2023 WATER MARKET INTELLIGENCE REPORT

FRIEDRICH NAUMANN FOUNDATION For Freedom.

GreenCape

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GREENCAPE

GreenCape is a non-profit organisation that works at the interface of business, government, and academia to identify and remove barriers to economically viable green economy infrastructure solutions. Working in developing countries, GreenCape catalyses the replication and large-scale uptake of these solutions to enable each country and its citizens to prosper.

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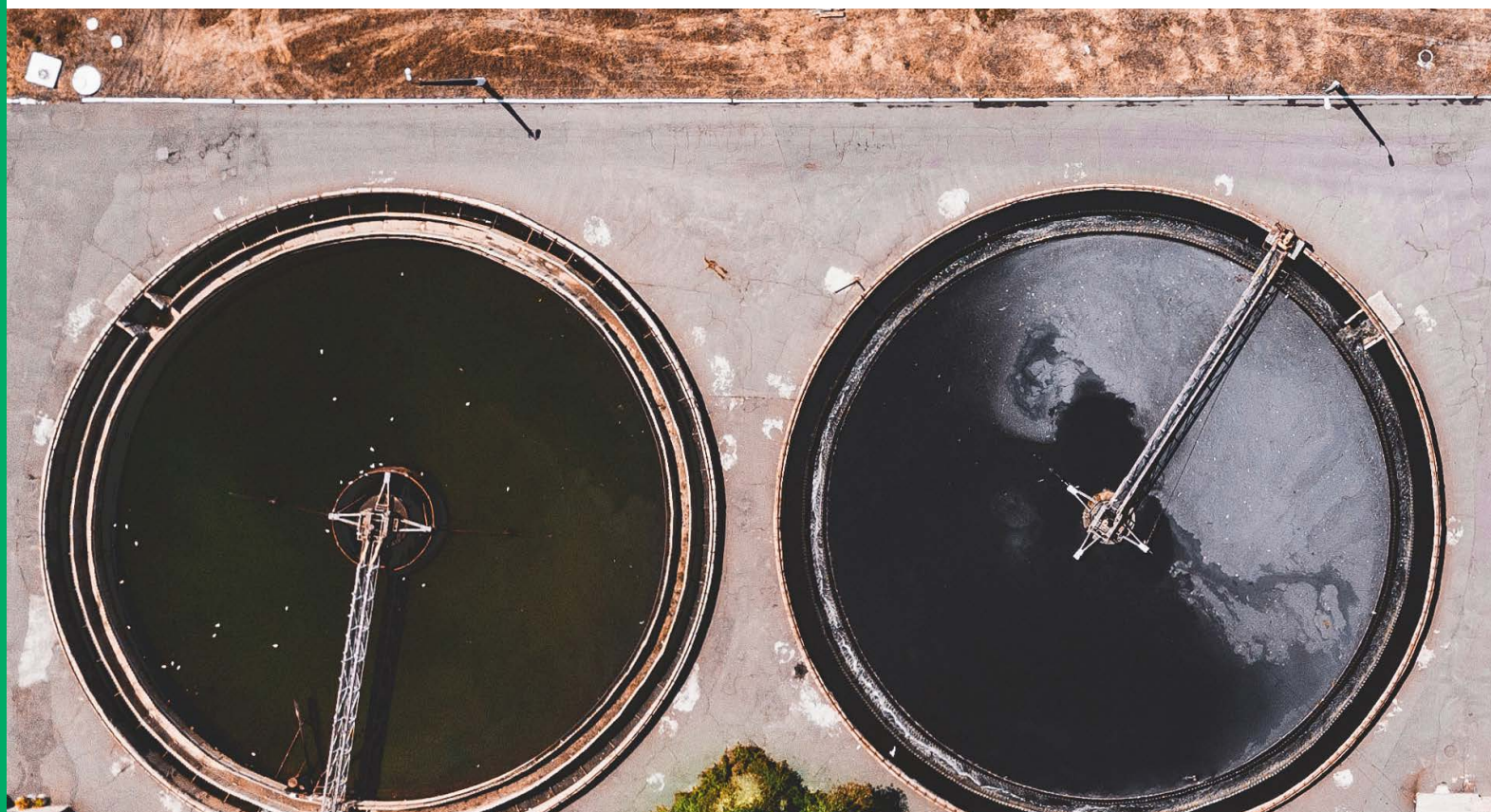

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LIST OF ABBREVIATIONS AND ACRONYMS

AADD	Annual Average Daily Demand
AFD	*Agence française de développement* – French Development Agency
B-BBEE	Broad-based Black Economic Empowerment
BOT	Build-Operate-Transfer
CHP	Combined heat and power
C&I	Commercial and Industrial
CoCT	City of Cape Town
CoGTA	Cooperative Governance and Traditional Affairs
COVID-19	Coronavirus disease
CSAG	Climate System Analysis Group
CSD	Central Supplier Database
DBSA	Development Bank of Southern Africa
DEADP	Department of Environmental Affairs and Development Planning (Western Cape Government)
DEDAT	Department of Economic Development and Tourism (Western Cape Government)
DEFF	Department of Environment, Forestry and Fisheries
DFI	Direct foreign investment
DLG	Department of Local Government (Western Cape Government)
DWA	Department of Water Affairs (now DWS)
DWAF	Department of Water Affairs and Forestry (now DWS)
DWS	Department of Water and Sanitation
EE	Energy efficiency
EEDSM	Energy Efficiency Demand Side Management
EIA	Environmental Impact Assessment
ELU	Existing lawful use
EME	Exempted micro enterprise

ERRP	Economic Reconstruction and Recovery Plan
FNF	Friedrich Naumann Foundation for Freedom (*Friedrich-Naumann-Stiftung für die Freiheit*)
GA	General Authorisation
GDP	Gross Domestic Product
GFD	Green Finance Desk
GIZ	*Gesellschaft für Internationale Zusammenarbeit* (Society for International Cooperation)
GN	Government Notice
GTAC	Government Technical Advisory Centre
GVA	Gross Value Add
ILI	Infrastructure Leakage Index
ISUPG	Informal Settlements Upgrading Partnership Grant
MFMA	Municipal Finance Management Act No. 56 of 2003
MIG	Municipal Infrastructure Grant
MIR	Market Intelligence Report
MLD	Megalitres (million litres) per day
MTREF	Medium Term Revenue and Expenditure Framework
NBI	National Business Initiative
NBR	National Building Regulations
NCPC-SA	National Cleaner Production Centre South Africa
NDP	National Development Plan
NEES	National Energy Efficiency Strategy
NSSS	Non-sewered sanitation systems
NRW	Non-revenue water
NRWP	Non-Revenue Water Programme
NT	National Treasury
NWA	National Water Act
NWRIA	National Water Resource Infrastructure Agency
NW&SMP	National Water and Sanitation Master Plan
PICC	Presidential Infrastructure Coordinating Commission
PPP	Public-Private Partnership

QSE	Qualifying Small Business Enterprise
RBIG	Regional Bulk Infrastructure Grant
RFQ	Request for Quotation
SALGA	South African Local Government Association
SANS	South African National Standard
SDG	Sustainable Development Goal
SIDAFF	Sustainable Infrastructure Development and Financial Facility Programme
SIV	System input volume
SLA	Service level agreement
SIP	Strategic Infrastructure Project
TIF	Technology and Innovation Forum
TMG	Table Mountain Group
UISG	Upgrading of Informal Settlements Grant
UNIDO	United Nations Industrial Development Organisation
VAT	Value-added tax
VROOM	Very Rough Order of Measurement
WASH	Water, sanitation, and hygiene
WASH-FIN	USAID Water, Sanitation and Hygiene Finance Project
WCWDM	Water Conservation and Water Demand Management
WCWSS	Western Cape Water Supply System
WCG	Western Cape Government
WEF	World Economic Forum
WISA	Water Institute of Southern Africa
WMA	Water Management Area
W&S	Water and Sanitation
WRC	Water Research Commission
WSA	Water service authority
WSI	Water services intermediary
WSIG	Water Services Infrastructure Grant
WUL	Water Use Licence
WW	Wastewater

WWF	World Wide Fund for Nature
WWTW	Wastewater Treatment Works
W&WW	Water and wastewater

Provinces:

EC	Eastern Cape
FS	Free State
GP	Gauteng
KZN	KwaZulu-Natal
LP	Limpopo
MP	Mpumalanga
NC	Northern Cape
NW	North West
WC	Western Cape

Metropolitan Municipalities:

BC	Buffalo City
CoCT	City of Cape Town
Ekur	Ekurhuleni
eThek	eThekwini
JHB	Johannesburg
Mang	Mangaung
NMB	Nelson Mandela Bay
Tshw	Tshwane

Conversions:

1 Megalitre = 1 million litres = 1 000 000 litres = 1 000 kl = 1 000 m^3

EXECUTIVE SUMMARY

CLICK TO WATCH A SUMMARY OF THE MIR OPPORTUNITIES

This year's Water Market Intelligence Report (MIR) is written for investors and businesses interested in opportunities in the South African public wastewater infrastructure sector, with particular emphasis on South African metropolitan municipalities.

