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WATER AND SANITATION SUSTAINABILITY IN SOUTH AFRICA: PAST, PRESENT, AND FUTURE

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About this publication

This policy paper reviews the status quo in the water and sanitation sector in South Africa. It forms part of a series of papers aimed at providing a barometer of South Africa's transition to sustainable development. It is a component of a global initiative spearheaded by the Green Economy Coalition (GEC).

The GEC is the largest global alliance of organisations working on a green economy. The membership spans Asia, Africa, South America, North America and Europe and represents a wide range of interests including the poorest, the environment, business, the United Nations, research and government. Despite its diversity, the coalition is committed to accelerating the transition to green and fair economies. In South Africa, Trade & Industrial Policy Strategies (TIPS) and the African Centre for a Green Economy (AfriCGE) are active members of the coalition.

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Key findings

- The water gap is widening. Low water availability is being worsened by pollution and extreme events associated with climate change. Water demand is also set to increase due to growth in activities that demand water, inefficient usage, wastage, leakage, and unsuitable infrastructure.
- The country has made significant progress in the provision of water services, however, more work still needs to be done to cover backlogs while maintaining reliable and quality services.
- Besides the important milestones that have been made in the water sector, poor governance-related factors are cited as some of the factors constraining the sector. If there is poor governance, many other challenges then also manifest.
- There is an extensive and well-developed network of infrastructure, however, some of the infrastructure is deteriorating due to poor operation and maintenance.
- Although significant financial resources are being dedicated to the water sector, these are inadequate.

Key recommendations

- **All stakeholders** need to be more proactive in addressing the water gap. The strategy should be three-pronged: enhancing supply; boasting the productivity of water use; and demand management. In the short term, more effort should be directed at the low hanging fruit of reducing demand and improving efficiency.
- There is need for renewed effort to **address service backlogs.** More resources are required as those without services (e.g. in informal settlements and rural areas) are likely to fall in the indigent category, which implies that the government will have to provide for them.
- **The country is generally noted for having good legislation,** and this should be accompanied by proper implementation, regulation, and enforcement.
- **There is need for effective asset management that is proactive rather than reactive**. It should take care of both old and new infrastructure. In addition, people tasked with the planning and implementation of infrastructural projects should avoid taking shortcuts as this often result in substandard infrastructure, whose lifespan become even shorter.
- Finding ways to **bridge the shortage of skills**, particularly in municipalities, is needed.
- **Eradicating non-revenue water** will greatly contribute to improving the financial position of municipalities. Above all, the available financial resources need to used effectively and efficiently.
- **The government needs to forge synergistic partnerships** with other key players, in particular the private sector, as well as external support agencies. There should be clear incentives for the private sector to participate in the water sector, while at the same time ensuring that socioeconomic objectives of equality and rights to basic services of people are not compromised.

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Abbreviations

AWS	Alliance for Water Stewardship
BAAM	Business Adopt-a-Municipality
CARL	Current Annual Real Losses
CCPS	Centre for Cooperation with the Private Sector
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DPP	Development Partnership with the Private Sector (GIZ)
dti (the)	Department of Trade and Industry
DWS	Department of Water and Sanitation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GWI	Global Water Intelligence
IAPs	Invasive Alien Plants
ILI	Infrastructure Leakage Index
IWaSP	International Water Stewardship Programme
MDGs	Millennium Development Goals
Metro	Metropolitan Municipality
MIIF	Municipal Infrastructure Investment Framework
NBI	National Business Initiative
NRW	Non-revenue water
OPEX	Operating Expenditure
PICC	Presidential Infrastructure Coordinating Commission
PPP	Public-Private Partnerships
SDGs	Sustainable Development Goals
SIP	Strategic Integrated Project
Stats SA	Statistics South Africa
SWPN	Strategic Water Partners Network
WCWDM	Water Conservation and Water Demand Management
WHO	World Health Organization
WRC	Water Research Commission
WSA	Water Services Authority
WTWs	Water treatment works
WUAs	Water User Associations
WfW	Working for Water
WWF	WorldWide Fund for Nature
WWTW	Wastewater treatment works

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Introduction

We have a single opportunity to change the narrative on water by acting timeously in pursuit of a more promising future, in a better world, which should never face the scenario of the last single drop of water, in our lifetime and for generations to come.

President Cyril Ramaphosa – United Nations and World Bank, 2018.

The importance of water for socioeconomic development cannot be understated. Water is an essential component in people's livelihoods, in production activities as well as in the functioning of ecosystems. The centrality of water is recognised, especially with the growing acknowledgement of the water, food and energy nexus. Water provision and accessibility issues have been topical for some time. At the global level, their inclusion in the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs) is testament to this.

Broadly, water can be viewed from three important spheres: first, clean water is necessary for human health and survival; second water is crucial for the maintenance of ecosystems; and third, water is needed for socioeconomic, industrial and production activities, such as agriculture and manufacturing. Many other services are also enabled by the availability of water. Given this importance, it is necessary to explore cross-cutting issues that relate to water from a sustainability angle.

This policy paper provides a barometer of the country's transition to sustainable development, paying special attention to water, as well as its Siamese twin "sanitation". It has three main themes, namely: the water gap; household water and sanitation access; and governance and funding issues in the sector. The structure of the policy paper is as follows. Each theme starts with a brief introduction and motivation; then a diagnostic on the current state of affairs in the country on that particular theme; and then recommendations for that particular theme. This is followed by an overall conclusion.

2 The water gap

Water security challenges in the country are immense and are becoming more glaring. In this context, the water gap manifests as a result of the interaction between high demand for water on the one hand, while on the other, there is relatively low water availability. At the national level, this gap is projected to grow if no appropriate measures are implemented (DBSA, 2012).

2.1. Diagnostic: Zooming in on water supply and demand

The water situation has been described as precarious (the dti, 2017) and a looming water crisis (DWS, 2017b).There is, however, no single water problem, and the issues in the sector vary widely from place to place (Muller, 2019). Multiple factors entail both demand-side and supply-side issues. The National Water and Sanitation Master Plan (DWS, 2018a) attributes this to insufficient water infrastructure maintenance and investment, recurrent droughts driven by climatic variation, inequities in access to water and sanitation, deteriorating water quality, and a lack of skilled water engineers. In some parts of the country, the water gap is already evident, with demand far outpacing supply. The country needs to act urgently to limit demand for water and find ways of increasing supply (ActionAid, 2016). The diagnostic reviews each of these, starting with the supply-side issues, then the demand-side ones.

Supply side – water availability challenges

South Africa is susceptible to water limitations due to natural as well man-made challenges. The country is ranked as the 30th driest country in the world, with average annual precipitation of 450 mm that is well below the world average of 860 mm (Bekker, 2016; DWS, 2015b; 2015c; 2018a). The country is not only water scarce, there is extreme rainfall fluctuation and variability across the country – from less than 100 mm per annum in the west to more than 1500 mm per annum in the east (DWS, 2015c). The country's water is mostly derived from four main rivers (shared with other countries), namely the Limpopo, Inkomati, Pongola

(Maputo) and Orange (Senqu) Rivers. These rivers drain about 60% of the country's land area and contribute to about 40% of its total surface river flow (DBSA, 2012).

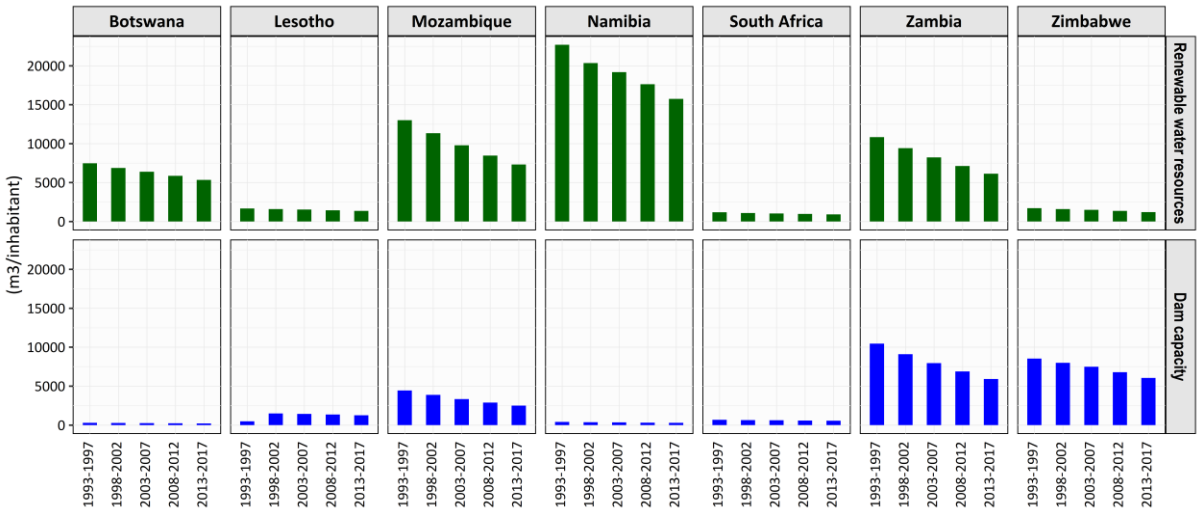
Water availability is negatively affected by a variety of factors, including low rainfall and the associated droughts, degradation of water sources, poor land use practices, water pollution, erratic runoff, evaporation losses, shallow dam basins, siltation, and deteriorating infrastructure. These factors also affect the health of rivers, which in turn lowers the quantity and quality of water available.

Water pollution is a growing challenge that limits water supply and quality, with negative implications on the cost of supply and the health of ecosystems. Water pollution is due to both natural and anthropogenic processes (DWS, 2015b). Natural processes, for instance, can include the release of dissolved salts from host rocks in certain areas, such as Namaqualand in the Northern Cape. Anthropogenic sources of water pollution entail mining activity, urban development, industries, and agriculture (the dti 2017). The pollutants vary but include acidity and increased metals content, salinity, nutrients, emerging contaminants in personal care and medical products, microbiological, chemicals, toxins, sediment, and agro-chemicals.

Eutrophication, which results in excessive plant growth due to excessive nutrients and minerals in water bodies, is evident across the country. This exacerbates the negative impacts on water quality and aquatic ecosystems. It has been acknowledged that, despite special attention to deal with the problem in dams such as Haartebeespoort, Rietvlei and Roodekoppies, those strategies have not worked well as the problem continues unabated, with the Roodeplaat Dam moving from eutrophic to hypertrophic status (DWS, 2014a). This is also the case with the Vaal Dam, where there is significant pollution as the waste water treatment plants along its river system continuously malfunction (Khumalo, 2017).

Based on AQUASTAT data (FAO, 2016), Figure 1 shows that compared to other countries in Southern Africa, South Africa generally has low total renewable water resources and dam capacity per capita. In the period 1993-1997, South Africa had total renewable water resources per capita of 1 176m^3, which fell to around 905m^3 in 2013-2017. The dam capacity per capita in the country was 681m^3 in the period 1993-1997, and it declined to 547m^3 in 2013-2017. However, it is noteworthy to stress that the decline in total renewable water resources and dam capacity per capita is also happening across many other countries. The current scenario of declining water resources in the country and the region is not sustainable in the long term.

FIGURE 1: TOTAL RENEWABLE WATER RESOURCES AND DAM CAPACITY PER CAPITA IN SELECTED SOUTHERN AFRICAN COUNTRIES



SOURCE: AUTHOR BASED ON AQUASTAT DATA, FAO, 2016

Supply side – infrastructural development

Besides the extensive network of water and sanitation infrastructure, the provision of services is threatened by the continued deterioration of the infrastructure. South Africa has a substantial existing water and sanitation network valued at an estimated R1 362 billion in 2017 at capital replacement value (DWS, 2018a). The 2017 Infrastructure Report Card (SAICE, 2017) assessed the state of the infrastructure in the country. Generally, the infrastructure is not in good condition. For water infrastructure, the grades [1] were as follows: D for bulk water resources; C+ for supply in major urban areas; D for supply for all other areas. For sanitation, the grades were: C for major urban areas; and E for all other areas. At least 33% of the water services authorities (WSAs)[2] are regarded as dysfunctional, while more than 50% have no or very limited technical capacity (DWS, 2017b). About 56% of the more than 1 150 wastewater treatment works(WWTW) and about 44% of the 962 water treatment works (WTWs) are in poor or critical condition (DWS, 2017b). A large percentage of rural water treatment plants do not comply with required water quality standards (Deloitte, 2014). In addition, a number of dams in the country have structural instability (SAICE, 2017). The country's water infrastructure had, in 2012, a weighted average age of 39 years, which makes it liable to ageing effects associated with internal and external stresses (Creamer Media, 2012).

