand Water to comply with its water licence conditions. Finally, it has been suggested that treating AMD to potable standards could help to make more water available. However, the cost of this option in terms of both capital and operating costs needs to be assessed and compared with other alternative options and approaches of further surface and ground (raw) water development and reuse of sewage effluent.

In the longer term, gains made in the short term need to be sustained and further systemic measures introduced. Improved Planning for new urban development and housing and alignment with municipal water services infrastructure planning can make a substantial difference to demand for water. One effective intervention is to increase urban density, which is closely associated with reduced water use (although it may increase flood risks). Approaches must be adopted that enable and encourage reduced water use. Building regulations must require the use of water-efficient and low flow fittings and the use of these must be enforced for all new buildings as well as retrofiring of existing building over time.

While behavioural changes, better planning and greater efficiency are unlikely to prevent water demand from growing, current planning studies indicate that they could make it possible to delay the need for major new supply expansions well beyond 2035⁴⁸.

6.3 Ensure sufficient supply to meet demand

To ensure that Gauteng has an adequate and reliable supply of water to meet current and future population and economic growth needs, it is necessary to focus on both short-term operations of the existing system and long term planning and development of the overall system. Such planning must give as much attention to the demand-side as to the supply-side.

6.3.1 Short-term operational guidance requires strategic engagement

The IVRS model provides crucial information about water availability, water use, and emerging water shortages. However, the model is only effective if it is appropriately used. This requires that there should be regular review meetings at least twice a year, around the beginning and end of the rainy season. These reviews must include not just the water resource managers but all major water users; civil society organisations should also be involved to ensure that wider perspectives are gathered, and that information is better understood and disseminated. The exact timing of such reviews should be agreed with the water users to ensure adequate early warning is provided to enable action to be initiated when and where required. This may require the number of review meetings to be increased. All major stakeholders should ensure attendance at a strategic technical level. GPG should ensure that this process functions effectively and should consider introducing institutional arrangements to give it greater influence.

⁴⁸ Department of Water and Sanitation, (2018), Continuation of the Integrated Vaal River system Reconciliation Strategy (Phase 2). Department of Water and Sanitation. Pretoria.

The IVRS model should be regularly updated to ensure, *inter alia*, that emerging climate change trends are detected as early as possible and can be reflected in the analysis. The current hydrological dataset has not been updated for over 15 years and thus does not take account of some recent extreme events which could alter the conclusions drawn.

6.3.2 Adaptive long-term planning: early information to identify future options

Beyond the completion of the Polihali Dam in LHWP2, a range of further water supply options have been identified for the IVRS. These include water reuse, AMD treatment as well as new inter-basin transfer projects from the uThukela basin. The choice between these projects and the timing of their implementation needs to be effectively guided to avoid unnecessary expenditure while minimising risks. The IVRS model is therefore also an important tool for the long term-planning of the IVRS and neighbouring river basins on which it depends. As the experience of Cape Town has shown, it is important to maintain an objective perspective on the performance of the system and its users and the hydrological risks to guide decisions on the nature and timing of new infrastructure development. It also helps to identify the potential impact of other water management options, such as water demand management, and enables their performance to be monitored and assessed.

Critically, the IVRS planning process also provides a vehicle through which the broader development planning processes of the Province can be reflected and informed.

Like operational monitoring, the planning of system development is an ongoing process that must be repeated regularly. However, time frames involved are different. The planning cycle will usually look 30 to 40 years ahead and so the process to reconcile projected supply and demand needs to be repeated at approximately five yearly intervals. In this process, the growth and changing characteristics of the Gauteng City Region need to be monitored. An important focus area must be on the evolution of water demand and progress towards the achievement of targets for water loss control and water demand reduction should be regularly reviewed to ensure maximum impact.

Both the operational analysis and the planning process require intensive technical work as well as structured engagement with key stakeholders. This process needs to be adequately resourced and managed and all stakeholders, including GPG should maintain oversight to support it.

6.3.3 Timely intervention is key to water security

Planning for the IVRS will only contribute to Gauteng's water security if the interventions that are identified through the planning process are effectively implemented when required. This has been illustrated in the IVRS over the past decade when it was recognised that the security of the system was being undermined by illegal irrigation abstractions in the Free State. Once the risk to the system was identified, it was possible to initiate a campaign to end illegal use, which has significantly increased the amount of water reliably available to the legitimate users of the system.

In the planning process, the importance of water conservation and demand management is also identified as a key intervention and targets set to reduce water consumption. This has proved more difficult to implement since it requires action by a range of stakeholders. But the IVRS planning process provides a mechanism to monitor progress and to adjust planning accordingly.