The pursuit of water security, resilience, universal access to water and sanitation services, and sustainable economic development have become key drivers for investment in the country's public wastewater infrastructure. South Africa is facing a water crisis primarily due to drought and flooding disasters, driven by climate change, and ageing infrastructure, caused by inadequate maintenance and investment in infrastructure repairs and upgrades. The National Water and Sanitation Master Plan (2019) estimates that South Africa has accumulated repair and upgrade backlogs of ~R25 billion and ~R332 billion in municipal water and wastewater infrastructure, respectively. Furthermore, the national water supply and demand gap is forecasted to keep growing despite planned additional water supply projects, indicating the critical need for an efficient and resilient water system.

To achieve water security and equitable access to water and sanitation services by 2030 and beyond, South Africa will need to invest in new wastewater infrastructure projects, including the refurbishment, replacement, repair and maintenance of existing ageing infrastructure, particularly municipal infrastructure such as treatment works, pump stations and the associated technologies. Furthermore, municipalities will need to do more to create value from wastewater sludge by using beneficiation technologies that will help improve water and energy efficiency (EE) and enable better management of operations and infrastructure.

This year's Water MIR draws on market trends and presents emerging longer-term investment and business opportunities to improve water security, resilience, and universal access to water and sanitation as key enablers of sustainable economic growth, and social progress.

Specifically, the MIR focuses on the following opportunities in the public wastewater market in South Africa:

- **New wastewater infrastructure, repair, and upgrades** to address the challenge of delivering sustainable and equitable water, sanitation and wastewater services to industries, new property developments, rural communities, low-income households and informal settlements. **Repairs and maintenance** of ageing wastewater infrastructure to accelerate the eradication of infrastructure backlogs, improve service delivery and reduce environmental pollution.

- **Sludge beneficiation** is a circular economy solution for primary-, waste activated- and digested wastewater sludge. This presents an opportunity for interested service providers offering circular solutions to manage primary and waste activated sludge in the short to medium term, and digestate cake in the medium to long term.

- **The implementation of renewable energy and EE interventions** is vital to reduce electricity demands and the associated costs at wastewater treatment works (WWTWs). Since most WWTWs in South Africa are aged, advances in technology and existing well-proven equipment can be used to improve the EE of WWTWs. **This unlocks several opportunities to install and maintain renewable energy and EE technologies at WWTWs.**

Key *drivers* of these opportunities are:

- **Project preparation support**

  Project preparation support for WWTW infrastructure projects from national government to municipalities has increased. A Project Preparation Facility and Infrastructure Fund led by the Development Bank of Southern Africa (DBSA) and supported by other strategic organisations has been set up to prepare infrastructure projects, including the prioritised Strategic Infrastructure Projects (SIPs). This is expected to attract long-term capital and create a pipeline of bankable infrastructure projects.

- **Policies, plans and financial mechanisms to invest in wastewater infrastructure to address backlogs and demand**

  The historical backlogs in accessing water and sanitation services and rapid urbanisation are key drivers for planned investment in new wastewater infrastructure in South Africa. The operational reality is that existing, ageing WWTW infrastructure has been stretched due to significant underinvestment in new infrastructure and delays in maintenance. Large maintenance backlogs and delays in upgrades exist in municipal infrastructure such as treatment works, pump stations and associated technologies. The national government has committed to ensuring that funding allocated to the water sector is utilised to restore functionality of existing wastewater infrastructure.

- **Regulatory changes**

  Sludge beneficiation is largely driven by a number of regulatory changes, most notably the national ban on liquid wastes to landfill that was implemented in 2019. In the case of the Western Cape, a provincial restriction of organic wastes to landfill is being phased in. In due course, organic waste landfill restrictions may be implemented in other areas of the country.

- **Increased energy costs and energy insecurity**

  The implementation of EE and renewable energy interventions at WWTWs has been driven by rising energy tariffs and energy shortages (leading to load shedding). Since WWTWs are energy intensive, there has been much focus from global climate financing funds and the Department of Mineral Resources and Energy (DMRE) to adopt clean technologies.

While the public wastewater sector represents a large business and investment opportunity, there are a few *barriers* specific to this market. They relate to municipalities' **ability to access funding, capacity constraints, procurement processes,** and a lack of **locally demonstrated technologies.**

Nonetheless, the urgency to redress poor basic service delivery, political will, and support structures will likely ease some of the barriers to investment in the public wastewater infrastructure market.

Table 1: Summary of market opportunities within the water market

Opportunity		
Public sector wastewater infrastructure repairs and upgrades		
Opportunity term: 0-10 years		
Key drivers	**Barriers**	**Macro-environment**
• There is a renewed focus on national infrastructure due to the reinstatement of the national Department of Water and Sanitation's Green Drop programme after a seven year hiatus. This highlighted the state of wastewater treatment works in the country. • The VROOM[1] index specifies areas that require upgrades across WWTWs nationally, and provides estimates specifically for civil, mechanical and electrical costs. It was determined that **R8 bn** is required to restore the functionality of existing municipal wastewater infrastructure. • South African Government has committed to ensuring that funding allocated to the water sector will be allocated with the objective of **restoring functionality of existing wastewater infrastructure** in line with the findings of the Green Drop report. The VROOM informed restoration focussed grant management will be effected with the support from National Treasury. • A National Water Resource Infrastructure Agency (NWRIA) has been established. This will own, manage, maintain and operate water resource infrastructure nationally and take responsibility for raising funding. • A Water Partnerships Office has been developed by the Development Bank of South Africa (DBSA). This seeks to facilitate partnerships and manage joint accounts for funding projects implemented through collaboration between the public and private sector. • There is an increase in project preparation support and availability of development finance linked to impact and sustainable development goals.	• Capacity constraints are leading to several local municipalities failing to execute all their functions as a Water Service Authority (WSA). • Lack of provincial water and sanitation master plans. • Lack of technical capacity in municipalities. • Inadequate budget allocation to implement projects and delays on project implementation. • Grant allocations are insufficient to immediately upgrade WWTWs in the short term and requires a multiyear implementation approach. • Financial mismanagement of municipalities impacts on their ability to access funding. • Lack of a pipeline of bankable projects with completed pre-feasibility reports to demonstrate viability of projects to potential funders. • Lack of verified or demonstrated technologies and projects locally limits municipal confidence in innovation.	• In some provinces sewer spillages of untreated waste water have contaminated ground and surface water resources and degraded the ecological infrastructure. • Several institutions have invested in infrastructure upgrades, extensions, and refurbishments via capital funding. However, these systems were still found to fail the regulatory standards (mostly not meeting effluent quality limits), and/or fail accepted engineering and workmanship standards, and/or in certain cases, have not been commissioned in part or in full. • A total of 334 (39%) of municipal wastewater systems were identified to be in a critical state[2] in 2021, compared to 248 (29%) in 2013. • Municipal systems that are in critical positions are listed from high to low: Limpopo has 78% of its systems in critical state, followed by Northern Cape (76%), North West (69%), Free State (67%), Mpumalanga (43%), Eastern Cape (39%), Gauteng (15%), KwaZulu-Natal (14%), and Western Cape (11%).

[1] The Very Rough Order of Measurement (VROOM) model was incorporated in the 2022 Green Drop reports and provides insights on the state of the key elements of the wastewater infrastructure and provides an order of magnitude estimate of the cost to return infrastructure to a functional condition,

[2] A wastewater system is determined to be in critical state when a Green Drop score 0 - <31% is obtained for the WWTW and urgent targeted Intervention is required for all aspects of wastewater management

Table 1 continued...

Opportunity		
Sludge beneficiation		
Opportunity term: 0-10 years		
Key drivers	**Barriers**	**Macro-environment**
• Liquid waste to landfill ban (2019): As of August 2019, the nationwide ban of liquid waste disposal to landfill came into effect[3]. • Restrictions on organic waste disposal to landfill (this is only being implemented in the Western Cape, but initiatives to divert organic waste from landfill are expected to be adopted in other areas of the country) [4]. • Increased transportation costs (as a result of rising fuel costs). • South Africa is a net importer of fertilisers, which leaves the agricultural industry susceptible to price fluctuations based on the exchange rate and constrained supply due to the Russia-Ukraine war. Therefore, there is an increased demand for locally produced fertilisers. • Increased electricity costs have the potential to be reduced by the use of sludge as a biofuel to create heat or renewable energy. • Potential for revenue generation from circular economy uses and applications. • Availability of local innovative solutions to beneficiate sludge. • Carbon Tax Act.	• Investment into research and technology is required to develop end-markets for sludge. Currently, there is a lack of locally verified technologies. • Lack of a regulatory framework to guide the assessment and treatment of sludge. • Aged infrastructure that is unable to sufficiently dewater sludge. • Poor infrastructure resulting in inconsistent volumes and quality of sludge production. • Poor sludge and effluent monitoring at WWTWs (effluent and sludge compliance scored an average of 26% nationally in the Green Drop 2022 report). • Municipal procurement processes that constrain the ability of solution providers with innovative technologies to secure bids. • Lack of technical capacity in municipalities to implement new technologies.	• Limited space at landfills and increased landfill disposal costs have significantly decreased the feasibility of sludge disposal at landfill. • Sludge is a valuable resource that can have many uses. Beneficial use of sludge and associated nutrients were among the opportunities identified to address some of the challenges identified in the Department of Water and Sanitation's Green Drop 2022 report. • Key sludge treatment technologies used at WWTWs include solar or thermal drying beds (256), sludge ponds (99), belt press dewatering (73), anaerobic digestion (50), gravity sludge thickening (8), centrifugal thickening (3) and composting (1). Altogether 48 treatment works noted other types of treatment and 312 had insufficient information.