Rapid expansion of new infrastructure can result in a functionality gap. This happens when most of the resources are dedicated to constructing new infrastructure and less attention is paid to operation and maintenance, hence the infrastructure starts breaking down. The challenges of poor maintenance of infrastructure can be attributed partly to a lack of focus on sustainable asset management (DWS, 2015b). Municipalities do not have dedicated operation and maintenance programmes for their bulk water infrastructure, and their operation and maintenance tends to be reactive (DWS, 2015a). Maintenance is mostly done when there is a breakdown or problem.

Many municipalities lack the capacity to properly operate, maintain and manage the infrastructure. Some water supply schemes are not functional due

[1] The grading is based on a five-point scale (A to E). A indicates the infrastructure is world-class and capable of enduring pressure from unusual events, e.g. influx of more people or droughts. E indicates the infrastructure is in a state of disrepair or failure, exposing the public to possible health and safety hazards (SAICE, 2017).

[2] A WSA is a municipality that has been accorded responsibility to provide water services. Of the 257 municipalities in the country, only 144 are considered WSAs (DWS, 2017d).

to inadequate maintenance and operation budgets, ageing infrastructure, overutilisation of capacity, poor management and upkeep, and a lack of technical skills (Bekker, 2016; World Bank, 2011). There has been depletion of skilled personnel and officials at senior levels in the sector (SAICE, 2017). One of the key challenges relates to limited funding, with budgets and spending on maintenance, rehabilitation and expansion of infrastructure remaining inadequate. The funding mechanisms favour the building of new infrastructure rather than the operation and maintenance of the infrastructure already in place (DWS, 2017b). Some of the infrastructure is located in settings that do not have the financial capacity to meet the operation and maintenance needs. Indeed, smaller and rural municipalities have less capacity to operate and maintain infrastructure. The challenges with funding can be attributed partly to the fact that politicians who make decisions on the allocation of funds have little understanding of the importance of operation and maintenance, thus when budgets are tight, operations and maintenance bears the brunt (Infrastructure Dialogues, 2015).

With the recognition that some municipalities lack the necessary capacity, the Department of Water and Sanitation (DWS) has been providing funding and institutional support to such municipalities. For example, part of the water services infrastructure grant was allocated to 27 priority rural district municipalities to assist them in providing water from tankers, boreholes, standpipes and pipelines, and the refurbishment of water treatment works (NT, 2016). Some authors (e.g. Khumalo, 2017) have called on DWS to take over the day-to-day management of the infrastructure in some municipalities to prevent further deterioration.

Besides the lack of proper operation and maintenance, the breakdown of infrastructure can be attributed partly to civic disrespect. This includes theft, arson, vandalism, or wastage of resources (SAICE, 2017). On the one hand, there is vandalism related to service delivery protests. On the other hand, there is vandalism that is purely criminal, such as theft of metals like copper, aluminium and steel components, as well as illegal connections. News24 (2018) reported rampant theft and vandalism at aquifer drilling sites and other water infrastructure in Cape Town – anything perceived to have scrap value is targeted. The SABI Magazine (2017 p.3) reported that, when one resident was asked why a communal tap was left permanently open, the reply was ''water comes from government and will never get finished". Given this, there seems to be a general lack of understanding of who is or what is government, and its responsibilities, as well as the role that the public should play in safeguarding resources and infrastructure.

Equally important in the discussion on water sustainability is the immense contribution of ecological infrastructure to water security. As an illustration, while the Drakensberg mountain range occupies less than 5% of South Africa's total surface area, it produces 25% of the country's surface water runoff, with a supply reach that covers almost 60% of the country (Blignaut et al., 2008). Unfortunately, some of South Africa's ecological infrastructure is degraded (SANBI, 2014; DEA, 2011). There is a major problem of invasive alien plants (IAPs). The IAP infested area in the country doubled between the mid-1990s and 2007 (Driver et al., 2012). Furthermore, the extent of the country's main rivers in poor ecological condition increased by 500% between 1999 and 2011; at the same time the country has lost over 50% of its wetlands, and 48% of the remaining 3.2 million hectares are critically endangered (DWS, 2017b).

Besides these challenges, there are efforts directed at restoring and maintaining ecological infrastructure in the country. This includes steps towards implementation of the Strategic Integrated Project 19 (SIP 19), which focuses on ecological infrastructure to enhance water security[3] (PICC, 2014). The uMngeni Ecological Infrastructure Partnership in KwaZulu-Natal is also a notable example. Other efforts have seen the government together with other stakeholders directing resources towards the eradication of IAPs. figure 2 shows the extent of the land that was cleared of IAPs and the associated employment that was created in the working for water (WfW) programme from 2000/01 to 2009/10.

[3] Following the 2012 National Infrastructure Plan, the South African government established the Presidential Infrastructure Coordinating Commission (PICC). The PICC developed 19 SIPs to integrate and co-ordinate the country's long-term infrastructure build

FIGURE 2: LAND CLEARED OF IAPS AND THE NUMBER OF EMPLOYMENT BENEFICIARIES IN THE WFW PROGRAMME (2000/01 TO 2009/10)

SOURCE: AUTHOR BASED ON DWAF, 2017

A complementary effort to developing and maintaining ecological infrastructure is water stewardship. It involves "engaging those who do not hold a government mandate to manage water resources or water infrastructure and enabling them to contribute positively to water security" (Colvin et al., 2015). This concept is gaining traction in the country as businesses are looking beyond their "factory fences" and collaborating with other stakeholders to reduce the risk that water may have on their profitability and long-term viability (GreenCape, 2017). Non-governmental organisations, such as the International Water Stewardship Programme (see IWaSP, 2018), WWF South Africa, and Alliance for Water Stewardship (see AWS, n.d.) have been promoting water stewardship in the country (for some examples, see Table in the Appendix).However, it remains to be seen how such efforts will contribute to the restoration of ecological infrastructure and water security as it takes time to realise the outcomes.

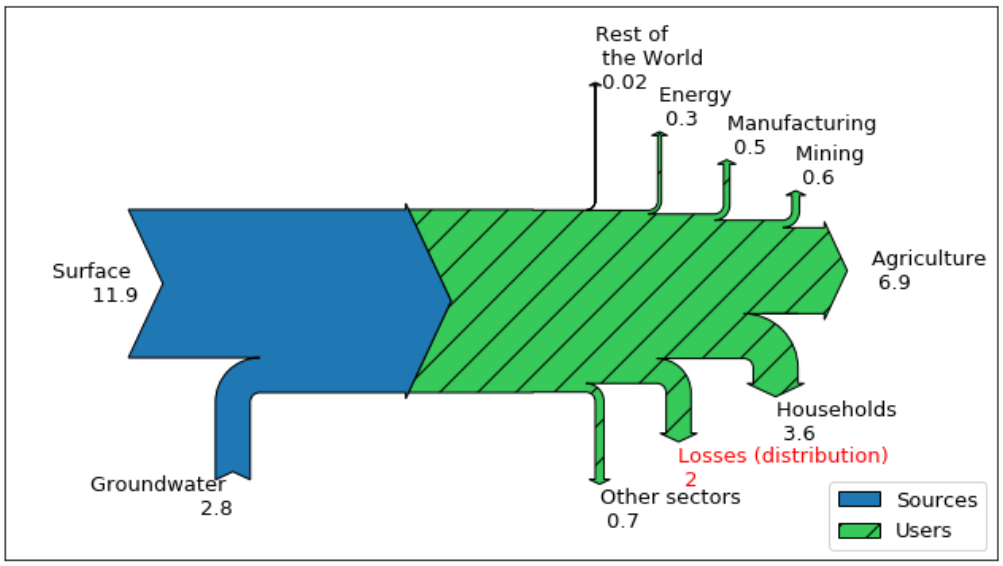
Water demand

Understanding water usage and demand can help give a better picture of the issues that need more attention. From the literature, there are variations in the estimated volumes of water use and demand. For instance, the Strategic Overview of the Water Sector in South Africa (DWS, 2017d) pegs the total water usage at 19.9 billion m^3/annum, with 17.1 billion m^3/annum being surface water usage, and groundwater being 2.8 billion m^3/annum. However, the National Water Accounts for South Africa (Maila et al., 2018) pegs the country's total water usage in 2016 at 14.7 billion m^3/annum, with surface water being 11.9 billion m^3/annum, while groundwater was 2.8 billion m^3/annum.

The volumes of water usage across different sector also varies. The Strategic Overview of the Water Sector in South Africa(DWS, 2017d, p.9) splits the total water usage of 19.9 billion m^3/annum as follows: agriculture (55%), industry (18%), municipalities (17%), mining (5%), and afforestation (5%). The National Water Accounts (Maila et al., 2018) splits the total water usage of 14.7 m^3/annum as shown in **figure 3**. This breakdown shows that agriculture (47%) is still

the highest, followed by households (24%), other sectors (5%), mining (4%), manufacturing (3%), and energy (2%). The estimated water losses through distribution systems were 2.0 billion m^3/annum (14%). Overall, Maila et al. (2018) estimated the total net water use at 9.9 billion m^3/annum, with 4.8 billion m^3/annum of the total water usage being returned to the environment. The breakdown of the return flows is as follows: waste water treatment works (1.8 billion m^3/annum), agriculture (0.7 billion m^3/annum), mining (0.3 billion m^3/annum), and the water losses through distribution systems (2.0 billion m^3/annum) (Maila et al., 2018).

FIGURE 3: VOLUME OF WATER FROM SOURCES TO USERS (BILLION M3/ANNUM) IN SOUTH AFRICA (2016)



SOURCE: AUTHOR BASED ON MAILA ET AL., 2018P. VII

Overall, the country has a high gross average water consumption of 237 litres per person per day, compared to the world average of 173 litres per person per day (DWS, 2015c; 2017b). Unfortunately, while water consumption is above the world average, the country's annual rainfall is below the world average (Bekker, 2016; Hemson, 2016). This shows the need for serious action to close the water gap, and promote sustainability in the sector.

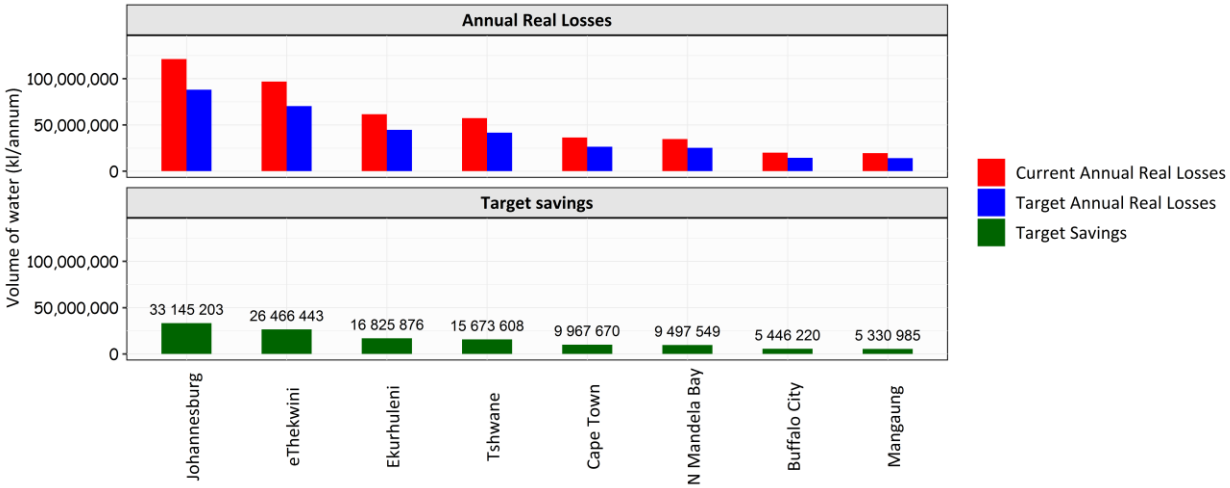
Non-revenue water

Non-revenue water (NRW) is the volume of water supplied by a water utility for which it receives no income. This can occur due to commercial losses or physical leakage. Aged and leaking infrastructure contributes to high NRW (Venktess, 2018).

Physical losses imply that the water does not get to the users, it just goes to waste. The National Water Accounts (Maila et al., 2018) indicate that about 2.6 billion m^3/annum (13.6%) of all distributed water in the country could be classified as non-revenue water, comprising of water losses, own use by water authorities or unaccounted-for water. The No Drop report (DWS, 2015a) shows that the total volume of NRW from the country's metropolitan municipalities was 923.5 million m^3/annum, with the average NRW per metro at 34.5%. If translated to monetary value, assuming an average of R 6.00 a kilolitre (kl) purchasing cost, these losses equate to about R5.5 billion per annum (DWS, 2015a). The average Infrastructure Leakage Index, an indication of the current physical losses versus the expected physical losses, was 5.4 for all metros – meaning that the current leakage in the system is 5.4 times the expected minimum leakage.