Gauteng's present water security predicament is the result of delays in the initiation of the LHWP2. That process is now on track, with project implementation being undertaken by the Lesotho Highlands Development Authority, with financing through the TCTA, under the supervision of the bilateral

Lesotho-South Africa Water Commission. Given the importance of the project, GPG should maintain a watching brief and ensure that it is aware of progress and, in particular, so that it can intervene as appropriate if there are any developments that might lead to further delay.

6.4 Diversifying the water mix

Given the constraints on the IVRS, it is important to consider whether there are other opportunities to increase water availability in the short term and to diversify sources of supply to reduce risks. Three immediate opportunities have been identified:-

6.4.1 Groundwater

Groundwater is available in some parts of Gauteng and what is available is often polluted or in areas where its abstraction may cause sinkholes and related property damage. Local investigations should be undertaken by municipalities to identify potential groundwater sources that could supplement IVRS water on a permanent or emergency basis. The specific opportunities and limitations of using water from old mines should also be considered.

Consideration has also been given to using underground geological formations as a strategic storage reserve. This has the advantage of providing a local reserve in the event of a catastrophic infrastructure failure in the main supply system. However, for the storage of large volumes of water, this approach faces the same constraints of pollution and subsidence as for groundwater abstraction. Given the uncertainties, the potential role of groundwater management as an element of GPG's water security strategy needs further investigation.

While individual users are often able to use groundwater, this may need to be monitored since a proliferation of boreholes may rapidly lead to the depletion of local resources. However, if there is no conflict between users or undesirable environmental impacts, small-scale use may contribute to a reduction of demand on the overall public supply system.

6.4.2 Reuse of wastewater and treated AMD

While the province has few significant alternative natural water sources available in the short/medium term, rising use does produce growing volumes of wastewater that could be treated and reused. The development of wastewater reuse (based at existing treatment works) must urgently be considered as a supply option. This will also contribute to an improvement of environmental water resource quality. However, it should also be noted that there are downstream water users on both the Vaal and Crocodile Rivers that depend on the flows of treated wastewater and the needs of these users will have to be considered in any application of reuse in Gauteng.

In addition to wastewater reuse, there are also proposals to treat water currently pumped from old mine voids (AMD) to potable standards to supplement supplies as well as to reduce surface water pollution as noted in section 5.4 above. Since this could be a more expensive option that will provide only limited quantities of water, the possibility of using already available, partly-treated, AMD to substitute for IVRS supplies to some users (e.g. industrial) should continue to be evaluated.

These issues are discussed in more detail in section 6.6 (managing water resource quality).

6.4.3 Rainwater harvesting

Rainwater harvesting cannot provide a significant supply source during the dry winter season nor if there is a severe drought, but it may enable households and commercial and institutional users to reduce the amount of water they draw from public supplies which could slightly reduce consumption from the overall system and enable reserves to be maintained. Since this will not reduce the distribution infrastructure currently required, it will simply increase the cost of providing water. However, rainwater storage may be useful to provide users with a reserve in the event of supply interruptions due to, for instance, infrastructure failures. In this case, however, storage should be kept full and will not help to reduce the capacity of the supply system. Rainwater harvesting may also provide a useful educational and behavioural tool for schools where principles of sound water management and use should be integrated into teaching and learning.

6.5 Ensure effective municipal performance

It is evident that many of the challenges of sustaining water security at municipal level relate to general challenges of municipal management within and beyond the water services functions. Key dimensions, as they relate to different elements of water services and water security are outlined in this section.

6.5.1 Access to water supply services

The technical challenges of maintaining reliable access to enough safe water for all residents of Gauteng people are straightforward. In the first place, there needs to be an assurance of a reliable bulk water supply. Thereafter, each municipality that operates as a water services provider must ensure that it has

- an appropriate organisational structure,
- staffed with appropriately qualified and experienced people,
- provided with sufficient financial resources, with
- performance standards set, and
- structured planning, operational and monitoring processes in place to achieve them.

Such a team would be able to operate and maintain existing infrastructure and to promote necessary capital works to refurbish and expand the systems for which they are responsible. The technical standards have generally been defined (although distribution capacity may have to be increased to meet demand during predicted periods of hotter weather). However, the primary challenges are the associated institutional and financial arrangements.