[3] As required by the Norms and Standards for Disposal of Waste to Landfill (Notice R 636 of Government Gazette No. 36784, 23 August 2013).

[4] All Western Cape based municipalities, including the City of Cape Town, are required to reduce the landfilling of organics by 50% by 2022, and 100% by 2027.

Opportunity		
Energy efficiency at municipal WWTWs		
Opportunity term: 0-10 years		
Key drivers	**Barriers**	**Macro-environment**
• Escalating electricity costs that substantially increase operating expenses and electricity bills at municipalities. • Suppliers of technologies that contribute to EE are manufacturing more efficient and cost effective equipment, which makes the implementation more accessible and feasible. • A constrained electricity supply and increased load shedding necessitate the implementation of improved technology that can reduce electricity consumption. • Carbon Tax Act.	• Lack of technical capacity in municipalities to implement and operate new technologies. • Several technologies require large capital costs. • Lack of baseline energy audits at WWTWs. • Lack of a pipeline of bankable projects with completed pre-feasibility reports to demonstrate viability of projects to potential funders. • Difficulty to access finance.	• Specific power consumption for most WWTWs in South Africa exceed international benchmarks for each of the specific technologies used[5]. • The average standard Eskom tariffs have increased by 653% between 2007 and 2022. Historical data from the Bureau of Economic Research (2022) and StatsSA (2022), reveal that inflation over this period was 129%. Thus, electricity tariffs increased four-fold (or quadrupled) in real money terms in 14 years. • WWTWs are large electricity consumers (on average a third of a municipality's electricity consumption is from operating WWTWs). • A total of R1.1 bn in viable combined heat and power (CHP) projects at WWTWs in South Africa[6].

[5] Based on 166 WWTWs that reported their specific power consumption values and use advanced technology and 26 WWTWs that use basic technology.

[6] Only includes costing of CHPs at WWWTs with existing anaerobic digesters that require minor refurbishment.


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WHAT'S NEW

The 2022 Water Market Intelligence Report (MIR) focussed on the various emerging long-term investment opportunities in the South African municipal sector that promote economic recovery following the COVID-19 pandemic, water security and resilience. The report highlighted business and investment opportunities in the public sector, and specifically those linked to water and wastewater infrastructure and smart systems for water and wastewater management.

After a seven-year hiatus, the Department of Water and Sanitation's Green Drop programme was reinstated to evaluate the state of WWTWs nationally. The subsequent publication of the Green Drop Report in 2022 has revealed that 39% of WWTWs are in a critical state.

CLICK HERE TO ACCESS PREVIOUS WATER MIRS

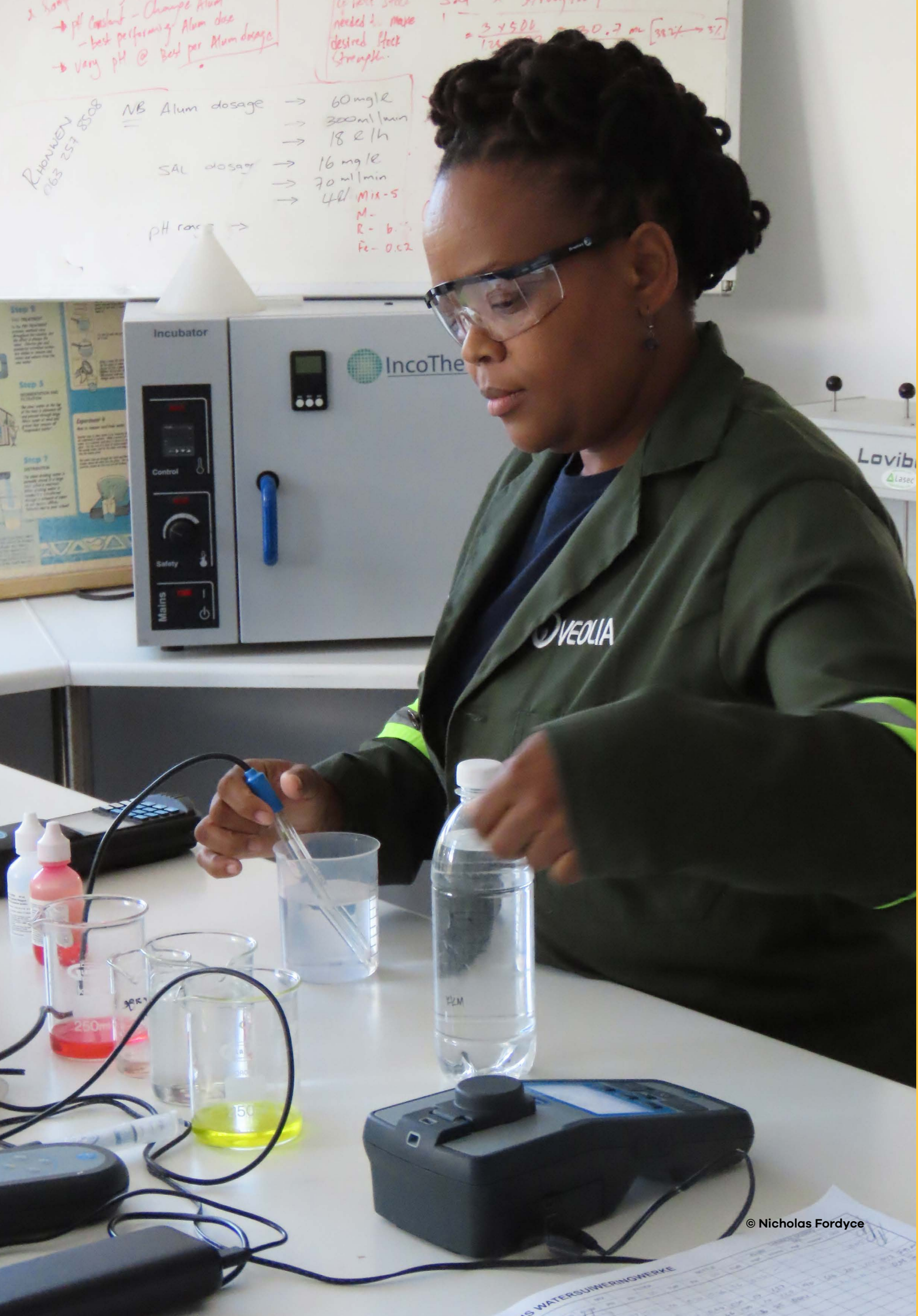
In response, while the market opportunities presented in the 2020, 2021 and 2022 Water MIRs are still relevant, this year's Water MIR provides a detailed analysis of three additional business and investment opportunities in the public sector:

- **the upgrade of wastewater infrastructure in the public sector;**
- **the beneficiation of public sector wastewater sludge; and**
- **the implementation of renewable energy and EE interventions at public sector WWTWs.**

Investors and business owners who would like a comprehensive view of all opportunities are encouraged to read the previous Water MIRs together with this 2023 MIR.

INTRODUCTION AND PURPOSE

This report is written for investors and business owners interested in the South African wastewater sector, with particular emphasis on opportunities in South African metropolitan municipalities.



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The report provides insights into the wastewater sector in South Africa. It also outlines market opportunities and barriers to be considered by businesses who are active or interested in doing business in the wastewater sector, and investors who are active or interested in growing businesses in the wastewater sector.

The key drivers of growth and long-term investment in the wastewater sector in South Africa are three-fold: increasing resilience to weather events induced by climate change; ensuring water security through renewed infrastructure for sustainable economic recovery and growth; and achieving universal access to clean water and sanitation.

This year's report focusses on investment and business opportunities within the public market: WWTWs infrastructure **(new, upgrades, repairs and maintenance of municipal treatment works)**, resource recovery **(circular economy solutions for the beneficiation of wastewater sludge)** and clean technology deployment **(renewable energy and EE interventions).**

The report provides a sector overview (Section 2), which outlines water supply and the state of WWTWs in South Africa. This is followed by an overview of relevant policies and regulations (Section 3) that are attendant to wastewater infrastructure, as well as details of investment and business opportunities linked to infrastructure, sludge beneficiation and renewable energy and EE interventions, and the barriers to realising these opportunities (Section 4). The final sections focus on finance and incentives (Section 5) and explain GreenCape's work within the green economy space (Section 6).