Figure 4 hows the annual real losses and target savings for water in the metros. The current annual real losses (CARL) are extremely high, for instance, Johannesburg had CARL of 121 million kl/annum, followed by eThekwini with 97 million kl/annum. If metros were to succeed in implementing their water conservation and water demand management (WCWDM) programmes, it could result in substantial water savings particularly in large metros, namely Johannesburg, eThekwini, Ekurhuleni, and Tshwane.

FIGURE 4: ANNUAL REAL LOSSES AND TARGET SAVINGS OF WATER IN SOUTH AFRICAN METROPOLITAN MUNICIPALITIES



SOURCE: AUTHOR BASED ON DWS, 2015A, P.49

Besides the challenge of physical losses, water use tends to be wasteful and inefficient. The wastage is rampant across both poor and rich users, which can be partly attributed to the long history of underpricing of the services (SAICE, 2017). In particular, there is a lot of inefficiency in water usage in the agricultural sector; its water consumption is mostly unmetered, there are cases of unauthorised abstraction, and the sector pays lower tariffs compared to other users – hence less incentive to adopt water efficient irrigation practices (DWS, 2017b). The National Water and Sanitation Master Plan (DWS, 2018a) highlights that average water loss in 59 out of 78 large government irrigation schemes is around 27%. This is well above the unavoidable seepage and evaporation losses in concrete canals, which are about 12% of the total loss.

Without effective metering and billing, water consumption in urban and rural areas will continue to rise (DWS, 2015c). Van der Westhuizen (2008) warned that failure to manage water resources could possibly result in future water "loadshedding". For example, in early 2018, Cape Town was on the verge of the much anticipated "Day Zero", and serious water restrictions had to be imposed to conserve the limited available water in reservoirs.

One of the key challenges associated with NRW is that a number of water consumers are not paying for the services they receive. Non-payment for water services is a threat to increased water

service coverage that has been achieved (Bekker, 2016). In this context, the policy of providing free basic water has been attributed to increased reticulation losses (DST, 2007); the "free for all" approach overloads systems and leads to supply failures (SAICE, 2017).Some users do not appreciate the value of water, and there is a tendency to think that all services should be free, with implication on payment for services. Non-payment can be due to two main reasons. On the one hand, it relates to affordability issues as some customers are poor and not able to pay for the service. About 77% of rural households in the country are indigent and as such do not currently pay for municipal services (DWS, 2017b). On the other hand, there are consumers who have the ability to pay for the services but are not willing to pay or have found a loophole in the system that allows them to benefit without paying for the service. The latter are a real concern if sustainable water provision is to be achieved because in one way or another someone has to pay if the service is to be provided.

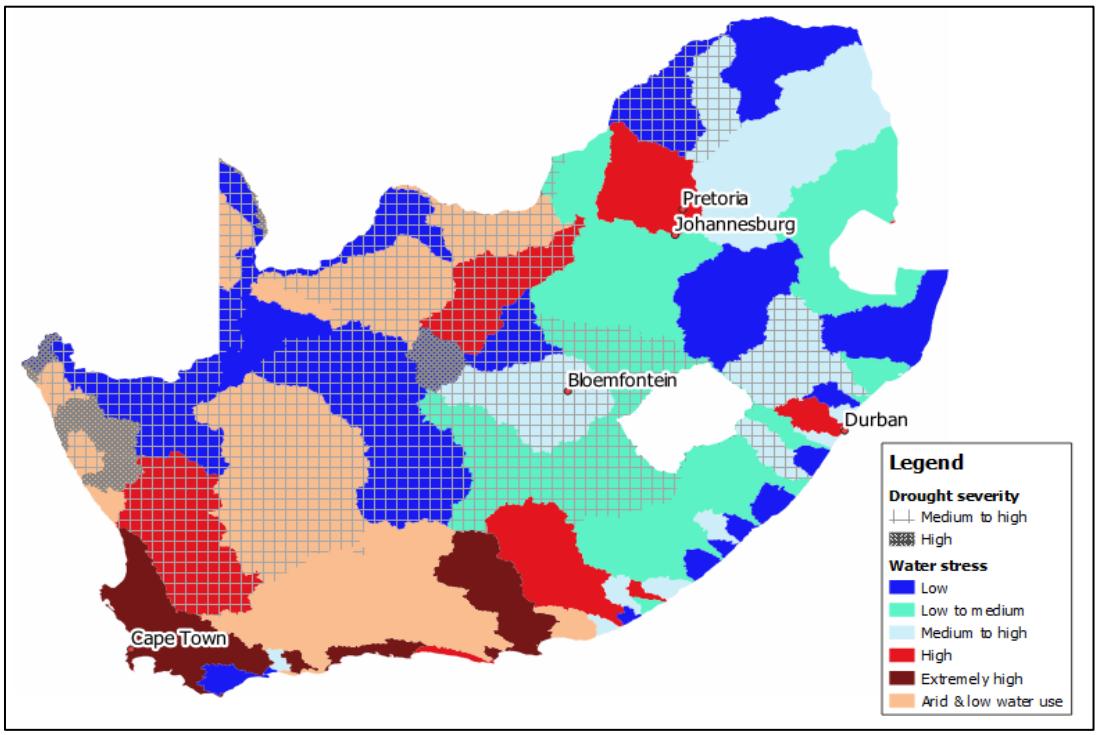
Water stress

The interplay between low water supply and high water demand contributes to the water gap. Demand-side factors that worsen the situation are overconsumption, inefficient use, wastage, leakage, inappropriate infrastructure choices (e.g. water-borne sanitation in arid areas), as well as population and economic growth (DWS, 2017b). By 2030, South Africa is projected to be demanding 17% more water than what is available; the net deficit between supply and demand could grow to between 2.7 and 3.8 billion m^3 (the dti, 2017; DWS, 2017b; WRC, DST and DWS, 2015; WRG, 2009). The Global Water Intelligence (GWI, 2017) projects an increase in total water withdrawals from 16.77 billion m^3/annum in 2015 to 19.18 billion m^3/annum in 2030.

The water stress[4] for South Africa is projected to worsen with time. Under the various scenarios, the water stress in the agricultural sector will be *high*, while for the domestic and industrial sectors, the water stress will be in the *medium to high* category (Luo, Young, and Reig, 2015). Compounding the water stress situation in the country is the general vulnerability to droughts. In this context, consistent droughts since 2014 have had a significant negative impact on water supply in South Africa (DWS, 2018b). Figure 5 shows the spatial extent of water stress and areas that tend to experience severe droughts.[5] Relatively high water stress is mostly concentrated in areas of high economic activity, in particular, major cities such as Pretoria, Johannesburg, Durban and Cape Town. In such areas, there is high demand for water to meet the various socioeconomic needs. Broadly, areas of relatively high drought severity tend to be in the middle half of the country stretching mostly from the west to the east as well as the upper part of the country.

[4]Water stress measures total annual water withdrawals (municipal, industrial and agricultural) expressed as a percentage of the total annual available blue water (Luo, Young, and Reig, 2015).
[5]Drought severity measures the average length of drought multiplied by the dryness of the droughts, from 1901 to 2008 (WRI, 2015).

FIGURE 5: PROJECTED WATER STRESS AND DROUGHT SEVERITY IN SOUTH AFRICA

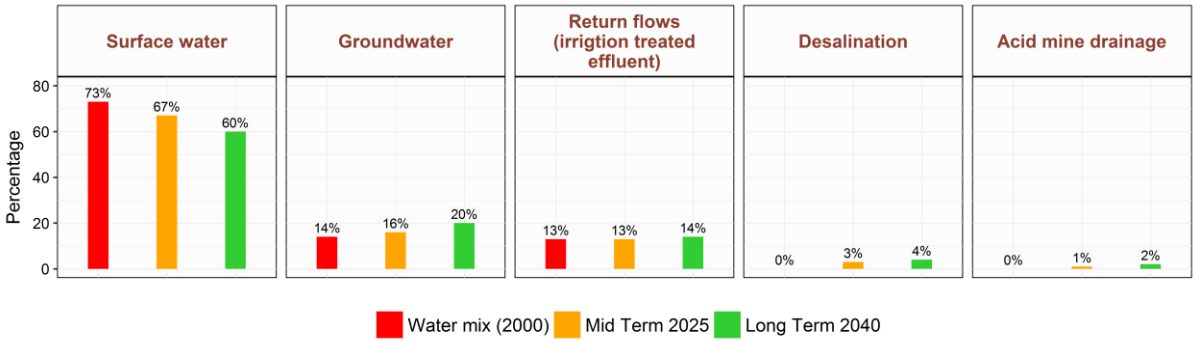


SOURCE: AUTHOR BASED ON DATA FROM WRI, 2015

The Global Risks Report 2016 ranks water crises as the third most impactful global risk, and ninth most likely to occur (WEF 2016a; 2016b). The forecasted water deficit for South Africa is projected to be worsened by climate change(DWS, 2017b; WWF-SA, 2017). Climate change predictions point to a drier western half of the country; while in the east, there will be far more variability and more extreme events (DWS, 2015c). This might translate into a dire situation, especially in those areas that are already prone to droughts and other extreme weather events. Not only will climate change impact on water availability through variations and changes in the amount of rainfall (with direct consequences on the quantity available), but there will be other potential impacts. These include flood damage to water infrastructure systems, which can affect supplies as well as contaminating water resources (DWS, 2016).

The projected water mix in the National Water and Sanitation Master Plan shows that the dependency on surface water will tend to fall with the increasing incorporation of new sources of water, in particular acid mine drainage and desalination (Figure 6). The diversification of water sources might help reduce the potential water stress in some areas. The current desalination capacity in South Africa is relatively small and mostly applied in the power, refining and chemical sectors (GWI, 2017). The largest desalination plant in South Africa supplies 15 million litres/day and is located at Mossel Bay; big metros such as eThekwini (Umgeni Water), Nelson Mandela Bay Municipality, and the City of Cape Town are at various stages of considering and implementing sea water desalination projects (DWS, 2017d). Though desalination is increasingly becoming popular as an alternative, its viability as a sustainable large-scale water option in South Africa has been called into question. This is particularly so because of the high costs associated with the technology. It is energy intensive and expensive from a capital and operational perspective (DWS, 2017d; Patel, 2018).

FIGURE 6: SOUTH AFRICA'S PROJECTED WATER MIX



SOURCE: AUTHOR BASED ON DWS, 2017B P.10

2.2. Recommendation

The water gap is real and the impacts will become more visible if no proactive remedial action is taken. The National Water and Sanitation Master Plan (DWS, 2018a) calls for the need to reduce water demand, and at the same time increase water supply. The WRG (2009) suggested three options to close the water supply-demand gap. First, holding all other things constant, the supply can be increased. Second, the productivity of water use can be enhanced, i.e. improved efficiency. Third, the demand for water can be reduced through change in water-using activities. From these, the option of increasing water supply (e.g. through desalination) seem to be less viable and more expensive. Wider adoption of water recycling and reuse will contribute immensely to augmenting water supply. As the country diversifies its water mix, there is need to adhere to proper standards to protect people's health. For example, the production and use of acid mine drainage needs to be carefully monitored as some sources can have high levels of uranium which, if consumed untreated, will have serious health implications (Hemson, 2016).

Given the high cost of some measures to increase supply, more effort should be directed at the low hanging fruit of reducing demand and improving efficiency. Increased efficiency in water usage implies more output for less amount of water. A paradigm shift from an engineered supply focus to demand management that acknowledges water scarcity is required (ActionAid, 2016; WWF-SA, 2015). While every sector needs to employ appropriate water conservation and demand management measures, it is necessary to pay more attention to water-intensive sectors and those that use a lot of water, especially the agricultural sector and the urban domestic sector.

The government has been instituting a number of programmes with the aim to reduce water losses, such as the War on Leaks, the No Drop programme, the Drop-the-Block campaign, and other WCWDM initiatives. Efforts to implement such programmes should continue, regardless of the relatively slow manifestation of positive outcomes. Processes that require behaviour change tend to be slow, as the majority of people take time to adjust and adopt. Social norms are difficult to change; however, once they are changed the impacts on the system will be significant and wide-ranging (De Hallgren and Root-Bernstein, 2018). There is a serious need to reduce NRW, and municipalities should positively embrace the fight against NRW. Water losses can actually be a great opportunity for municipalities to save water and create employment (WRC, 2014). For instance, reducing water losses in metros can generate additional income of about R2 billion annually through reduced water purchases and increased water sales (DWS, 2015a). The benefits

are notable as the strain on scarce water resources is reduced, while also allowing more resources to be available for maintenance and further investment (WHO, 2017). Water conservation and demand management is everyone's responsibility, and therefore should be promoted as such.