While technical access can be sustained, ensuring that people can afford an adequate water supply and are not prejudiced in the event of a drought is not as easy. In the event of supply restrictions due to drought or further delay in expanding IVRS supplies, system managers will have to develop strategies to ensure that water supplies can be restricted and equitably shared between different communities. This will require the adoption of a range of techniques and may require, as in the Cape

Town case, investment to establish, monitor and control flows in smaller supply zones as well as a review of tariff structures. Measures will also be required to restrict supplies to users who do not comply with restrictions. Operationalisation of such restrictions will require intensive management and procedures should be developed before they are required so that personnel can be appropriately trained. A first step will, however, be to ensure that there is adequate capacity to undertake routine operations and maintenance activities effectively. Achieving this capacity is an essential requirement for the successful implementation of restrictions should these become necessary.

6.5.2 Sanitation services and wastewater management

The achievement of adequate sanitation services is somewhat more complicated than for water supply. While there are similar generic requirements, the physical framework for sanitation provision is often more difficult, not least because it is significantly affected by the broader built environment. Waterborne sanitation depends on proper building maintenance if blocked drains and spills into stormwater systems are to be avoided. This may require the deployment of environmental health and building inspectors. The high cost of sanitation reticulation infrastructure (and of the water required for the waterborne systems which are the desired norm in Gauteng) already imposes a significant financial burden. This is aggravated by the relatively high cost of effective wastewater treatment. As a result, and because water supply tends to be prioritised, sanitation services are often underfunded. Projects to reuse wastewater may incentivise better wastewater management since they yield obvious benefits in the form of a stream of usable water.

Efficiencies (and thus better services) can also be achieved through the adoption of appropriate policies and processes in housing development and urban planning more generally. Water efficient fixtures should be systematically promoted, and consideration given to alternative sanitation arrangements in the planning and layout of new urban settlements, to reduce the capital and operating costs of sanitation systems. Cooperation between neighbouring municipalities may also help to achieve scale efficiencies and reduce the cost of wastewater treatment.

6.5.3 Stormwater management and flooding.

Stormwater management should be given more attention in new and existing settlements. Priority should be to ensure that there is provision of stormwater drainage in low income communities to reduce risks to life, health and property. However, in all communities, stormwater drainage systems need to be maintained and municipalities should ensure that adequate resources are devoted to this. A priority must be to avoid stormwater entering into and overloading sewage disposal systems

In this context, urban development planning must become more water sensitive. It is far easier to address these issues at the planning stage than after the event. Where new development promotes increased urban density, it must be recognised that this may create greater flood risks which should be considered in the location of development and the design of stormwater drainage systems. Planning and development must be guided by information about flood vulnerability, with up to date floodlines, and clear policies on environmental management priorities for rivers, streams and wetlands.

One possible consequence of climate change is that 'runoff', the proportion of rainfall that flows into streams and rivers, may be reduced. This presents a challenge since water security in the IVRS and South Africa generally already depends ensuring that enough water is captured in storage to maintain

supplies in dry periods. This means that it will often be inappropriate to adopt drainage practices that reduce overall runoff and that stormwater should rather be safely channelled into natural streams.

Most stormwater and flooding risks in Gauteng occur at a local scale. However, the Vaal River does occasionally experience major flooding. To manage these floods, the DWS has a computerised system that, in the event of high rainfall events, provides real-time warnings of the dangers of large scale floods and guidance for their management to minimise downstream damage. These systems must be maintained and regularly tested and affected communities should be advised of the potential risks and responses required.

6.6 Manage water resource quality

Although there is significant ‘diffuse pollution’ caused by human activity such as dumping and littering, the poor quality of Gauteng’s rivers and dams described in section 6.4 is largely due to the inadequate management of sanitation systems, specifically waste water (sewage) treatment works. This can only be remedied through action at a municipal level since the management of drains and sewers to avoid sewage spills into the stormwater system and thence into rivers and streams is a clearly defined municipal function.

However, the failure to manage wastewater treatment effectively may also be addressed through institutional means since sewerage systems often cross municipal boundaries. ERWAT, a specialised public wastewater treatment company already operates 19 plants serving three Gauteng municipalities. Rand Water is also cooperating with Sedibeng District Municipality to support the expansion of the Sebokeng Wastewater Treatment Plant.

Water reuse may best be implemented at a regional scale which would enable economies of scale to be achieved. The involvement of Rand Water and ERWAT as implementing agents and TCTA as a funding agent would enable this option to be developed within the resources available to municipalities.