While this report focusses on the public sector water market, there are inherent links between agricultural and urban water use projects, and between biosolids production projects and their land application. Similarly, there are links between organic waste valorisation and energy production related to treating wastewater, as well as resource recovery opportunities throughout the water value chain. These opportunities have been included where they fall within the water value chain; however, please consult the **2023 Sustainable Agriculture Market Intelligence Report, 2022 Waste Market Intelligence Report** and **2023 Energy Services Market Intelligence Report** for opportunities specific to those sectors.

ACCESS THE MARKET INTELLIGENCE PAGE ON THE WEBSITE HERE

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SECTOR OVERVIEW

This section presents an overview of the South African water sector with a specific focus on water supply and wastewater treatment.

2.1. Water supply in South Africa

South Africa has a mean annual rainfall of 456 mm, with the world average being 860 mm annually. Climate change is projected to make the country even more arid and localised droughts will become more recurrent (World Food Programme, 2021). Despite South Africa being a water-scarce country, the national average consumption is around 237 litres/capita/day (l/c/d) (Murwirapachena, 2021). These figures are much higher than the average international benchmark of 173 l/c/d (DWS 2019)[7]. If demand continues to grow at current levels, the deficit between water supply and demand could be between 2.7 and 3.8 billion m^3 per annum by 2030, which represents a gap of about 17% of available surface and groundwater (DWS, 2018).

This will be driven by low water tariffs, inefficient use, inadequate cost recovery, leakages, inappropriate infrastructure choices (e.g. water-borne sanitation in a water-scarce country), and increased demand in the municipal, industrial, and agricultural sectors (Donnenfeld, Crookes, & Hedden, 2018). The growth in demand by the municipal sector is expected to be the greatest, which is partly driven by urbanisation, but also by increased industrial production, commercial activity, and population growth.

At present, South Africa is using 98.6% of the total water supply available nationally. Over the next 20 years, it is expected that supply of water will increase by roughly 24% while demand will rise by 25%.

The very small margin between the allocation of water and plans for augmented supply to match demand puts South Africa's water security at high risk should any external shocks affect the supply of water. Further to this, water supply varies across the country, with some instances where demand exceeds supply.

The country has a reliable yield (i.e. supply from current infrastructure) of ~15 billion kl/year (at 98% assurance of supply – or 2% annual probability of supply failure). The majority of this yield is from surface water (77%), desalination (14%) and groundwater (9%) as shown in **Figure 1** (DWS, 2022a). The projections of the water supply mix for 2025 and 2040 (**Figure 1**) and current (2022) and projected water use in 2050 (**Figure 2**) are also included.

[7] These figures are based on the system input volume divided by the population served. The system input volume includes commercial and industrial demand, and water losses through infrastructure leaks.

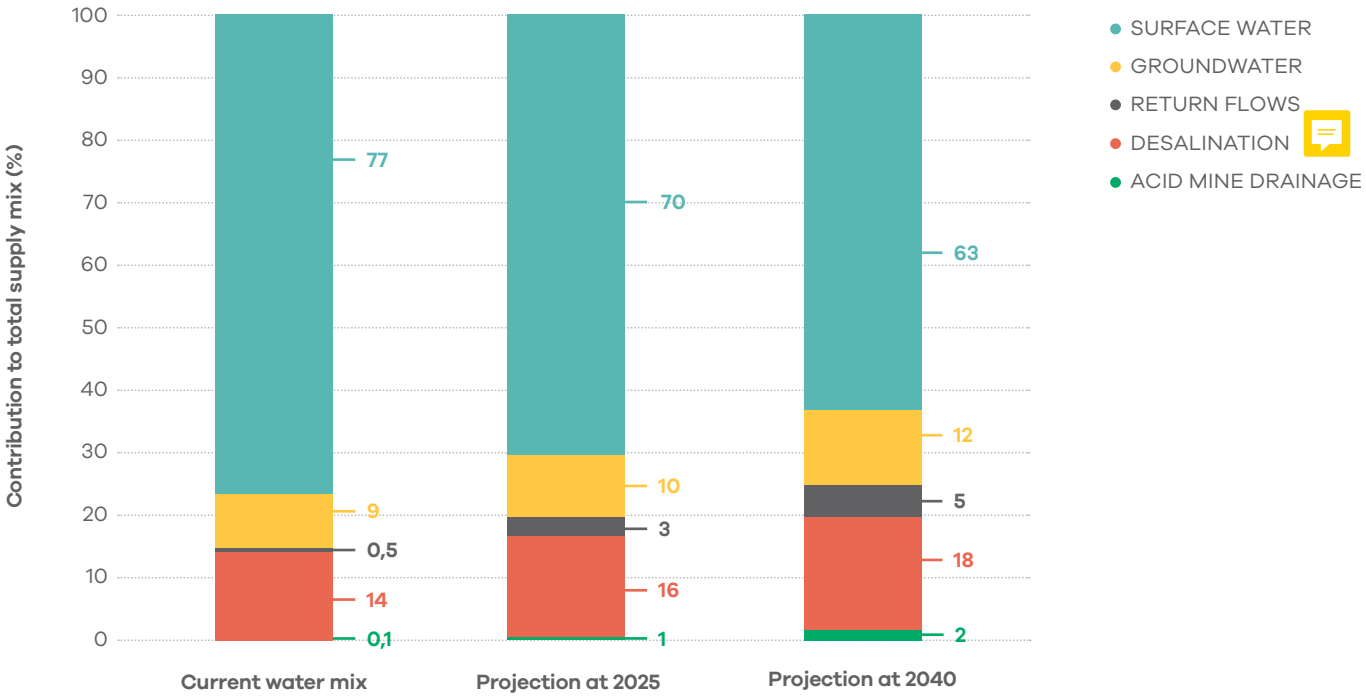
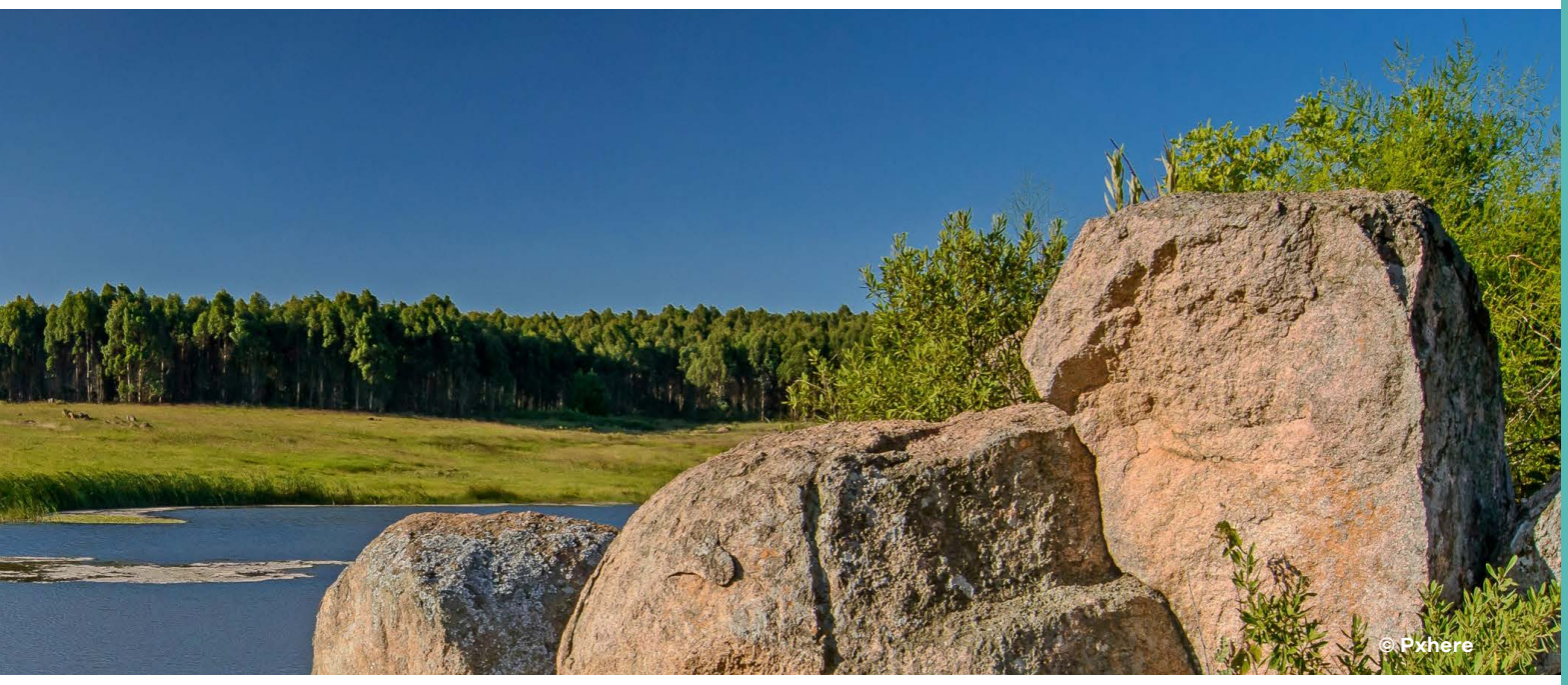


Figure 1: National overview of the current water resource mix and the projected resource mix for 2025 and 2040, respectively

Source: DWS, 2022a

It is evident that water security is mainly reliant on fresh surface water, with desalination, groundwater and return flows utilised to a much lesser degree. Surface water is limited and to build a resilient water system for the future, supply will need to be augmented with additional water sources such as groundwater, seawater, springs water, fog harvesting and rainwater harvesting.