The National Water and Sanitation Master Plan (DWS, 2018a) acknowledges that water is severely underpriced and that cost recovery is not being achieved. Many municipalities sell water below what it costs them to supply it, thus can barely cover their operational costs (NBI, 2019b; Dikgang et al., 2017). Appropriate water pricing can be an important instrument in tackling challenges in the water sector. It can contribute to improving social equity, improving water use efficiency and ecological sustainability, and securing financial sustainability of water utilities and operators (Maila et al., 2018).

Implementing a sustainable asset management programme that is proactive in the maintenance of infrastructure rather than being reactive is needed. Monitoring, evaluation, and taking remedial action are key and should be integral to all projects and programmes. Both old and new infrastructure must be taken care of. With a proper maintenance programme, the lifespan of infrastructure can be greatly increased.

Generally, there is ignorance about how water is made available and what needs to be done to ensure adequate and reliable supplies (Muller, 2019). An important component of sustainable access to water services is that water services beneficiaries should be custodians of the water infrastructure. There is need to change the notion that public infrastructure is government's infrastructure and that vandalising it (for instance, during protests) hurts the government. People should be aware that public infrastructure is their infrastructure; destroying it will be tantamount to destroying their own infrastructure. When the infrastructure is damaged, they will pay for it in one way or another. Resources that were supposed to be used for further development will be diverted back to replacing or repairing that damaged infrastructure. In this regard, awareness should be inculcated from an early age, either through inclusion in the school curricula or general public awareness campaigns. Components of education for sustainable development are necessary to raise awareness and to conscientise people to safeguard infrastructure. This new thinking and behaviour should be evident at all levels, from the policymakers down to the general population. People tasked with planning and implementing infrastructural projects should take responsibility to do it properly and avoid using shortcuts, which often result in sub-standard infrastructure.

3 Household water and sanitation access in South Africa

Water access goes hand in hand with access to improved sanitation. Universal access to these is required for sustainable livelihoods. Provision of water and sanitation services is a high priority area for the government. Constitutional imperatives, combined with the national water and sanitation policy papers, the National Water Act No. 36 of 1998 and the Water Services Act No. 108 of 1997 seek to provide universal and equitable access to reliable water supply and sanitation services (DWS, 2018a). The importance of water and sanitation to the development of the country demands a better understanding of the extent of access and the quality thereof. A detailed analysis of access to water and sanitation services at the household level can be found in the TIPS Working Paper *Unpacking Water and Sanitation Access in South Africa: A Renewed Call for More Action*. (Mudombi, 2020). Some of the findings are presented in the following subsection.

3.1. Diagnostic: Exploring the dimensions of access to services

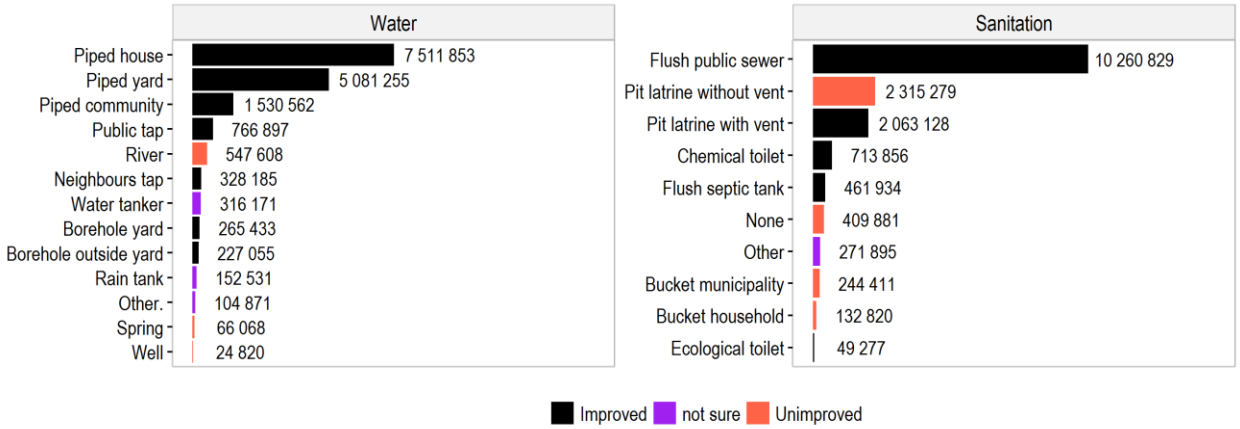
One dimensional view on access to household water and sanitation services at the national level

The first step in understanding access to water and sanitation is to assess the number of households using a particular water source or sanitation facility (usage access[6]) and determine whether the source/facility is improved or not[7]. Based on the Community Survey 2016 (Stats SA 2016a)data, there were a total of about 16.9 million households in 2016. Of these, 15.7 million (93%) used an improved water source, while 13.5 million (80%) used an improved sanitation facility. Largely,

[6] In this paper, *usage access* refers to a household having access to a particular water source or toilet facility, regardless of the quality of access (i.e. not taking into account distance, location, sharing or interruption). This is to distinguish it from *overall access,* which is also used in this paper to refer to access to the water or sanitation services evaluated across a number of access dimensions.

[7] The categorisation of water sources or sanitation facilities adopted by Mudombi (2020)is based on the criteria used by Stats SA (2017) which is broadly based on the World Health Organization (WHO) Joint Monitoring Programme for Water Supply and Sanitation methodology. Improved water sources are those that are properly constructed which, when used properly, protect the water from outside contamination. Improved sanitation facilities are those that prevent human contact with faeces. From the Community Survey 2016, it was difficult to know based on the data whether some of the water source categories were safe and well protected or not (hence the category "not sure". Thus, drawing from Stats SA (2017), water sources that were considered in this paper as improved are limited to piped water, as well as water from boreholes, while improved sanitation facilities are flush or pour-flush to piped sewer system or septic tank or pit latrine, ventilated improved pit latrine, chemical toilet, and ecological toilet.

FIGURE 7: HOUSEHOLD ACCESS TO WATER AND SANITATION BY SOURCE OR FACILITY



SOURCE: MUDOMBI, 2020 P.5, BASED ON STATS SA, 2016B

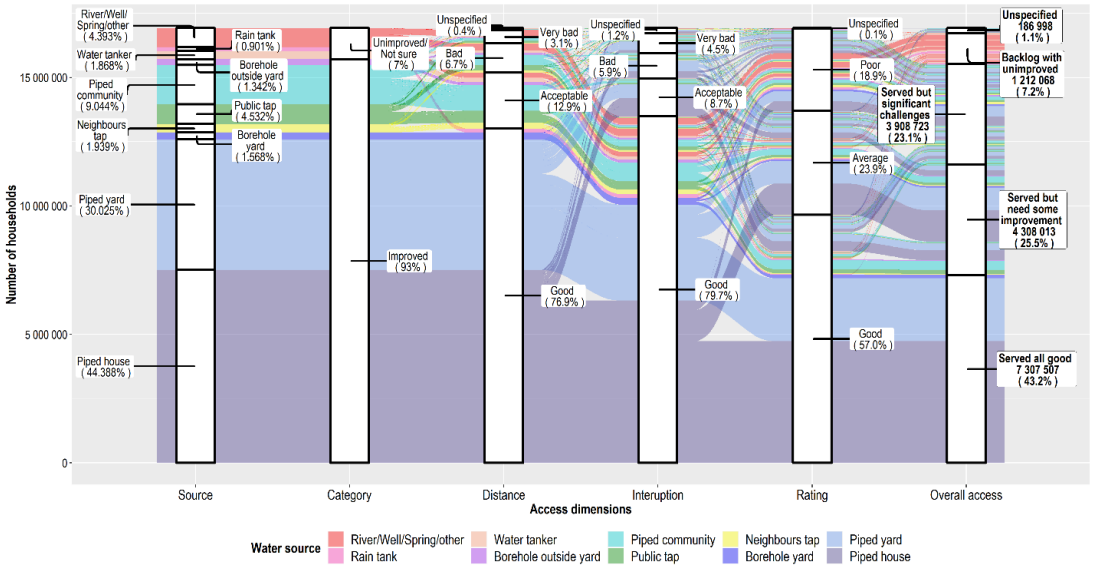
access to improved water sources tends to be higher than access to improved sanitation. The breakdown of the number of households per water source and sanitation facility is shown in Figure 7.

The most common improved water source used by households was piped water inside the house, with about 7.5 million (44%) households, followed by piped water inside the yard with about 5.1 million (30%) households. The most common unimproved water source was a river, with slightly over 0.5 million (3%) households. For sanitation, the flush toilet connected to the public sewer was the most common improved sanitation facility and it was used by about 10.3 million (61%) households, followed by pit latrine with ventilation pipe which was used by 2.1 million (12%) households. The most common unimproved sanitation facility was the pit latrine without ventilation pipe, used by 2.3 million (14%) households. In addition, a notable number of households did not use any sanitation facility and this amounted to 0.4 million (2%) households.

Multidimensional view on access to water and sanitation services at the national level

Having *usage access* to an improved water source or an improved toilet facility does not guarantee good access. There are other attributes/dimensions that need to be considered to ensure good access and also reveal the sustainability of such services. Using the Community Survey 2016 (Stats SA, 2016a) data, overall access to water services by households in South Africa can be explored across four dimensions, namely the type of water source; distance; interruption of service; and rating/perception. For more details, refer to Mudombi (2020). **Figure 8** gives a multidimensional view of access to water services by households. While about 15.7 million (93%) households used an improved water source, only 7.3 million (43%) benefited from good access to water services across all dimensions ("served all good" category). A notable number of households were in the "served but need some improvement" category, which amounted to 4.3 million (26%) households, while households which were "served but with significant challenges" were 3.9 million (23%). Households in the "backlog with unimproved" category amounted to 1.2 million (7%).

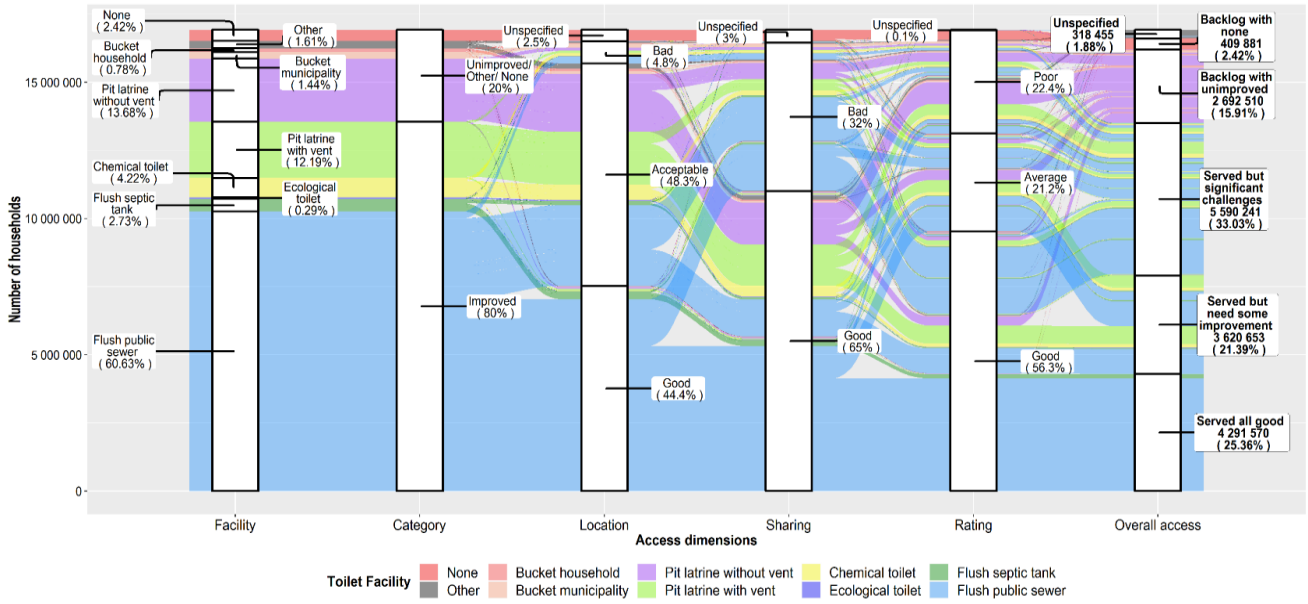
FIGURE 8: ALLUVIAL DIAGRAM SHOWING ACCESS TO WATER SERVICES ACROSS VARIOUS DIMENSIONS



SOURCE: MUDOMBI, 2020 P.7, BASED ON STATS SA,2016B

For sanitation services, four dimensions, namely type of sanitation facility, location, interruption of service, rating/ perception, determine overall access (Figure 9). While just over 13.5 million (80%) households used an improved sanitation facility, only about 4.3 million (25%) had good access to sanitation services across all dimensions ("served all good" category). Households that were in the "served but need some improvement" category were 3.6 million (21%), while those that were "served but with significant challenges" were close to 5.6 million (33%). This means that the greatest proportion of all households that had usage access to an improved sanitation facility faced significant challenges in one way or the other. Households in the "backlog with unimproved" category amounted to about 2.7 million (16%), while those in the "backlog with none" category were about 0.4 million (2%).