Related to this, a strategic planning decision also must be taken with respect to the rivers into which Gauteng’s wastewaters should be disposed. At present, much of the used water originating in the Vaal system is discharged into the Crocodile and Olifants rivers. While this contributes to water supplies downstream, it also causes pollution of locations such as Hartbeespoort, Roodeplaat, Rietvlei and Bon Accord dams if it has not been adequately treated. A proportion of this wastewater could also be disposed back into the Vaal River where, if properly treated, it would help to keep pollution at levels acceptable to downstream agriculture and meet other downstream needs.

This approach may conflict with current proposals for further treatment of AMD to reduce the amounts of freshwater water required to maintain downstream water quality. However, the high capital investment required for full AMD treatment is a significant disincentive. In addition, operating costs of R2.2 billion annually would add 25% to Rand Water’s current operating expenditure⁴⁹; this would provide just 5% of Rand Water’s overall requirement. It should be investigated whether wastewater reuse could achieve this goal more cost-effectively, though neither intervention is likely to be available before 2022 at the earliest.

⁴⁹ Department of Water and Sanitation, (2018), Continuation of the Integrated Vaal River system Reconciliation Strategy (Phase 2). Department of Water and Sanitation. Pretoria.

While AMD can have local impacts, there has been no reported increase in salinity in water from Hartbeespoort Dam, which is used for irrigation downstream, although AMD has been decanting into the Crocodile River since 2011. Similarly, in the Vaal River at the Barrage, the concentration of sulphates and chlorides, the salts of concern from an agricultural perspective, have decreased steadily from its 1988 levels and have only increased slightly from 2010 to 2017, the period in which significant AMD discharges began. It has even been suggested that the high iron content of AMD could usefully be applied in wastewater treatment to reduce the phosphate levels that are contributing to the eutrophication of the Province's dams.

Given the capital and operating cost of interventions to improve water resource quality, the choice and implementation of these must be well founded and supported by scientific evidence. There is little recent analysis about the source, scale and trends of water pollution in the province on which to base such strategic decisions. Updated water quality modelling is required to guide policy interventions such as (expensive) proposals to pump and treat acid mine drainage as well as to guide wastewater disposal strategies to reduce eutrophication risks in the province's dams and increase the volumes of reusable water.

6.7 Improved management of water institutions

6.7.1 Financial sustainability could limit access

The review of current performance shows that financial resources are increasingly constraining the ability of water sector institutions to sustain water security. All municipalities report substantial investment backlogs while funding for operations and maintenance is often either inadequate, inefficiently used or sometimes diverted to unrelated municipal functions.

Traditionally, there are three sources of funding for water services – tariffs, taxes and transfers (grants and aid). There is limited scope for significant increase in any of these sources. Tariff increases will have limited impact in circumstances where many users do not pay for water; taxes are already tapped to support a system of conditional and unconditional grants designed to ensure that basic minimum supplies can be provided and sustained as well as to underpin the regulatory functions of DWS; while external transfers (such as foreign aid) are not significant in a South African context.

Increasing the tariffs of commercial and industrial users is an option that is used in a number of countries. But there is a limit to revenue that can be raised from that source since:

- i. these users represent only a portion of consumption;
- ii. if increases are significant, they may simply be incentivised to introduce internal efficiency measures that reduce their consumption; and
- iii. this would be counter to the general policy of seeking to reduce the cost of doing business to promote economic activity.

Another option would be to take actions to increase payment for water that is metered and billed but not paid (and which is reported to account for a significant proportion of municipal debt). But that is likely to be politically unacceptable, not least because the users concerned may simply not be able to pay and there are limited sanctions that can be applied since water supply to domestic users cannot be cut off.

In these circumstances, the most effective approach is thus likely to be to reduce costs. A number of, sometimes related, approaches are available for this:-

- Reduce physical water losses
- Reduce unauthorised use of water
- Mobilise communities to give direct support to water security related initiatives
- Greater operational efficiencies (in staffing and use of resources such as energy)
- Greater focus on investment efficiency both inside and outside the GCR (avoiding unnecessarily expensive projects and ensuring efficient implementation of those that proceed).

All institutions in the water sector will need to reflect on the strategies that they can adopt to reduce the cost of water services which still achieving water security. As a start, greater attention must be given to monitoring and reporting water use, billing and collection rates at a user level.

Given the high proportion of domestic users that do not pay for their services, and the Constitutional obligation to ensure that all people have access to a basic minimum supply, it is necessary to review the current approach to 'free basic water'. At present, according to StatsSA surveys, a substantial proportion of households continue to benefit from *de facto* free water. However, this is sometimes done in a manner that creates a substantial debt problem for the entire water sector when households are billed but do not pay.