Agriculture is the largest water-use sector (58%), followed by municipalities (30%). It covers residential, commercial, and industrial water users supplied by municipalities (Figure 2; DWS 2022a).



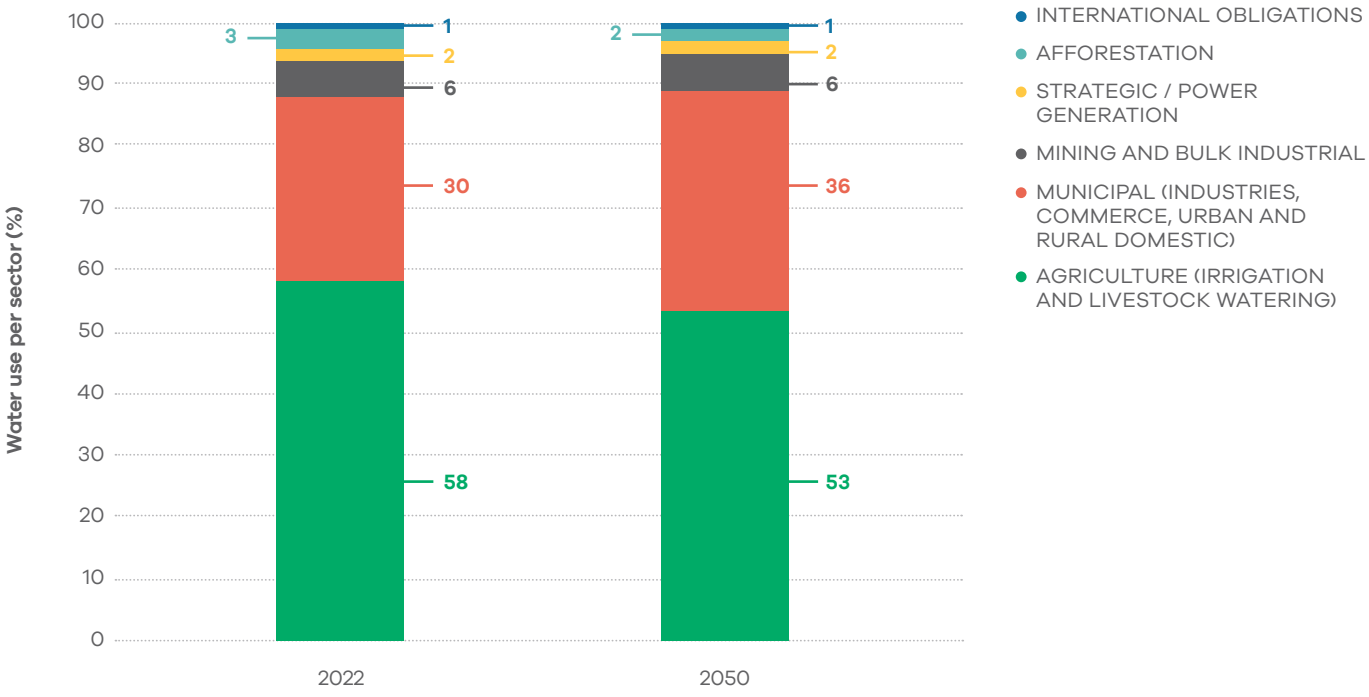


Figure 2: Water use per sector as at 2022 and projected for 2050

Source: DWS, 2022a

Although the agricultural sector is the largest consumer of water (by volume), it makes up just 2% of the overall financial sales value of water. This is mainly due to the use of non-potable water (raw ground and surface water) in the agricultural sector. The **2022 Water Market Intelligence Report** provides more information on the distribution of water sales, water sources and water use in South Africa.

Table 2 outlines water availability versus the requirements in key large water resource systems without interventions or planned augmentation projects (DWS, 2022a)

Table 2: Water availability versus requirements in key large water resource systems

Source: DWS, 2022a

Water Resource System	Province	Total Storage capacity in Mm^3 in 2021	Current In Mm^3 /year, base year 2021			Future in Mm^3 /year, projected for 2040 without interventions		
			Availability (system/ scheme yield)	Demands (estimated require-ments)	Deficit (-)/ Surplus (+)	Availability (system/ scheme yield	Demands (estimated require-ments)	Deficit (-)/ Surplus (+)
Western Cape WSS [8]	Western Cape	895	545	585	-40	585	830	-245
Crocodile East	Mpumalanga	340	67	350	-283	154	375	-221
Olifants WSS	Limpopo	1859	425	458	-33	442	566	-124

[8] WSS = water supply system

Table 2 continued...

Water Resource System	Province	Total Storage capacity in Mm^3 in 2021	Current In Mm^3 /year, base year 2021			Future in Mm^3 /year, projected for 2040 without interventions		
			Availability (system/ scheme yield)	Demands (estimated require-ments)	Deficit (-)/ Surplus (+)	Availability (system/ scheme yield	Demands (estimated require-ments)	Deficit (-)/ Surplus (+)
Integrated Vaal River System	Mpumalanga, North West, Gauteng, Free State	10566	2877	3130	-253	3640	3680	-40
Mhlatuze WSS Richards Bay	Kwa-Zulu Natal	413	243	252	-9	290	325	-35
Caledon Modder (Bloem-fontein)	Free State	84	105	104	1	162	191	-29
Outeniqua WSS (Mossel Bay)	Western Cape	49	62	68	-6	62	90	-28
Amathole WSS	Eastern Cape	241	109	102	7	124	130	-6
Letaba & Levubu WSS	Limpopo	472	243	215	28	276	277	-1
Algoa WSS	Eastern Cape	281	135	167	-32	355	355	0
Polokwane WSS	Limpopo	254	268	261	7	433	408	25
Crocodile West WSS	Limpopo, North West	495	1200	1170	30	1460	1365	95
Mgeni WSS	Kwa-Zulu Natal	978	405	452	-47	736	552	184
Orange River System	Northern Cape, Free State, Eastern Cape	7996	3323	2545	778	3679	3141	538
Total		24923	10007	9859	**148**	12398	12285	**113**

In order to narrow the gap between supply and demand, various water augmentation and demand management projects have been planned to provide water security. For example, the City of Cape Town, which relies on the Western Cape Water Supply System (WSS), plans to add ~ 310 ML/d of water from surface water, ground water, desalination and reuse sources by 2028.

The national Economic Reconstruction and Recovery Plan (ERRP) highlights the retrofitting of public and private buildings with technologies to improve water efficiency as a major part of South Africa's green agenda. The implementation of the programme for public buildings has the potential to build a labour intensive local industry (Presidency 2020).

For example, the TIPS Water and Sanitation Industry Master Plan Research Report estimates that the sanitation industry could support 32 871 jobs in delivering improved sanitation to the ten most water-stressed municipal districts (TIPS, 2022)[9].

[9] Trade & Industrial Policy Strategies (TIPS) is an independent, non-profit, economic research institution established in 1996 to support economic policy development.

If planned additional water supply is added, and realistic water efficiency[10] is achieved, the gap between supply and demand by 2030 (illustrated in **Figure 3**) can be addressed.

Figure 3: National water balance projections by 2030 with and without critical interventions

Source: DWS 2019

[10] The water demand management target aims to reduce the per capita water consumption by 26% from 2018 to 2030 to match the average international benchmark (173 litres/day). During and after the 2016 – 2018 drought in the City of Cape Town (CoCT), a far greater per capita reduction in water consumption (~50%) was achieved due to increased awareness in the period 2016 to 2020, which suggests that this target is very much achievable.

While total demand is projected to increase despite increased efficiency and planned augmentation schemes, it is important to note that these interventions can narrow the supply gap. However, augmentation sources will still need to be diversified. There are a number of water resource development projects underway and planned that could augment water supply across South Africa. These span a range of water sources (i.e., surface water, groundwater, desalination, effluent reuse, use of acid mine drainage) across eight water resource systems. More details of these existing and planned water resource development projects between 2020 and 2050 have been provided by the Department of Water and Sanitation (DWS, 2022a, p58-59).

In total, **R126 billion** is required to finance key water resource development projects in the **next 10 years**. In addition, a number of other initiatives are being driven by DWS to strengthen water supply. These include:

- Technical regulatory assessments to measure the level of compliance with the Green Drop (wastewater) and Blue Drop (potable water) regulatory standards.
- Restructuring of the Water Boards following a review of the state, sustainability and functionality of the Water Boards during 2022.
- Establishment of the National Water Resource Infrastructure Agency (NWRIA) to raise private sector finance and implement the large-scale investments in national water resource infrastructure. The NWRIA Bill was published for public comment in September 2022, with a view to taking it before Parliament in July 2023 (DWS, 2022e).
- Cooperative governance: DWS will work together with National Treasury and the Department of Cooperative Governance and Traditional Affairs (CoGTA) to guide, support and monitor business plans of the municipalities to ensure that water conservation and demand management projects are prioritised and that municipalities make use of the related grants available to them for this purpose, namely the Water Services Infrastructure Grant (WSIG), Regional Bulk Infrastructure Grant (RBIG), and Municipal Infrastructure Grant (MIG).