FIGURE 9: ALLUVIAL DIAGRAM SHOWING ACCESS TO SANITATION SERVICES ACROSS VARIOUS DIMENSIONS



SOURCE: MUDOMBI (2020, P.9) BASED ON STATS SA (2016B).

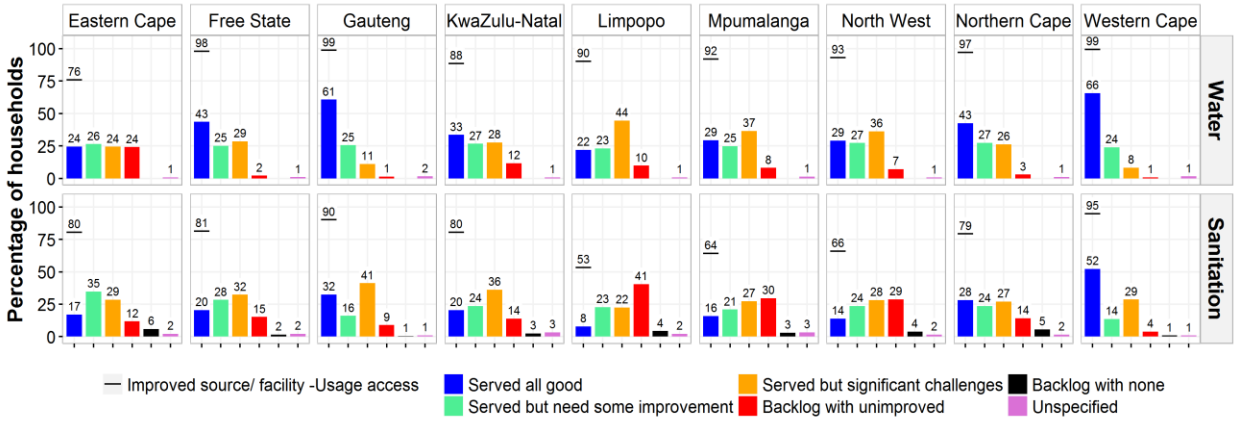
Multidimensional view on access to water and sanitation services at the provincial level

The overall access to services, as depicted in **Figure 8** and **Figure 9** can also be broken down at provincial level. **figure 10** shows the percentage of households using a particular water source or sanitation facility, juxtaposed with the bars representing the various categories of overall access.

For water access, the percentage of households with *usage access* to improved water sources was 90% or above in seven out of nine provinces, with the exception of KwaZulu-Natal and Eastern Cape, which had 88% and 76% respectively. This shows high access to water services. But, as highlighted, to have a better picture it is important to take into consideration the quality of the services. Unpacking the overall access categories shows that Western Cape and Gauteng had the highest overall access to water services. In Western Cape, 99% of the households had improved water sources with the following breakdown: 66% of the households were in the "served all good" category, while 24% were "served but need some improvement", and 8% were "served but with significant challenges". In Gauteng, 99% of the households had an improved water sources, broken down as: 61% of the households were in the "served all good" category, while 25% were "served but need some improvement", and 11% were "served but with significant challenges".

Though many of the provinces had high percentages of households with improved water sources, the analysis shows that the overall access is not good. For instance, in Eastern Cape, Free State, KwaZulu-Natal, Mpumalanga, North West and Northern Cape, the percentage of households which were in the "served but significant challenges" category were between 24% and 37%, while in Limpopo it was very high, with 44% in this category. The province with the highest percentage of households in the "backlog with unimproved" category is Eastern Cape with 24%, followed by KwaZulu-Natal with 12%, while Limpopo had 10%.

FIGURE 10: CHARACTERISATION OF OVERALL ACCESS TO WATER AND SANITATION BY PROVINCE



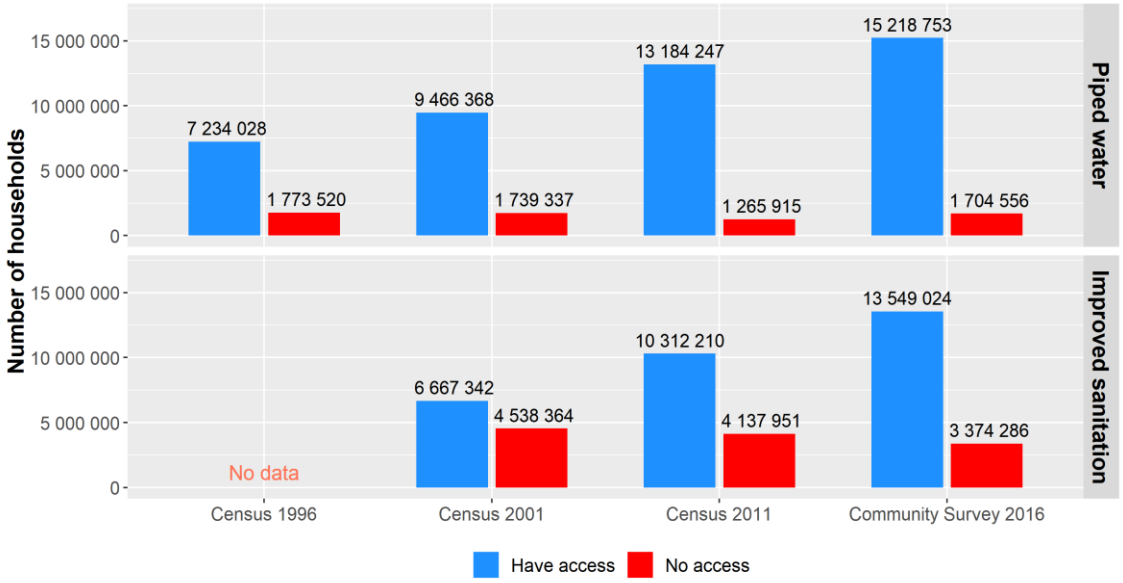
SOURCE: MUDOMBI, 2020 P.9, BASED ON STATS SA, 2016A

With access to sanitation services, the Western Cape and Gauteng provinces had the highest access. In Western Cape, 95% of households had usage access to an improved sanitation facility, while in Gauteng it was 90%, and the lowest was in Limpopo with 53%. A look at the overall access categories shows that Western Cape was the only province that had most households (52%) which were "served all good", while other provinces ranged between 8% and 32%. Though most of the provinces had households which were "served but significant challenges" in the range of 20% to 30%, Gauteng had the highest with 41%, followed by KwaZulu-Natal with 36%. Backlogs for sanitation were split between backlogs for those with unimproved sanitation facilities, and backlogs for those with no sanitation facility. Notable "backlog with unimproved" were present in Limpopo with 41%, followed by Mpumalanga and North West with 30% and 29% respectively. It is important to stress that the percentage of households in the "backlog with none" category was between 1% and 6% across provinces, with Western Cape having the lowest at 1% while Eastern Cape had the highest with 6%, followed by Northern Cape at 5%, and Limpopo and North West at 4%.

A critical look at the progress made in the provision of water and sanitation services

Despite the remaining backlogs, the country has made notable progress, over the years, in providing water and sanitation services. For water, Figure 11 shows that the number of households that have access to piped water (regardless of other access dimensions) has greatly increased, doubling from about 7.2 million in 1996 to about 15.2 million in 2016. However, besides this progress, the absolute number of households with no access to piped water has largely remained unchanged, slightly falling from about 1.8 million in 1996 to around 1.7 million in 2016.

FIGURE 11: TRENDS IN HOUSEHOLD ACCESS TO PIPED WATER AND IMPROVED SANITATION: CENSUS 1996 – COMMUNITY SURVEY 2016



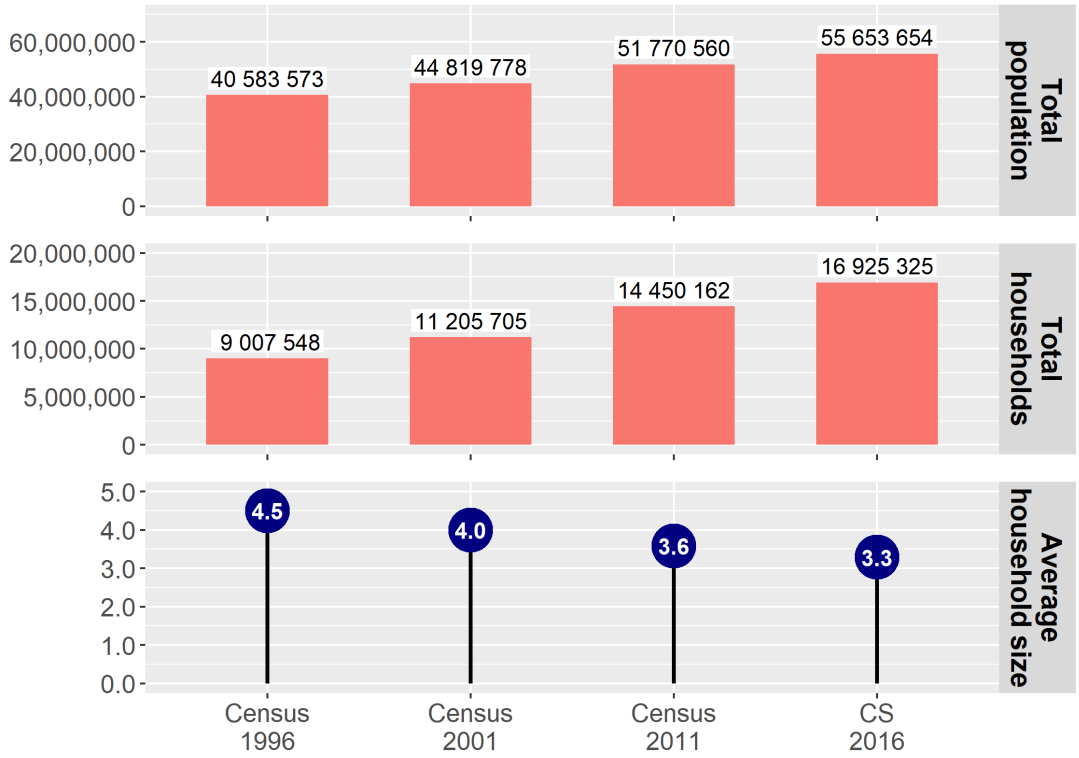
SOURCE: MUDOMBI, 2020 P.11 BASED ON STATS SA, 2016B

For sanitation, Figure 11 shows that the number of households with access to improved sanitation (regardless of other access dimensions) doubled from about 6.7 million households in 2001 to about 13.5 million households in 2016. However, the absolute number of households with no access to improved sanitation has only decreased from about 4.5 million households in 2001 to about 3.4 million households in 2016.

Figure 11 shows that, while significant progress has been made in the provision of water and sanitation services, the absolute number of households with no access has been decreasing at a much slower pace. This can be better understood by looking at the population dynamics seen in Figure 12. While both the total population and the total number of households have been increasing, it is noteworthy to point out that the total number of households has been increasing at a faster rate than that of the total population, as shown by the overall fall in the average household size. This has important implications for service provision.

To keep pace and ensure increased access to water and sanitation at the household level, attention should be paid both to the increased demand as a result of growth in the population as well as the growth in the number of households. Though households might share dwellings and facilities, an increase in the total number of households does, to some extent, translate into an increase in the number of dwellings that require the infrastructure and the services. In this context, the expansion of informal settlements is an ever-growing challenge.

FIGURE 12: TRENDS IN TOTAL POPULATION, TOTAL NUMBER OF HOUSEHOLDS, AND AVERAGE HOUSEHOLD SIZE



SOURCE: MUDOMBI, 2020 P.11 ,BASED ON STATS SA,2016B

Overall, the country has made significant progress in providing water and sanitation services. As noted, access to clean and safe water is generally high in the country, but there are challenges with the quality and reliability of the services. The inadequacy of water and sanitation services contributes to the prevalence of service delivery protests across the country (ActionAid, 2016; DWS, 2017a). The occurrence of water and sanitation related protest events has been increasing; a total of 528 events were recorded countrywide in 2017 and this increased to 737 events in 2018 (Mudombi, 2020).