The classification of households as 'indigent' will not resolve the problem, since it is likely to be challenged unless it can be demonstrated that it does not exclude households that cannot otherwise access adequate water supplies. A mechanism is required that is seen to be just and equitable but that is also affordable to both households and water providers. A reversion to general free basic water, linked to the enforcement of payment for water used beyond the free allowance, might achieve this since it would give legitimacy to levy higher charges on large users as well as to restrict supplies to users who take more than a basic amount but do not pay for it. Such a measure would also contribute to preparation for potential drought restrictions since, at present, there is no credible mechanism to restrict individual usage in a large proportion of households.

Finally, since the inter-governmental grants process sets policy approaches as well as providing financial transfers, it is important to liaise with NT, COGTA and DWS to review the structures and conditions associated with conditional grants made under the Division of Revenue Act. The aim must be to ensure that these grants are designed to support actions that promote effective and efficient management of water supply services and the achievement of water security.

6.7.2 Addressing institutional weaknesses

Many of the institutional problems in the water sector mirror those in the public sector more broadly. There are obvious inefficiencies and service deficiencies as well as frank corruption that should be resolved in the normal course of operational management or through political intervention at a higher level. However, there are also a set of sector specific responses that emerge from this review. Many of these relate to i) coordination; and ii) prioritisation.

Many of the actions identified require strong **coordination** mechanisms to ensure that oversight of impending risks is maintained and effective responses are timeously identified and implemented. Some of the activities, notably those that involve municipalities, should be coordinated at a provincial level. Others must be coordinated at the level of the wider IVRS, in cooperation with national

government as well as affected local institutions. A final set of activities require structured interactions with key units of national government.

Existing cooperative governance structures, notably the Premier's Coordinating Forum, provide an appropriate overall structure for provincial level coordination with municipalities and other local organisations. To support the Premier's Office, it would be appropriate, to task the Provincial COGTA with operational responsibilities for provincial coordination. Given the scale of the risks facing the province to associate many of the water security coordination activities with the Provincial Disaster Management function which lies in the COGTA department. This would support a policy approach that focuses on risk reduction rather than just risk response. The involvement of disaster management structures will also ensure that they are well prepared should their more active intervention be required. More generally, COGTA can take advantage of its oversight responsibilities for the municipalities that are key players in water security to ensure effective promotion of the water security agenda.

Provincial coordination with national government should initially be discussed within the framework of the President's Coordinating Council. However, given the specialised nature of the issues to be raised, specific coordination arrangements will have to be established with DWS.

These will have to address the need to maintain and strengthen existing IVRS operations and planning forums, with clear formal mandates and adequate human and financial resources. The existing arrangements currently enable municipalities and other major stakeholders such as Eskom, Sasol and agricultural organisations, to participate. These institutions offer additional information and perspectives to the deliberations as well as providing technical resources.

There should also be a discussion with the Minister of Water and Sanitation about the proposed establishment of a Catchment Management Agency for the Vaal. As presently proposed, this would address an area that excludes much of the Gauteng Province and, more seriously, would separate the water resource managers from the majority of water users, their information and resources. This will undermine the objective of decentralising water resource management activities and replicate the dysfunctional Western Cape arrangement which contributed to the delayed crisis response. GPG should request a review of the boundaries to ensure that the future CMA would create a formal organisation to which water resource management responsibilities could be delegated and which would enable major stakeholders to participate.

With respect to **prioritisation**, this must reflect the long time frames that are typical of the water sector and focus on interventions that are both urgent and important. These are identified in the Action Plan that follows. It should be noted however that, throughout this analysis, the availability of relevant information and its communication to relevant parties has arisen as a key determinant of the effectiveness (or otherwise) of management for water security. This is a key area for action.

6.8 Research and innovation

The wide range of responses required to achieve water security presents many challenges that cannot be addressed by a business as usual approach and will require innovation as well as effective implementation. South Africa has a long history of water research and a well-developed research infrastructure although capacity constraints are emerging. However, there is evidence that research outputs are not being taken up. This suggests that it does not always address the sector's current priorities but also that water sector institutions have limited capacity to introduce innovations – the

failure to achieve wider adoption of water-saving sanitation technologies is an often-cited case. A more systematic approach is required to ensure that research efforts complement and support implementation of this Action Plan as well as the development and application of the innovations required.

The research community includes the Water Research Commission (WRC), the Council for Scientific and Industrial Research (CSIR), specialised institutions such as the Agricultural Research Council, MINTEK and local Universities. While many of these have water-related research programmes, the coordination between them and water users has been weakened as a consequence of reduced involvement by organised and informed water user sectors.