2.2. Wastewater treatment in South Africa

2.2.1. Market overview

Globally, the water and sanitation market which was sized at US$862 in 2016 (TIPS 2022), with operational expenditure accounting for 64% or US$552 of the total market. It is expected that by the end of 2022, the market would have reached close to US$900 billion. South Africa holds 1.3% of the total market (ranking 16th globally).

In South Africa, the focus within the water sector has more recently shifted to wastewater following the reinstatement of the Green Drop programme to evaluate the state of WWTWs across the country. A major decline in the functioning of WWTWs has been noted since the last report was published seven years ago.

While the DWS is responsible for local water resource management (funded through the national fiscus), local governments (i.e. municipalities) are responsible for the provision of water and sanitation services, including bulk and resource infrastructure. In this capacity, municipalities are considered water service authorities (WSAs).

The Green Drop Report (DWS, 2022b) highlights that **significant investments are required for the restoration of existing infrastructure**, and to **provide additional capacity** for water resources infrastructure (responsibility of national government) and the **water services infrastructure** (responsibility of municipalities).

Government has tabled a combined budget of R111.25 billion until 2024/25 for water and sanitation infrastructure; however, there is a significant funding gap between the required amount and the budget allocated. **This funding shortfall, represented in Figure 7, demonstrates an opportunity for investors to provide innovative project financing.** Typically, private sector involvement in the municipal water and sanitation sector has been low due to a lack of capacity in municipalities to identify bankable projects and subsequently take these projects to market. This is coupled with a complex Public Private Partnership (PPP) regulatory framework that means that PPP processes could take between 8 to 12 years to complete.

Furthermore, in many instances, the public sector is unable to support the financing of the investment required to fund the necessary infrastructure as a result of the following (SALGA, 2022):

- low water tariffs – water tariffs are not cost reflective and in many instances water production costs are unknown;
- high-levels of non-revenue water – approximately 41% of municipal water does not generate revenue; of this, 35% is lost through leakage, resulting in R10 billion in revenue lost annually;
- municipalities currently owe the water boards in excess of R14 billion.
- low revenue collection.

To address this, two measures are being put in place to leverage private sector funding (DWS, 2022):

- Public-private collaboration agreements with industries, such as mining and agriculture, for the joint funding of infrastructure projects;
- A Water Partnerships Office (WPO) to assist municipalities to contract for public-private partnerships (PPPs) and independent water producers (IWPs). The WPO is a ringfenced entity led by the Development Bank of South Africa (DBSA) and assisted by the reforms of the PPP regulatory framework.

The WPO will work on 5 programmes:

1. **Non-revenue water:** Focussed on the reduction of water losses and overconsumption. The private sector will receive a return through an increase in revenue and increased system efficiency.
2. **Management contract:** The outsourcing of municipal services to the private sector. The private sector receives a return through increases in operational efficiency
3. **Wastewater treatment:** Assistance to municipalities to upgrade and refurbish wastewater treatment works. Funding will be sourced through collaboration with the private sector and grant funding.
4. **Water reuse:** Focussed on treatment of wastewater for non-potable reuse and resource recovery to enable revenue generation.
5. **Seawater desalination:** Enable Independent Water Producers (IWP) to produce potable water from seawater for sale to municipalities and other water users.

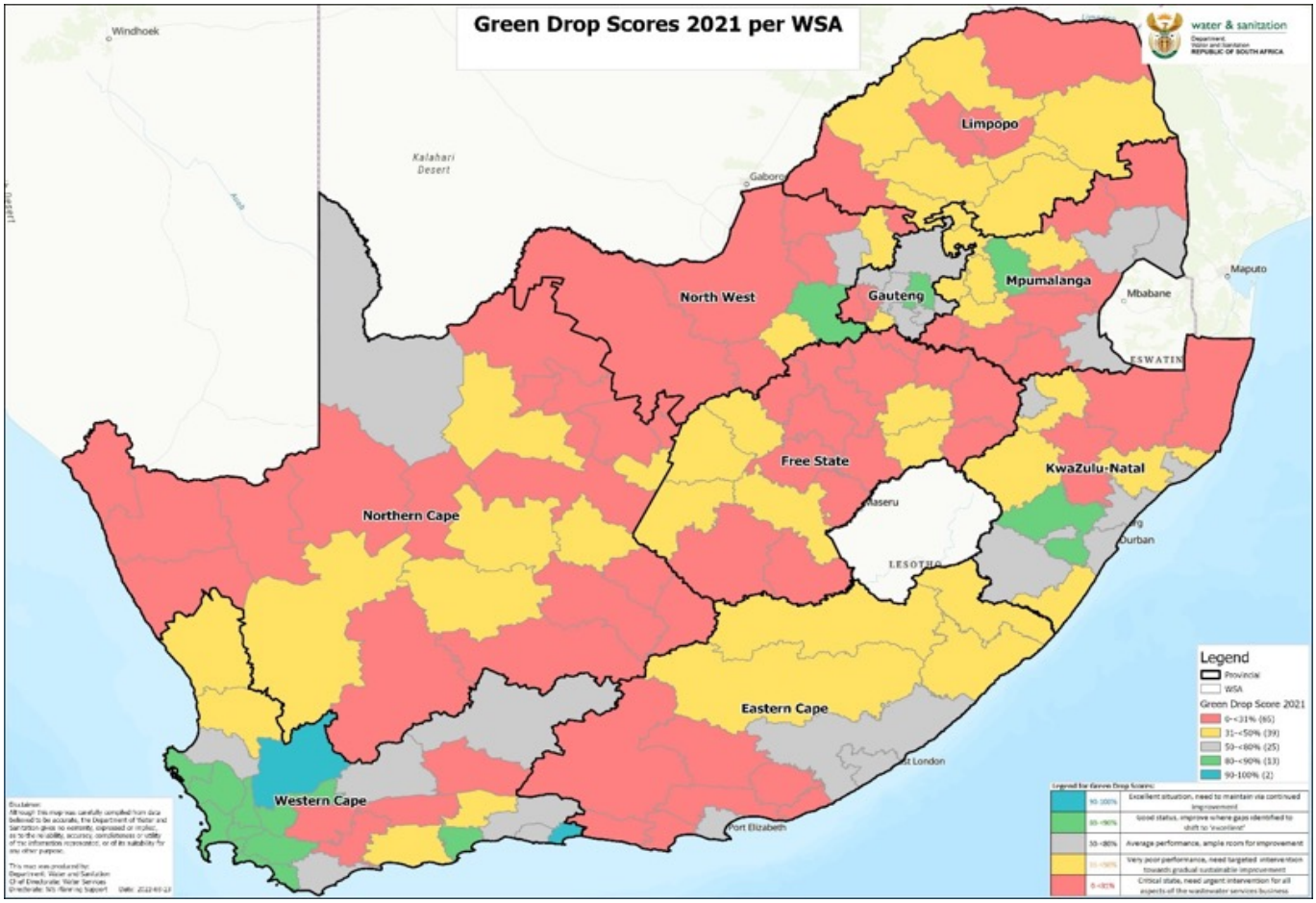
2.2.2. The Green Drop report

The Green Drop audit covered 144 water service authorities (WSAs) (850 systems), the Department of Public Works (DPW) (115 systems), and five private and state-owned organisations (30 systems), totalling 995 wastewater networks and treatment facilities. Systems were assessed from 1 July 2020 to 30 June 2021 according to the Green Drop Standards, which resulted in a Green Drop score. The Green Drop score by rating and type of system can be seen in Table 3.

Table 3: Summary of Green Drop ratings for national WWTWs owned by different authorities

Rating	Green Drop score	Number of systems			Overall percentage of systems (%)
		Water service authority (WSA)	Department of Public Works (DPW)	Private	
Critical state	0 – <31%	334	102	1	44
Poor	30 – <50%	208	11	8	22.8
Average	50 – <80%	190	2	16	21
Good	80 – <90%	96	0	4	10.1
Excellent	90 – 100%	22	0	1	2.3
Total number of systems		**850**	**115**	**30**	**995**

The condition of WWTWs varies greatly across the different water service authorities in the different regions of the country, as indicated in Figure 4.



- **Critical State,** Urgent targeted intervention required for all aspects of wastewater management.
- **Very poor Wastewater Performance.** Requires targeted intervention by WSA to ensure sustainable improvement.
- **Average Wastewater Management Performance.** Ample room for improvement.
- **Good Wastewater Management;** Gaps identified during audit should be addressed to shift to next level.
- **Excellent Wastewater Management;** Situation needs to be maintained via continuous improvement.