3.2. Recommendations

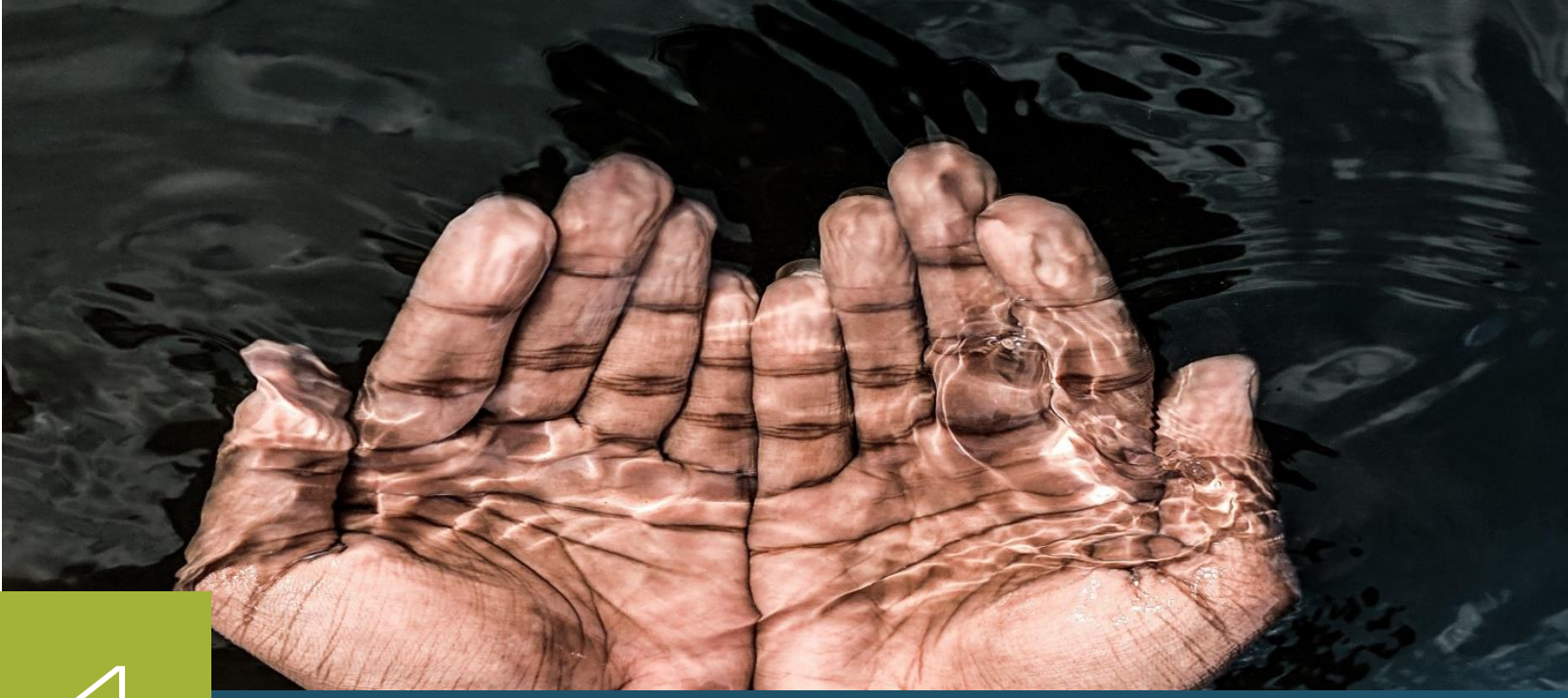
While significant progress has been made in the provision of water and sanitation services in the country since the end of apartheid, there are still backlogs and challenges. Behind the headline numbers, which ignore the quality of access, unpacking the various dimensions of access reveals a more complex and challenging picture.

Urgent attention needs to be paid to backlogs for those who do not have any facility, followed by those with an unimproved sources or facilities. Then, for those who are already served, there is need to prioritise those who are experiencing significant challenges. For water, this could be due to the distance being too long, or the interruption in services being very high or the services in general being very bad. For sanitation, this could also be due to the location not being suitable, the facility being shared, or the services in general being very bad.

Households that are served but are facing significant challenges need attention because, for some of them, there is a high risk of not having functional sources or facilities, which in the worst case can force them to revert to using unimproved sources or facilities, thus exacerbating the backlogs.

The challenges require a combination of solutions that include improved management of municipalities, operation and maintenance of infrastructure, appropriate technological options, and stakeholder buy-in and behaviour change. Water efficient/saving technological options, such as next-generation sanitation, need to be widely promoted and adopted. Proper operation and maintenance of infrastructure enhances its lifespan. There is need to be proactive and continuously improve on asset management so that all the infrastructure is well protected, operated, repaired, and maintained.

A comprehensive monitoring and evaluation programme is required to inform and alert relevant stakeholders on areas that need attention for the provision and accessibility of water and sanitation services. One critical cog is to focus on both the quantity and quality of access to water and sanitation services, as neglect of one will further reinforce the overall backlog. Embracing the multidimensional view and a systems approach will contribute to improved, appropriate, and sustainable access to water and sanitation for all.



4 Governance and funding issues in the water and sanitation sector

4.1. Diagnostic: Exploring how governance and funding issues impact on sustainability in the sector

Governance is the social infrastructure that complements the hard infrastructure and the ecological infrastructure to enhance sustainability in the water sector. Though important milestones have been made in the country's water sector, poor governance has been cited as constraining the sector. Equally important for the water and sanitation sector is funding. The availability of financial resources and how they are invested is a key determinant of the type and success of programmes, activities and infrastructure that can be implemented.

Public and private sector participation in the water and sanitation sector

Common challenges in the water and sanitation sector include poor governance issues, poor enforcement of policies, lack of capacity to manage, corruption, inadequate sustainable financial models, vandalism, theft, and illegal connections (SAICE, 2017).Having poor governance implies that tackling other challenges can be difficult. Chetty and Luiz (2014) assert that poor governance and a lack of capacity has negative implications on infrastructure development. In the same vein, institutional fragmentation and poor strategy implementation have been key impediments to the adoption of integrated water resource management practices at the national level and water demand management practices at municipal levels (GWI, 2017). When there is lack of clearly defined roles and responsibilities between different arms of government for the various aspects of service delivery, this can result in neglect of infrastructure and failure to provide adequate services, with negative implications on sustainability. Indeed, the governance framework is an important determinant of how different actors can participate and meaningfully contribute to solutions.

A sustainable water sector requires the participation of all actors, both public and private. Historically, private sector participation in the South African water sector has been extremely limited (GWI 2017). The existing policy framework does not provide incentives for the private sector to play a more significant role (McNicoll et al., 2017). The Department of Trade and Industry (the dti, 2017) notes that the private sector's participation in the sector has been confined to the provision of supplies and professional services. The limited participation of the private sector has been identified as a serious constraint in bridging the water gap, as public funding and capacity are limited. Thus, there is a strong case for private-sector participation in water infrastructure provision (Creamer Media, 2012).

While there is less affinity for direct privatisation,[8] the country's policy documents consider other forms of cooperation and partnerships with the private sector. South Africa has a regulatory framework[9] which enables national and provincial government institutions to participate in public-private partnerships (PPPs). PPPs can assist in leveraging private sector investment and expertise (NBI, 2019c). Though PPPs have been implemented in the water sector in the past, they are few. For example, the World Bank's Private Participation in Infrastructure Database lists 11 PPP projects that were implemented between 1992 and 2006 (McNicoll et al., 2017; World Bank, n.d.). These PPPs took the form of 25-30 year concessions or 5-6 years management contracts; but the majority of them have not been successful due to a number of barriers, such as lack of capacity, poor institutional arrangements, and a lack of effective partnership development frameworks (AFRICEGE, n.d.; Amis, 2016; McNicoll et al., 2017). While PPPs need to be approved by the National Treasury, there has been opposition to private enterprise from within government; in addition, there is inefficient legislation, high levels of bureaucracy, and the high financial risk to potential contractors due to the economic insecurity of municipalities (GWI, 2017). The private sector is also discouraged to co-finance with the public sector as there is poor governance in some water bodies, while some municipalities are not creditworthy.

The National Business Initiative (NBI) through the Kopano ya Metsi programme has been exploring the potential of PPPs in bridging the water gap in the country. Some of the major opportunities that were identified include desalination, wastewater treatment, water reuse, non-revenue water, conventional water treatment, and groundwater development (NBI, 2019c). The NBI also found that four of the 144 WSAs, namely City of Johannesburg, eThekwini Municipality, City of Cape Town and Ekurhuleni Municipality had excellent PPP potential; 24 had very good or good PPP potential, while 116 had low or very low PPP potential.

Besides PPPs, other forms of partnerships also exist in the country. The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) implemented the Development Partnerships with the Private Sector (DPP) programme in 2006, which covers several sectors, including water (GIZ, 2014a; 2014b). DPPs are projects jointly planned, financed and implemented by businesses, GIZ, the state, and civil society actors. Table 1 shows some of the DPP projects that have been implemented in South Africa with relevance for the water sector.

[8] It is noteworthy to stress that privatisation is an emotional and political issue in the country, it is not allowed in terms of the South African law as well as the water services policies (DWAF, 2003; Van der Westhuizen 2008). Concerns with privatisation relate to fears that there will be job losses and that the private sector might be more concerned with making profits rather than the welfare of the people, particularly when considering the huge number of people who require services yet they are in the indigent category.

[9] For national and provincial government departments, the main legislation is National Treasury's Regulation 16 issued to the Public Finance Management Act No. 1 of 1999, while for municipal government it is the Municipal Systems Act No. 32 of 2000, and the Municipal Finance Management Act No. 56 of 2003 (NT, 2004).

TABLE 1: WATER-RELATED DPPS IN SOUTH AFRICA (IN EUR)

Title	Partner	Period	Public contribution	Private contribution	Contribution by third partners	Total
Emfuleni Water Conservation Project	Sasol	2011-2014	204 082	647 347	306 122	1 157 551
Reducing shared water risk: from footprinting to watershed sustainability for SABMiller	SABMiller Plc	2009-2014	313 750	377 250	7 500	698 500
Practice-oriented Education and Training in Sanitary Engineering	Festo Didactic GmbH & Co. KG	2011-2014	199 900	202 200	60 000	462 100

SOURCE: GIZ, 2014A

In addition, some activities have been coming out of the Strategic Water Partners Network South Africa (SWPN-SA). This is an informal and voluntary collaborative platform, established in 2011, that seeks to address water risks and challenges in the country by bringing together various stakeholders including industry, government departments, development finance institutions (DFIs), business organisations, civil society organisations, and development agencies (Madden, 2015; NEPAD Business Foundation, 2013; WRG, 2012). The involvement and interest of the private sector has, to some extent, been driven by corporate social responsibility objectives. The Partnership for Risk and Resilience initiative implemented by Santam (a private insurance firm) in conjunction with other partners is one such example (Box 1)

Box 1: Partnership for risk and resilience: A case study of Santam

The Business Adopt-a-Municipality (BAAM) programme has contributed to creating some public private partnerships. One of the serious constraints for municipalities is lack of resources, so BAAM seeks to help bridge that gap (CoGTA and GIZ 2015). An example of the BAAM partnerships is the Partnership for Risk and Resilience initiative,which include the following partners: Santam, the Department of Cooperative Governance and Traditional Affairs, and the South African Local Government Association. Santam played an important role in disaster management, improving sustainability and service delivery in vulnerable municipalities by providing support for fire-fighting, flood and storm water management (Santam, n.d.). Santam takes a proactive approach to risk as it works on future proofing. This is important in enhancing the adaptive capacity at the municipal level and building national resilience. The rationale acknowledges that increased risks due to climate change and ecological degradation presents a shared risk for the insurance industry, governments and society, which necessitates the need for collaboration (Santam et al., n.d.). There are two-way benefits associated with this approach – building the capacity of municipalities helps them to deal with risk and disasters, which is also beneficial for the insurers.

In the initial phase, Santam supported five municipalities (four local and one district municipality) across various provinces in the country. The support provided by Santam included fire-fighting equipment, protective gear, GPS equipment, first aid kits, other first response equipment, and training firefighters. The employees of Santam also provided labour and expertise for capacity building through awareness programmes in communities. The success of the BAAM initiative enabled Santam to expand this work to include 10 district municipalities throughout South Africa, which comprises 54 local municipalities (Santam, n.d.).

An overview of funding requirements

Table 2 shows the breakdown requirement by infrastructure type. A total of R899 billion is required over the next 10 years for new water infrastructure as well as rehabilitation and upgrading. This translates to R89.9 billion a year. About 46% and 41% of the total water infrastructure cost requirements (R704 billion) would go towards rehabilitating old infrastructure and new infrastructure respectively, while 13% would be for upgrading. For sanitation, 46% of the R195 billion cost would go to new infrastructure, while 33% would go to rehabilitation and 22% to upgrading. All in all, the biggest proportion of cost (R145 billion) would go towards developing new water resources.