7 ACTION AREAS FOR KEY STAKEHOLDERS

This section has been prepared to ensure that each set of institutions knows what it is responsible for and what immediate actions should be taken. In some cases, responsibilities are already clear (the operational water services functions of designated municipalities for water services, for instance). In other cases, the potential role of an institution needs to be identified and confirmed. Thus, GPG COGTA's disaster management function should play an important coordinating role given that its mandate is to support disaster risk reduction and ensure disaster preparedness.

A broader challenge arises when coordinated action is required between several institutions, many instances of which are identified here. For this reason, a critical issue will be to identify and agree on which institutions should work together and how they should be coordinated. It is also necessary to make the best possible use of limited institutional, technical and financial resources. Therefore, the most important immediate action will be to convene a working Provincial Water Summit at which these issues can be resolved and roles and responsibilities confirmed.

Hence, this action plan is not yet exhaustive or definitive. It proposes a set of immediate actions that must give rise to a more structured and prioritised programme and aims to provide all concerned with a focus for discussion and decisions.

7.1 Gauteng Provincial Government

Gauteng provincial government will:

- Through the PCF, establish formal engagement with DWS and
 - Formalise the participation of GPG and municipalities in DWS's regular IVRS planning and operations fora.
 - Ensure that monitoring, operational and planning activities are strengthened and intensified through engagement with the national DWS and that there is active participation of GPG and Gauteng municipalities in all relevant planning and operational processes
 - Ensure that the IVRS model is updated and that DWS is adequately resourced to manage it and to convene the associated planning and operational fora.
 - Liaise with DWS to ensure that LHWP phase 2B is not further delayed
 - Encourage DWS to initiate discussions with the Lesotho Government with a view to changing the operating rules for Katse and Mohale Dams to reduce evaporation losses and unnecessary spills of surplus water from the IVRS.
- With DWS,
 - convene TCTA, water utilities, notably ERWAT and metropolitan municipalities to assess water quality interventions to optimise supply augmentation, cost efficiency and environmental impact
 - Review current water quality status in the IVRS and update water resource quality models
 - Review existing proposals to identify most cost-effective strategy to diversify the water supply mix and improve water quality, considering potential:
 - Reuse of wastewater effluent
 - Further treatment of AMD
 - Ground water storage and usage
 - Develop and implement a wastewater reuse programme.
 - Insist that DWS reinstate the Blue-, Green- and No- Drop monitoring immediately and publish results expeditiously, with full details for each municipality
 - Cooperate with DWS to support Rand Water in the promotion of Project 1600 to establish water allocation ceilings for individual municipalities
 - Review the Water Services tariff guidelines to ensure that they can provide for approaches that will sustain services during long periods of restriction
 - Propose the establishment of a CMA designed to cover the Vaal and surrounding areas supported by the IVRS to enable decentralisation of key water resource management activities and provide a forum where there can be a structured and focused involvement of major water users and related stakeholders in the development of strategy and systems operation.

- With NT, COGTA and DWS,
 - Promote a review of DORA grant structures with incentives to encourage action that supports effective and efficient management of water supply services.
- With municipalities
 - Monitor the state of readiness of water services institutions, especially municipalities, to manage a drought
 - Undertake a review of tariff approaches under restriction to ensure consistency and coherence across the Province as well as financial sustainability
 - Support Rand Water's Project 1600 to establish and manage processes to allocate available water from the IVRS between municipalities and other bulk water users and to operate within that constraint
 - With DWS, set NRW reduction targets for all water services providers and support their achievement
 - Set up a demand management learning forum for municipalities.
- With regional utilities (Rand Water, Magalies Water and ERWAT)
 - Ensure active participation in the GPG's programme of action
 - Promote Project 1600 in collaboration with DWS, GPG and municipalities
 - Strengthen contingency planning to cover future drought management challenges
 - Undertake a risk review to ensure that adequate measures are in place to address failures of major infrastructure, including a review of governance, capacity as well as technical backup arrangements and contingency plans
 - Provide regular public information about water availability, water use and water quality issues in their operational areas
 - Develop a coordinated approach to water reuse.