- 0 – <31%
- 31% – <50%
- 50% – <80%
- 80 – <90%
- 90% – 100%

Figure 4: Green Drop score per water service authority for municipal WWTWs

Source: DWS, 2022c

The number of systems in critical state and the total number of municipal systems are presented in **Figure 5**.

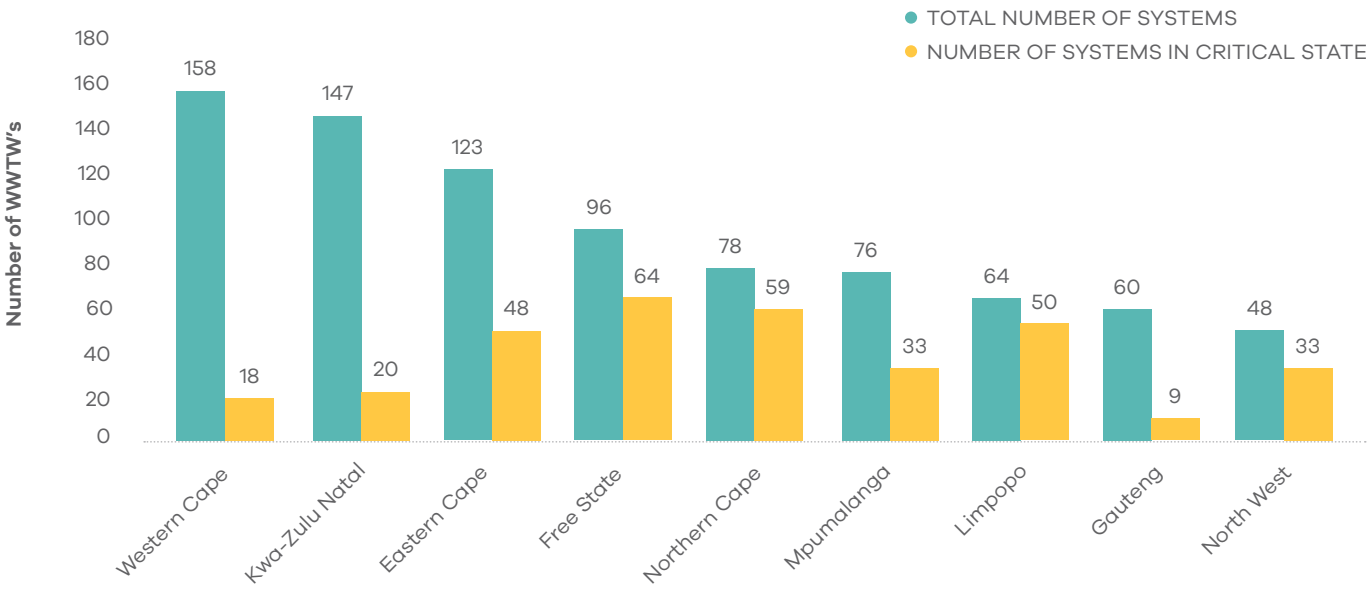


Figure 5: Number of municipal WWTWs in a critical state based on Green Drop assessment 2022

Source: DWS, 2022b

Average scores per key performance area (KPA) for the 850 WWTWs owned by WSAs can be seen in **Figure 6**.

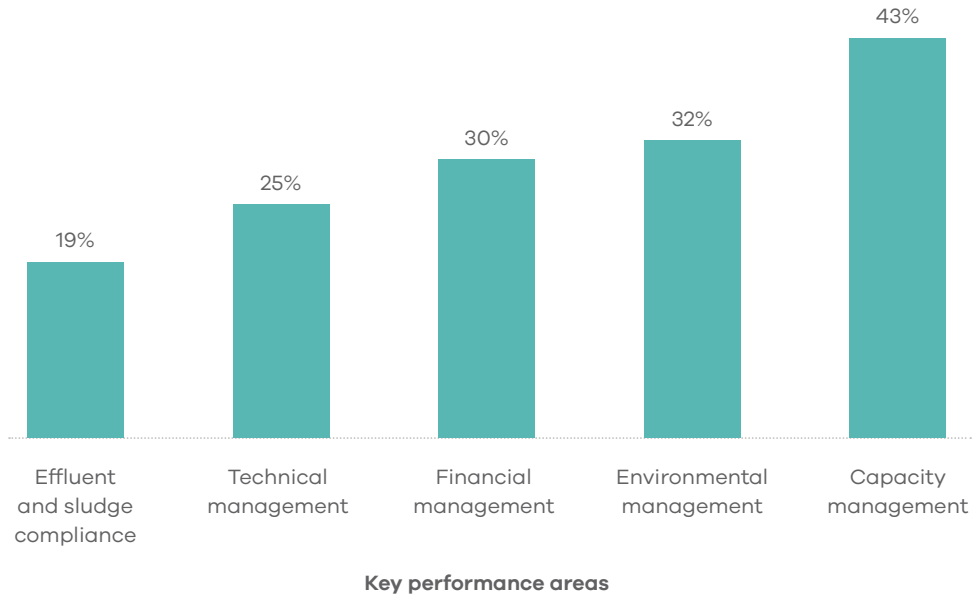


Figure 6: Average 2022 Green Drop score per KPA

Source: DWS, 2022b

Some of the key reasons for WWTWs being categorised as non-compliant include:

- **Effluent and sludge compliance:** Very poor compliance with microbiological, chemical and physical standards for discharge. This can be attributed to a lack of technical skills to monitor and submit data, insufficient equipment and infrastructure to monitor the parameters, and aged infrastructure that requires upgrades.
- **Technical management:** This indicates a lack of continuous monitoring of key parameters that inform operations such as average dry weather flow and chemical oxygen demand, and process audits and inspections not being completed by onsite staff. Audits are imperative to inform functionality of infrastructure and assess the remaining useful life and replacement value for forward planning.
- **Financial management:** Inability of the Water Service Institute (WSI), or Water Board, to determine the actual operation and maintenance costs per wastewater scheme in R/m^3. Poor budget and expenditure management.

The factors above have contributed to 39% of municipal wastewater systems being classified as being in critical state and requiring urgent intervention. Overall, municipalities often struggled to provide adequate wastewater treatment, with plants exceeding their design capacity, a lack of flow monitoring, dysfunctional processes, and rife vandalism.

For further information on the state of the WWTWs in each municipality, refer to the **Green Drop 2022 reports**.

2.3. Water sector funding

The financing of water and sanitation provision is done through tariffs paid by the different groups of users, and subsidies stemming from national and municipal budgets (including grants). Subsidies are used to finance both capital and operational expenditures. The Water Services Act 108 of 1997 stipulates that water economic flux[11] should be ring-fenced, i.e., meaning that all water tariff income is to be used for water related costs only.

The South Africa National Water and Sanitation Master Plan (NWSMP) estimates that there is a significant funding gap with **R898 billion required** to meet the national objectives of universal access to water and sanitation **over the next ten years, and – R565 billion funding available, resulting in R333 billion additional funding required** (DWS, 2018).

A visual presentation of the institutions that are primarily responsible for providing investments in water and sanitation across areas of the water value chain and their current projected funding and financing sources is shown in **Figure 7**.

[11] Water economic flux refers to the flow of money throughout the water value chain.