TABLE 2: TEN-YEAR INFRASTRUCTURE COST (R BILLION) IN 2017

Infrastructure type	New	Upgrade	Rehabilitation	Total
Internal	39	22	58	119
Connector: potable	22	13	56	91
Local bulk	25	14	29	68
Regional bulk	47	13	41	101
Connector: non-potable	14	3	53	70
Water resources	145	26	84	255
Total: Water	**292**	**91**	**321**	**704**
Sanitation	89	42	64	195
Total: Water and sanitation	**381**	**133**	**385**	**899**

SOURCE: DWS, 2017C, P.9

As highlighted, a total of R89.9 billion per annum is required for infrastructural costs. However, the available funding (current in 2017) was R 56.6 billion per annum, which gives a funding shortfall of R33.3 billion per annum, which is about 37% of the total requirement (Table 3).

TABLE 3: FUNDING REQUIREMENTS AND AVAILABILITY FOR WATER AND SANITATION IN 2017

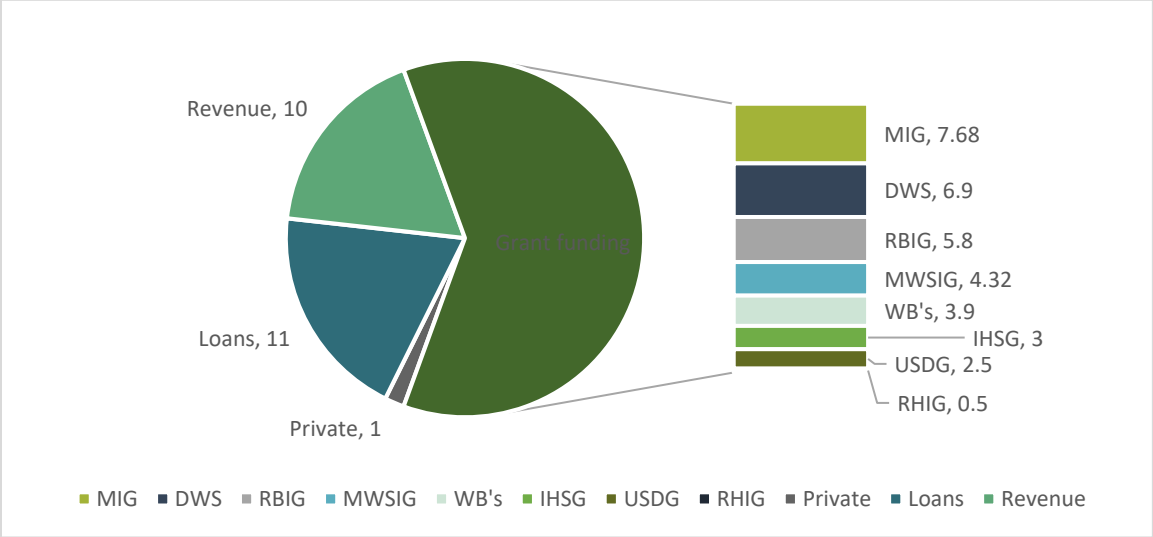
Infrastructure category	Required (R billion)	Current available (R billion)
Municipal water infrastructure	27.8	17.1
Regional bulk (potable) infrastructure	10.1	7.4
Regional bulk (non-potable) infrastructure	7.0	4.0
Water Resources Infrastructure	25.5	14.9
Total water infrastructure	**70.4**	**43.4**
Sanitation infrastructure	19.5	13.2
Total water services infrastructure	**89.9**	**56.6**
Funding shortfall	33.3	

SOURCE: DWS, 2017C, P.10

Funding sources and availability

There are various sources of funding for the water and sanitation sector. Figure 13 shows the breakdown of the funding sources for the R56.6 billion used for water and sanitation in 2017. The biggest source of funding is grant funding from the national government, with a total of R34.6 billion (61%), followed by loans amounting to R11 billion (19%), revenue sources amounted to R10 billion, while private sector funding was R1 billion (2%). The grants include the Municipal Infrastructure Grant, Municipal Water Infrastructure Grant, Regional Bulk Infrastructure Grant, Rural Households Infrastructure Grant and Urban Settlements Development Grant. Loans from DFIs, such as the Development Bank of Southern Africa (DBSA), also play an important role in bridging the financing gap in the sector.

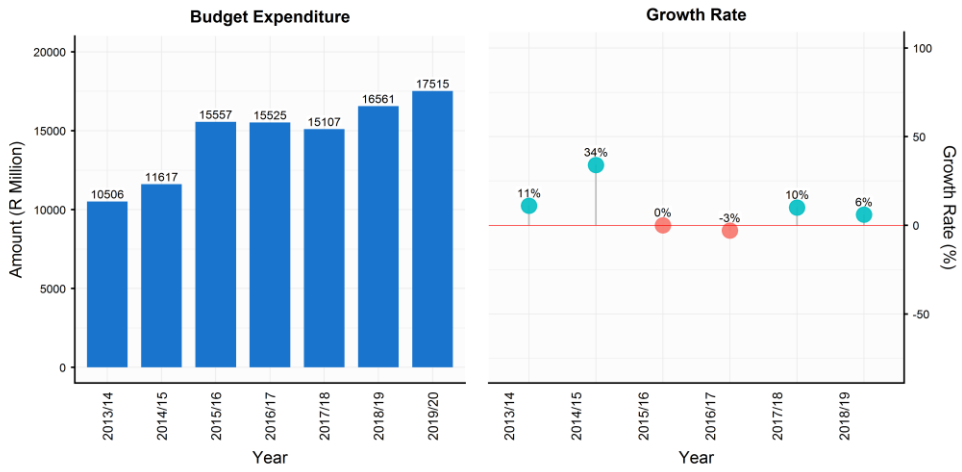
FIGURE 13: CURRENT FUNDING (R BILLION) FOR WATER AND SANITATION IN 2017



SOURCE: AUTHOR BASED ON DWS, 2017C P.10

The national water and sanitation budget has four main programmes, namely administration, planning and information management, infrastructure development, and sector regulation. In general, the biggest proportion of the budget (81%) goes to infrastructure development, followed by administration (11%), planning and information management (5%), and sector regulation (3%). Figure 14 shows the overall budget expenditure trends and growth rates for water and sanitation by the DWS. There has been a steady increase in the nominal budget expenditure for water and sanitation from R10.5 billion in 2013/14 to R15.1 billion in 2017/18, projected to go to about R17.5 billion in 2019/20. In general, the total expenditure has been increasing over the years, though there has been a slight stagnation in the last three years.

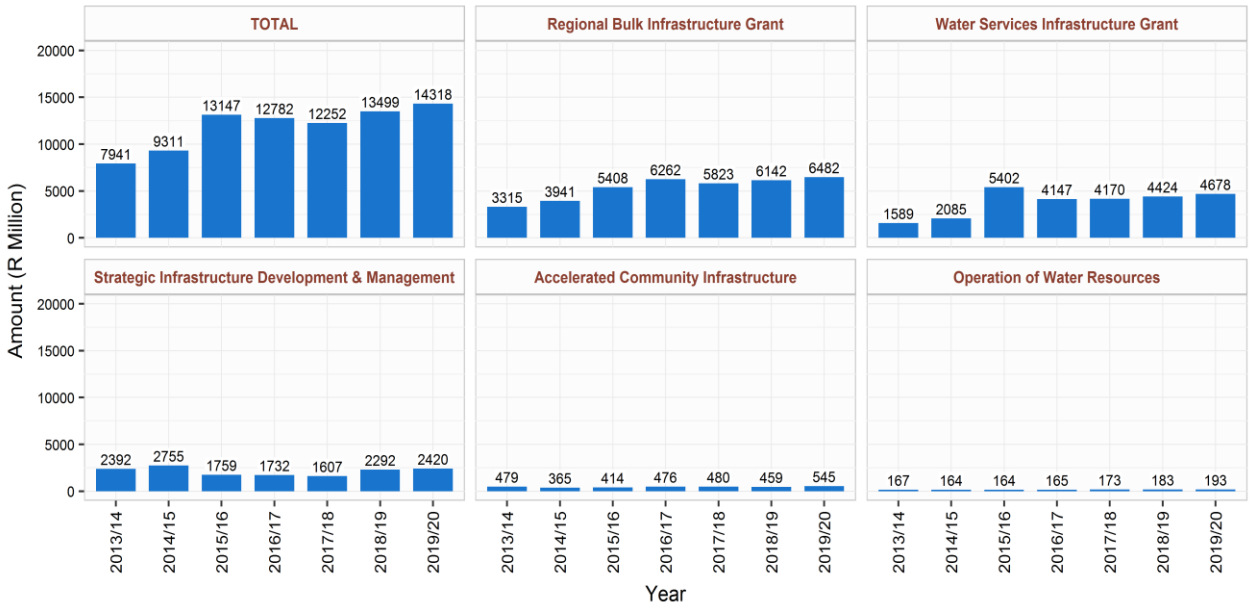
FIGURE 14: BUDGET TRENDS AND NOMINAL GROWTH RATES FOR THE DWS



SOURCE: AUTHOR BASED ON NT, 2017 PP. 3-4

Figure 15 gives a clear picture on the usage of financial resources by the government for water infrastructure development. The water infrastructure development programme has five sub-programmes, namely the Strategic Infrastructure Development and Management, the Operation of Water Resources, Regional Bulk Infrastructure Grant, Water Services Infrastructure Grant, and Accelerated Community Infrastructure Programme. The biggest chunk of the expenditure is allocated to the Regional Bulk Infrastructure Grant (generally around R6 billion) and the Water Services Infrastructure Grant (around R4.5 billion).

FIGURE 15: EXPENDITURE TRENDS AND ESTIMATES FOR WATER INFRASTRUCTURE DEVELOPMENT PROGRAMME



SOURCE: AUTHOR BASED ON NT, 2017 P. 23

The trends in capital expenditure have been mixed for various water entities (see Appendix, Figure 16). For some entities, such as Umgeni Water and Bloem Water, have seen a general growth in capital expenditure. However, for others their capital expenditure has generally stagnated, and in some cases there has been a general decline, such as Overberg Water, Sedibeng Water and Amatola Water.

The use of funds[10] from donors and external loans is relatively small in the country compared to the overall scale of government investment and local mobilisation of resources (World Bank, 2011). However, it is noteworthy to stress that external support agencies have been playing an important role through capacity building initiatives and support for assessments, policy development, and governance. Some of the programmes that have been undertaken include the GIZ's Climate Support Programme, DPP programme, and IWaSP; the Danish-South African collaboration in the water sector; the International Development Research Centre and UK Department for International Development-funded Managing Climate Risk for Agriculture and Water Resource Development programme; and the joint Dutch-South African Kingfisher programme targeting improved water governance.

[10]Globally, water and sanitation official development assistance spending increased from US$6.3 billion to US$7.4 billion from 2012 to 2015. However, aid commitments for the sector have declined from 2012 to 2015. Aid commitments globally decreased from US$10.4 billion to US$8.2 billion, while aid commitments to Sub-Saharan Africa decreased from US$3.8 billion to US$1.7 billion(WHO, 2017).

The inadequacy of financial resources for the sector is a key limitation. Maila et al. (2018) lament that the annual revenue of the water sector and its contribution to gross domestic product are relatively small for such a strategic sector. The water sector is locked in a constant, often losing, resource-allocation battle with other competing demands (the dti, 2017), hence the continued shortfall in funding. For the 2018/19 period, the DWS tabled a R15 billion budget despite its inadequacy in the face of historical contractual commitments amounting to billions of rands (DWS, 2018c).

Another key challenge relates to over- and irregular expenditure. For instance, the bucket-toilet-eradication programme has historically caused unauthorised expenditure, in the 2016/17 period, this amounted to about R292 million overspending in the sanitation programme (DWS, 2018c). In some cases, there is underspending. The National Treasury (2016) noted that, in 2014/15, there was underspending in the regional bulk infrastructure grant due to delays in finalising implementation plans by newly appointed implementing agents. This also happens at the municipal level. Moloto (2015) reported that about R182 million meant for provision of sanitation services in the City of Polokwane was likely to be returned to the National Treasury because it had not been spent.

4.2. Recommendation

Good governance of the whole water value chain requires responsible actions from the public sector, the private sector, non-government organisations, communities, and even individuals at the household level (WWF-SA, 2017). The country is generally noted to have good legislation, though its implementation and regulation has some shortcomings. The formulation of appropriate legislation, regulations, and guidelines should be accompanied by relevant implementation and enforcement.