7.2 Municipalities

Municipalities will:

- Ensure that their water services functions are staffed with appropriately qualified and experienced personnel and that staffing and institutional development processes support this since both short term resilience and long term sustainability depend on adequately resourced planning, development, operations and maintenance functions.
- Take steps to reduce all (domestic, industrial commercial, institutions) users' demand
 - Prepare, fund and implement a plan for WCWDM, with clear operational targets, to reduce per capita consumption
 - Participate actively in Blue, Green, No-Drop and other related reporting initiatives.
 - Encourage and support households to support their municipal service providers through reporting leaks and preventing damage to infrastructure through vandalism and theft

- Ensure that the municipality has contingency plans and backup arrangements to address possible failures of major infrastructure
- Review cost recovery and debt collection processes, enforce what is deemed as recoverable and identify the remainder as unrecoverable
- Prepare operational processes to enable supply restrictions to be imposed and enforced in the case of drought – i.e. drought and disaster management plans (including floods)
 - Review tariff structures to ensure adequate municipal revenue under drought conditions, including consideration of a fixed charge to be levied during restrictions
 - Review free basic water approach to ensure that drought restrictions do not affect access to water for the poor
- Introduce urban planning approaches that consider water security and design the city for a water secure future to ensure long-term sustainability
- Consider with DWS, Rand Water and ERWAT opportunities for large scale water re-use
- Improve wastewater treatment O&M, water quality protection etc. (through stormwater control, sewer maintenance and environmental health inspections).
- Continue to focus on rolling out water services to the households who do not yet have reliable access to water services

7.3 Public institutions, businesses and developers

- Major water users should participate at a strategic level in water security programmes as part of their core business since their operations will be impacted on by water supply failures.

Public and private institutions should

- Ensure that their new developments are water efficient and contribute to sound, water sensitive urban planning
- Monitor their water use and trends and seek to achieve and sustain reduced water use
- Establish procedures to inspect, monitor and maintain in-house water-using appliances
- Prepare plans to comply with water restrictions, should they be introduced
- Monitor their wastewater production and discharges and ensure that they are managed in accordance with relevant regulations
- Support water security initiatives with communities beyond their boundary fence.
- Manage their operations responsibly and
 - Avoid disposing of inappropriate materials in sewers and stormwater drains or allowing waste materials to be dumped where environmental harm may be caused
 - Ensure that stormwater does not enter wastewater sewers.
- Commercial developers should recognise the important contribution that they can make to water security and review their operations regularly, at Board level, to ensure that they are
 - cooperating with development planning processes,

- complying with policies and regulations and
- report corruption where it may undermine water sensitive planning and development and the achievement of water security.

7.4 Households and communities

Households and communities should:

- Recognise that all the region's citizens are custodians of its water
- As responsible citizens, work with ward councillors and other municipal structures
- Report leaks and damage to infrastructure through vandalism and theft
- Understand their own water consumption patterns and know where water savings can be achieved
- Use systems properly
 - Install water savings devices in existing dwellings
 - Fit new buildings and houses with dual flush and low flow fittings
 - Do not dump inappropriate materials in sewers and stormwater drains
 - Ensure that stormwater does not enter household wastewater drains.

7.5 Civil Society and media

Civil Society and media should:

- Develop an understanding of the key issues to act effectively and strategically in support of water security. To this end, training and briefing sessions will be organised by Gauteng Provincial Government so that civil society and media can:-
 - Inform the public about the growing water security challenges faced by the Province and responses needed
 - Mobilise communities to take local action to improve water supply and sanitation services
 - Support and monitor progress in provincial and municipal water management campaigns
 - Promote greater citizen involvement in the planning and oversight of water services and encourage innovation
 - Play a watchdog role and 'blow the whistle' on activities of both the public and private sector that could undermine the GPG's water security.

7.6 Research community

The research community should develop:

- A detailed agenda of research and development priorities to support this plan. The immediate focus should be a review of the information required to develop of a water quality strategy for the Vaal catchment.
- Analyse water distribution and consumption data to better understand trends in household water use and where water efficiencies and inefficiencies exist.
- Further developed and updated system operating models to ensure early warning of emerging climate change trends as well as providing better modelling of water demands.

8 COMMUNICATION AND STAKEHOLDER ENGAGEMENT

The Water Security Perspective for the GCR is just one, small, initial step towards achieving a water secure future for the people of the Province. The water security of Gauteng depends on a number of different organisations playing their role. Water security will only be achieved if all sectors of society are mobilised around a common, long-term, vision. This will require sustained, strategic communication guided by a team of senior practitioners who have a good understanding of the aims, objectives and strategies that are being adopted, the sensitivities and risks that must be managed and access to multiple channels of communications that can reach the many parties that are involved and affected. Communications should be an integral part of all the proposed actions, not a separate activity. f

In the short term, given the importance of stakeholder inputs and engagement, it is imperative to effectively communicate to the various role-players and to keep the issue of water security high on the public and institutional agendas. The initial communication must reach targeted stakeholders and role-players to ensure that they give their input and take ownership of a water plan and then support the achievement of its outcomes.

In the longer-term, as the Perspective is developed and implemented, the communication requirements will be developed for individual actions and role-players. It will still be necessary, however, to maintain coordination and to ensure that the strategic messages are continually reinforced and updated and that information is regularly shared amongst all those concerned. Communications must thus remain on the agenda for the overall coordinators of the Action Plan.

Continuous stakeholder engagement and communication forms an integral part of implementation with the aim to:

- Build ownership and buy-in of both the process and outcomes of the Water Security Plan to ensure that stakeholders can relate and support the implementation of the Plan;
- Build capacity and a common understanding of key issues ensures that the necessary skills and capacities are shared between and among stakeholders and supports strategic collaborative efforts; and
- Create awareness and enhance the level of understanding on issues about Water Security to improve and strengthen active stakeholders' participation.
- Develop an understanding of the long-term objectives and establish a process that will engage the broad community in following and supporting its progress.

8.1 Target Audience

The perspective itself is a key communication tool as well as a strategic guide. Understanding the range of stakeholders and developing appropriate messages/communication is important. The stakeholder groups will primarily fall into two categories:

Internal to Gauteng Provincial/Local Government - The purpose of targeting members within the Provincial Department is to ensure that there is holistic preparation of staff at Provincial, Local or catchment levels. These staff have a range of interests that function at differing strategic levels within the Province and as such have different capacity building requirements.

External to Gauteng Provincial/Local Government - There are a range of stakeholders that are interested and affected by the Water Security Plan, due to the inter-connectedness of the Vaal System. These include the private sector, research and academia, civil society including NGOs, other national and provincial government departments, River Basin Organisations (RBOs), umbrella organisations such as the South African Local Government Association (SALGA), the Chemical and Allied Industries Association (CAIA), Business Unity South Africa (BUSA), AgriSA, the Chamber of Mines, among others. The purpose of targeting these stakeholders is to solicit their input, create awareness and guide external stakeholders on Water Security issues, strengthen the understanding of the Water Security Perspective and its implications, and strengthen collaborative systems. Moreover, it is important for successful implementation that external stakeholders become more engaged.

8.2 Issues to communicate

This section gives the key messages that need to be communicated upon finalisation of the Water Security Plan:

- Place water security in context of broader socio-economic and environmental development goals.
- Alert users that their water security will be at risk in the event of a drought and that it is therefore critical that all water providers and users should prepare for this contingency.
- Outline the action plan to ensure a water safe Gauteng, emphasising the importance of early restrictions to manage water risk.
- Describe the complexity and integration of the IVRS system and publish its key indicators widely and regularly.
- Describe the roles and responsibilities for different stakeholders/institutions in executing the Plan, such as :-
 - National Government to develop and operate IVRS system.
 - Provincial government to prepare responses to potential shortage and disasters.
 - Water Boards to provide bulk services reliably, effectively and efficiently.
 - Municipalities to manage their systems effectively, efficiently and sustainably.
 - Households to actively engage with the Government (National, Provincial and Local) through the appropriate forums to build their capacity and be kept abreast of any updated. In addition, Households can improve their water use efficiency and prepare for supply restrictions
 - Public Institutions to audit and improve their water use efficiency
 - Academia and Research Institutions to guide on Best Practical Environment Option
 - Businesses and industries to audit and improve their water use efficiency

A key consideration around communication is to be cognisant of the appropriate mechanisms for communication and publicising of the Water Security Plan, to ensure is accessibility to stakeholders.

The use of existing platforms, such as Gauteng Provincial/Local Government websites, intra-nets, catchment/municipal forums, amongst others.

Appendix A: Dams in the IVRS

Dam	River	FSC
Bloemhof	Vaal	1243.0
Grootdraai	Vaal	349.6
Heyshope	Assegaai	445.0
Jericho	Mpama	59.3
Katse	Malibamatso	1519.2
Mohale	Senqunyane	843.6
Morgenstond	Ngwempisi	100.0
Nooitgedacht	Inkomati	78.4
Sterkfontein	Nuwejaarspruit	2617.0
Vaal	Vaal	2603.5
Vygeboom	Inkomati	78.1
Westoe	uSuthu	60.1
Woodstock	uThukela	373.3
Zaaihoek	Slang	184.7
TOTAL STORAGE		10554

Main dams in the Integrated Vaal River System

(FSC = full supply capacity in million cubic meters Mm³)