Participation and collective action go hand in hand; the full participation of all stakeholders nurtures an environment conducive for collective action and good governance. Collective action is necessary in the planning and securing of a sustainable water future for all stakeholders (WWF-SA, 2017). While the government has to take the lead, it has to forge mutually beneficial partnerships with other players. This is particularly relevant because most entities, such as municipalities, do not have the necessary skills and capacity needed to execute projects (Chetty and Luiz, 2014).

The funding gap in the water and sanitation sector is huge. A lot of opportunities exist to design and roll out alternative water services delivery models where the private sector can complement the government efforts(the dti, 2017). However, for improved participation of the private sector, there is need to tackle obstacles of underfunding, inefficient legislation, and high levels of bureaucracy (GWI, 2017).

The policy framework needs to provide clear incentives for the private sector to participate in the water sector, while at the same time ensuring that the socioeconomic objectives of equity and rights to basic services are not compromised. From a sustainability perspective, while PPPs make technical and economic sense in terms of improving service delivery, they do not seem to be a desirable option for households.[11] Since there is less appetite for water PPPs by households in the country, it is vital to clearly and proactively communicate and demonstrate the potential benefits of PPPs, so as to transform the negative perceptions.

There is a need to find alternative ways of financing the funding gap. In this context, raising tariffs is one option that is often mentioned. There is need to revise tariffs as they are not high enough to finance all the expenditure required (DWS, 2017c; GWI, 2017). While raising tariffs is politically and socially sensitive, it is widely acknowledged that

[11] A 2017 public perception survey on South African urban households (NBI, 2019a)revealed that in terms of preference for water services provision, municipalities were the most preferred (74%), followed by national government (73%), PPPs (57%), and then a private company (52%).

water tariffs tend to be relatively low in particular for high-income groups (Montmasson-Clair and Mudombi 2020). In addition to considering raising tariffs, service providers can focus on eradicating NRW, which on its own can greatly contribute to improved financial status of municipalities. Most importantly, because of limited financial resources, using the available financial resources effectively and efficiently by curbing corruption and wasteful expenditure is needed. Corruption reduces the provision and quality of services; unfortunately, the greatest negative effects happen in poor communities where service provision is already weakest (Muller, 2020).

5 Conclusion

This policy paper explored various issues important to South Africa's water sector, from a sustainability perspective. Three main themes were explored, namely: the water gap; household water and sanitation access; and governance and funding issues in the sector. The assessment revealed that the performance of the water sector has been mixed. Great strides have been made on some aspects while others have been lagging. While remarkable progress has been made in the provision of water and sanitation services in general, there are still backlogs and issues with the reliability and adequacy of services.

There are increasing threats to the progress that has been made particularly due to new challenges, such as climate change, which require the integration of climate proofing in the planning and implementation of new water projects, and at the same time retrofitting old ones for them to be climate compatible. This requires additional resources. In addition, eradicating backlogs in services provision is like chasing moving targets; the backlogs continue to grow due to growth in the population, an increase in the number of households, as well as expansion of settlements (including informal ones). To match the increase in the number of people in need of basic services, additional effort and resources are required. Equity and inclusion are crucial ingredients for sustainability in the water sector, as the lack of services thereof can have detrimental socioeconomic effects at the household, community, and national level. The water and sanitation challenges can be additional stressors that coalesce with other grievances to trigger protests. Already, poor service delivery is a hot issue in South Africa.

There is need to be proactive and continuously improve on asset management so that all the infrastructure is well protected, operated, and maintained. Monitoring, evaluation, and taking remedial action are key and should be an integral part of all projects and programmes. Adequate skills are required for planning and implementing projects and programmes; building, operating, and maintaining infrastructure; as well as managing and governing the sector. Most municipalities, particularly those in rural areas, have limited capacity to plan, operate, and maintain their infrastructure. This shortage of skills needs to be addressed; however the main challenge remains that some of the municipalities cannot provide the

requisite remuneration to attract skilled people. DWS has to play a much more important role in bridging this skills shortage at municipal level.

Most of the sectors that use significant amounts of water are expanding, which is further widening the gap between water supply and demand. If no proactive action is taken, water supply will ultimately and significantly limit productivity in many other sectors. The water gap can be closed through finding ways to increase supply; enhancing the productivity of water use; and reducing the demand for water. However, the option of increasing water supply tends to be constrained and relatively more expensive, particularly in the short term. Thus, more effort should continue to be directed at the low hanging fruit of reducing demand and improving efficiency through WCWDM. While every sector needs to employ appropriate water conservation and demand management measures, initially, it is necessary to pay more attention to water-intensive sectors.

The government has been instituting a number of WCWDM programmes with the aim of reducing water losses. Efforts to implement such programmes should continue, regardless of the relatively slow manifestation of the positive outcomes. Processes that require behaviour change tend to be slow, as the majority of users take time to adopt, adjust, and adapt. Municipalities should positively embrace the fight against NRW, as this will save water, and potentially generate additional income.

Appropriate governance of the whole water value chain is a necessary catalyst for sustainability. Although the country's legislation is seen as generally good, the implementation and regulation has some shortcomings. Legislation, regulations and guidelines should be accompanied by relevant enforcement, incentives to drive good actions, as well as disincentives to discourage bad actions.

The funding gap in the water and sanitation sector is huge. This requires synergistic partnerships to be forged by the government with other stakeholders. The policy needs to provide clear frameworks for the private sector to participate, while at the same time ensuring that the socioeconomic objectives of equality and rights to basic services are not compromised. Alternative ways of financing the funding gap are needed. In this context, raising tariffs is one option, though this is politically and socially sensitive. In addition, eradicating NRW can greatly contribute to improving the financial position of municipalities, and can thus be a relatively low hanging fruit. Most importantly, because of limited financial resources, there is a need to use the available financial resources effectively and efficiently. While traditional forms of PPPs are necessary for the development of infrastructure especially bulk infrastructure, there is also a need to foster new and softer forms of partnerships between stakeholders, such as DPPs.

It is necessary to acknowledge that the rhetoric by political leaders is a huge testimony for the high-level interest in seeking to improve the water and sanitation sector. Nevertheless, this rhetoric should be matched by action on the ground, i.e. proper implementation. Now is the time to walk the talk. Moreover, sustainability in the water sector requires patriotic citizens who have the zeal to safeguard and conserve water resources and, at the same time, be proud custodians of the both the physical and ecological infrastructure. People should be aware that public infrastructure is their infrastructure; destroying it is destroying their own infrastructure. This requires enhancing public awareness, integrating content in the school curricula, and other behaviour-change capacity building initiatives. Components of education for sustainable development are necessary to raise awareness and to conscientise people to safeguard infrastructure. This new thinking and behaviour should be evident at all levels, from the policymakers to society at large, as water conservation and demand management is everyone's responsibility.

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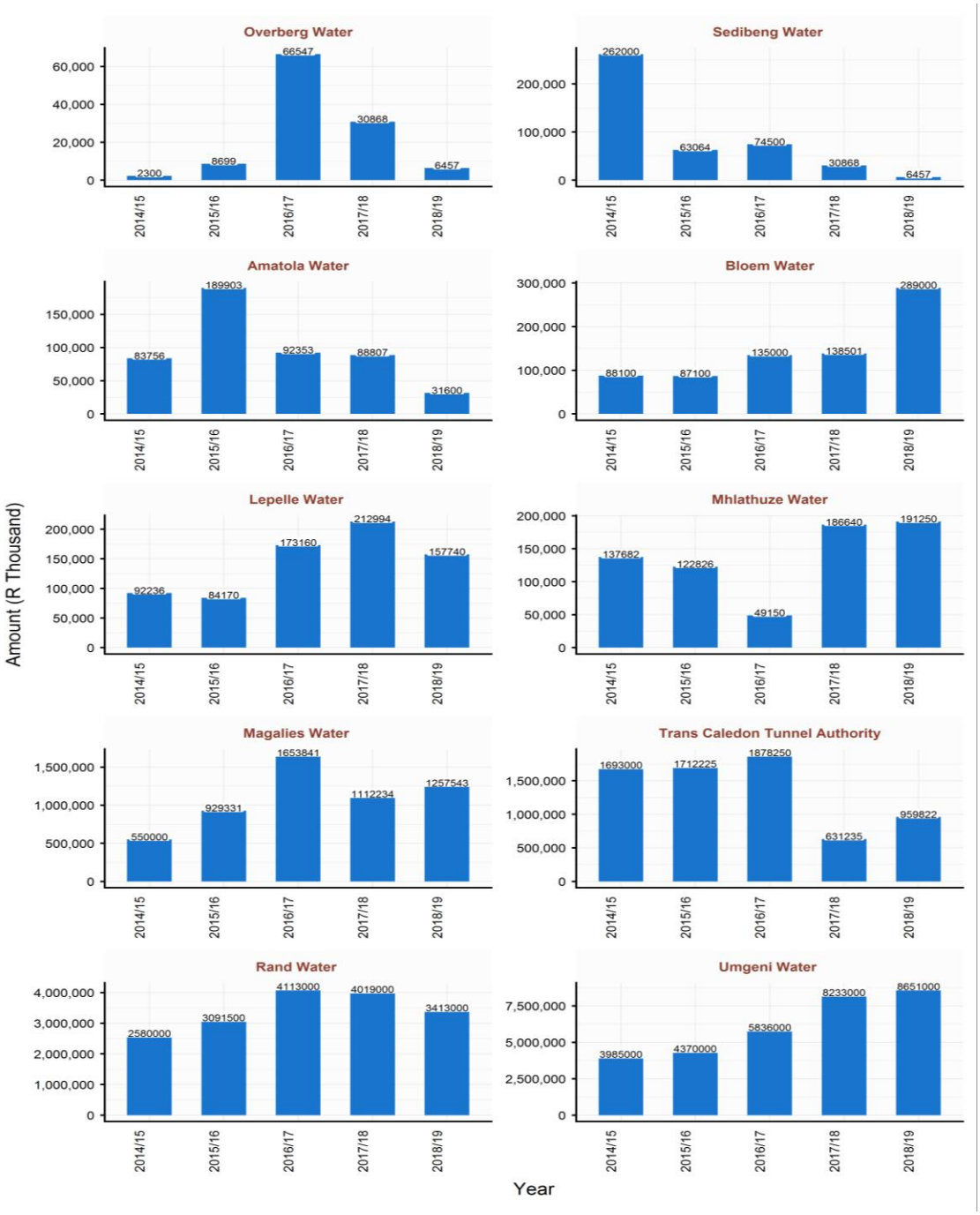
Appendix

TABLE 4. SOME WATER STEWARDSHIP PARTNERSHIPS IN SOUTH AFRICA

Partnership name	Sector	Objective	Duration	Partners
Support to the Strategic Water Partners Network	Multi-sector co-operation	A coordination platform for companies, government and civil society to collectively find solutions for the water challenge.	2014 – 2016	SABMiller, DWS, DEA, 2030 Water Resources Group, Absa bank, Anglo American, South32, Coca-Cola, Eskom, Exxaro, Nestlé, Sasol, Rand Water, Santam, Unilever, WWF, IWaSP
Improving water balance in the Southern Cape (George and Oudtshoorn) hops-growing region	Food and beverages	Seeks to enhance sustainable hops production in the context of water scarcity and alien-invasive plants, as well as enhance coordination in the catchment area.	2014 – 2016	South African Breweries, WWF, DEA
Water stewardship in the Upper Breede River Catchment in the Western Cape Province	Retail	Reduce water risks in deciduous fruit-growing regions in the country. Involves testing the AWS Standard at the farmlevel.	2015 – 2016	Marks & Spencer, IWaSP, WWF, AWS, Breede-GouritzCatchment Management Agency, Woolworths
Securing Port Elizabeth's water through landscape restoration and water stewardship	Insurance	Improve water security through large-scale restoration of degraded land in the three catchments that provide 70% of the city's water, and also enhance the capacity for disaster risk management and climate change adaptation	2015 – 2017	Santam, Living Lands, Commonland, DWS, Tsitsikamma-Mzimvubu Catchment Management Area, IWaSP
Water-loss reduction in Metsimaholo Local Municipality	Municipal/ government	Provide insights into financing options for water-loss reduction	2015 – 2016	Sasol, Metsimaholo Municipality, DWS, IWaSP

SOURCE: IWASP, 2018

FIGURE 16: THE CONSOLIDATED PROJECTED CAPITAL EXPENDITURE FOR WATER ENTITIES 2014/15 TO 2018/19



SOURCE: AUTHORS BASED ON DWS, 2015B P.96

Note: These water entities are very different in terms of sizes. However, different scales for Y-axis were used so as to show broadly the trends in capital expenditure

This policy paper reviews the sustainability of the water and sanitation sector in South Africa.

It forms part of a series of papers aimed at providing a barometer of South Africa's transition to sustainable development.

It is a component of a global initiative spearheaded by the Green Economy Coalition (GEC).

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