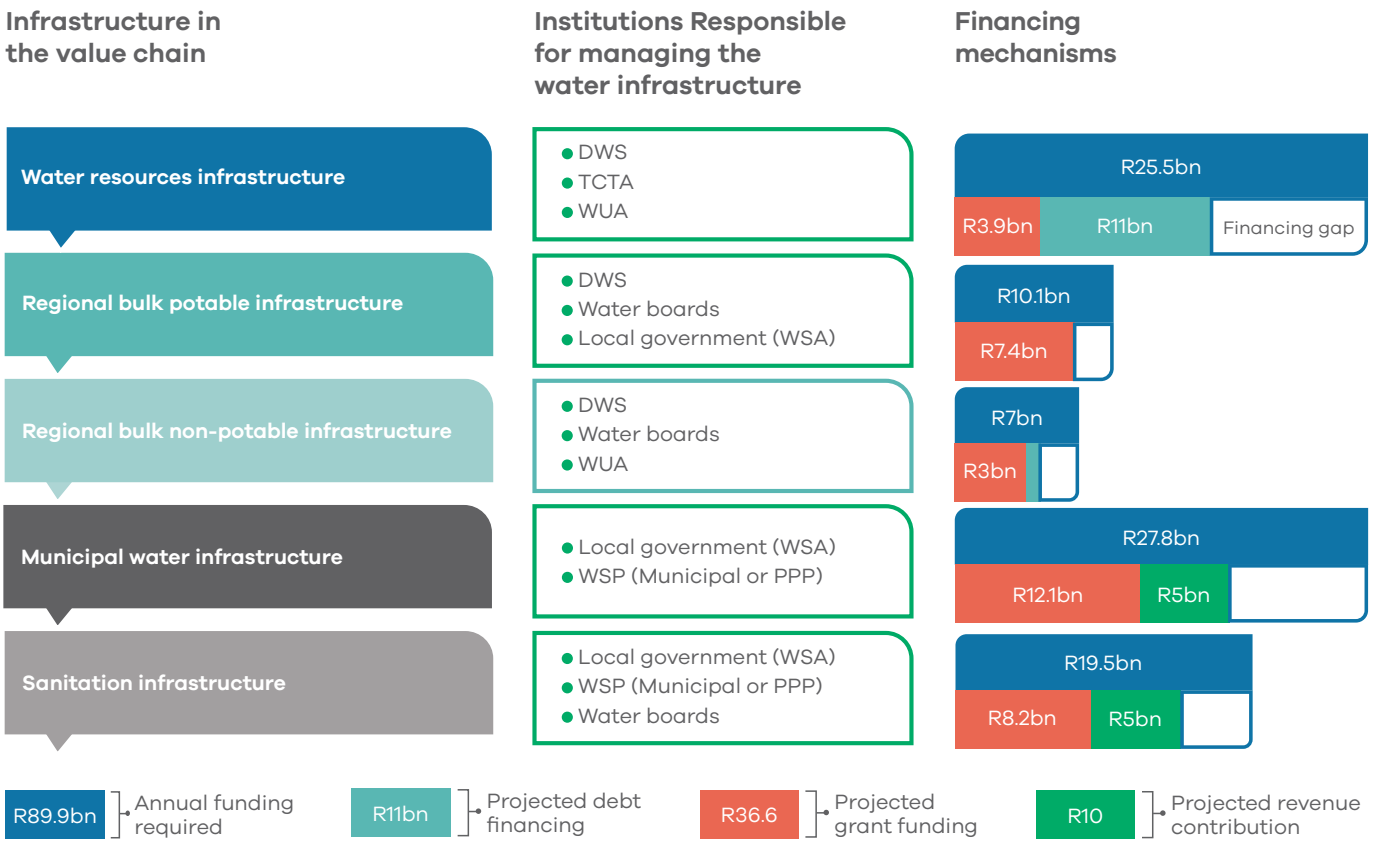


Figure 7: Institutional management of infrastructure in the value chain and financing mechanisms

Source: USAID WASH-FIN, 2020

As shown in Figure 7, there is a large capital investment funding gap for municipal water infrastructure. Municipalities receive funding from:

1. national government in the form of grants;
2. revenue from property taxes; and
3. tariffs from the provision of services such as water and electricity to consumers and solid waste collection.

Tariffs make up 80% of all funding in the water and sanitation sector (at municipal level). However, many municipalities fail to recover operating costs due to the non-payment of services from users and large proportion of households that benefit from the indigent support system (free provision of basic services). In 2020, Statistics SA (StatsSA) reported 2.67 million households as beneficiaries of free water supply (StatsSA, 2022).

As a result, there is limited money available for capital investments, which then has to be covered by government, external grants and the private sector. This represents an opportunity for private investors.

More detailed information on the more immediate funding requirements for water and sanitation infrastructure and services is provided in Table 4.

Table 4: Required, budgeted, and projected public sector funding for water and sanitation infrastructure and services

Source: National Treasury 2023

Funding Need	Revised Estimate 2022/2023 (R bn)	Medium term estimates 2023/2024 (R bn)	Medium term estimates 2024/2025 (R bn)	Medium term estimates 2025/2026 (R bn)	Average year-on-year increase (%)
Community development:	11.6	12.7	13.8	13.9	6.3
Regional and local water and sanitation services (subsidies for basic services)	11.6	12.7	13.8	13.9	6.3
Water and sanitation infrastructure:	33.3	42.6	46.9	54.2	1.6
Water resource and bulk infrastructure	27.5	36.4	40.1	47.4	19.9
Regional Bulk Infrastructure Grant (RBIG)	2.2	2.5	2.9	2.8	7.3
Water Services Infrastructure Grant (WSIG)	3.6	3.7	3.9	4.0	3.4
Total planned public sector funding for water and sanitation	44.9	55.3	60.7	68.1	12.9
Total estimated annual capital requirements (DWS 2019):	90.0	90.0	90.0	90.0	–
Water supply infrastructure	70.0	70.0	70.0	70.0	–
Wastewater infrastructure	20.0	20.0	20.0	20.0	–
Funding shortfall	-45.1	-34.7	-29.3	-21.9	-21.3

It is evident that there will still be a considerable funding shortfall. The expectation is that this shortfall will be filled by channelling infrastructure investment or loan financing to the public sector. Without investment, public sector infrastructure will remain poor. This need for investment opens up the related short- to medium-term opportunities highlighted in **Section 4**.

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POLICIES AND REGULATIONS

This section highlights upcoming changes to key policies and legislation relevant to potential investors, technology providers and financiers. Further information on policies and regulations can be obtained from the 2022 Water Market Intelligence Report[12].

12 The section does not comprehensively cover all relevant legislation; it highlights key information that may be useful to potential investors.

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3.1. Changes in national policies and legislation

Key legislation developments in the pipeline include (DWS Annual Report 2022 (DWS, 2022f)

Amendment to the National Water Act (NWA): The National Water Act 36 of 1998 (NWA) provides the legal framework for the effective and sustainable management of water resources (including surface water and groundwater) by the Department of Water and Sanitation (DWS) on behalf of the national government. The NWA gives DWS the overall responsibility and authority to:

- manage the use of water;
- protect water quality;
- allocate water; and
- promote inclusive water management.

The NWA will be amended to (DWS, 2022f):

- measure impact in long-term projects;
- facilitate the re-allocation of water use through curtailment of existing lawful water users;
- strengthen penalties for environmental non-compliance;
- strengthen protection of strategic water source areas;
- promote equitable access to water and sanitation services to previously disadvantaged groups;
- redress past imbalances; and
- provide a more effective dispute resolution process (DWS, 2022f).

Status: The draft bill is to be released for public comment in the first quarter of 2023, with anticipated submission to parliament at the end of 2023.

Amendment of the Water Services Act (WSA): This act aims to ensure sustainable water supply; and to regulate the provision of water and sanitation services by Water Services Authorities.

The Act is amended to (DWS, 2022f):

- address non-compliance by WSAs and the public in sludge handling, treatment and use;
- prescribe regulatory standards for the quality of drinking water (such as the SANS241); and
- align the governance structure to new policy developments.

Status: The draft bill is to be released for public comment in the first quarter of 2023, with anticipated submission to Parliament at the end of 2023.

Development of the National Water Resources Strategy Edition 3 (NWRS-3): The National Water Resources Strategy (NWRS) is the legal instrument to implement the National Water Act 36 of 1998 and is acknowledged as the main mechanism to manage water across all societal sectors in order to achieve the development goals of the national government. The goal of NWRS-3 is to assist socio-economic development and growth by ensuring water security and enabling equitable access to water and sanitation. The NWRS-3 is a strategy for all sectors and stakeholders who use and impact upon South Africa's water resources. It responds to the NWA by outlining strategic objectives and actions which are then carried forward for resourcing and implementation in the National Water and Sanitation Master Plan (NW&SMP) (DWS, 2022g).

Status: Cabinet has authorised the publication of the NWRS-3 for public comment. Public consultation planning is under way at the time of writing.

National Water Resource Infrastructure Agency Bill (NWRIA): Water infrastructure in South Africa requires large-scale infrastructure and maintenance on existing assets. Due to fiscal constraints, DWS cannot provide the amounts required and it was decided that an agency would be better positioned to raise external funds. The aim of the agency is to raise commercial and development finance, domestically and internationally, and establish public-private partnerships (PPPs) (DWS, 2022i).

Status: The NWRIA Bill should be enacted in the first quarter of 2023, depending on Parliamentary processes.

National Pricing Strategy for Raw Water Use Charges: This pricing strategy provides the framework for the pricing of the use of water from South Africa's water resources, i.e., the use of raw (untreated) water from the water resource and/or supplied from government waterworks, and the discharge of water into a water resource or onto land. Public consultations have been held to determine the pricing strategy for registered businesses abstracting water for commercial purposes.

The charges will be applicable to registered water users within the department, who are abstracting water either from a river or from a government water scheme, including the discharging of water back into the resource. The pricing does not apply to subsistence farming or domestic use.

Status: The revision of this strategy is open for comment at the time of writing.

SANS241 Drinking Water Quality: The South African Bureau of Standards (SABS) together with its Technical Committee 147 – Water (SABS/TC 147) has been working to revise and update the requirements of the national standard for drinking water in South Africa.

The draft seventh edition of the *South African National Standard, SANS 241 – Drinking Water Quality* was opened for public comment and the public enquiry phase ended in June 2022. The finalised standard will be published once due process has been concluded, including responding to the comments submitted by the public. The duration of the process will depend on the nature of the public comments, which may include further stakeholder engagements in the standards development process.

3.2. Regulations that impact on WWTWs and sludge treatment and beneficiation

Key regulatory regulations of note pertaining to WWTWs and sludge treatment and beneficiation include:

- Liquid waste to landfill ban (2019): As of August 2019, the nationwide ban of liquid waste disposal to landfill came into effect as required by the National Norms and Standards for the Disposal of Waste to Landfill (Notice R 636 of Government Gazette No. 36784, 23 August 2013).
- Organic waste landfill restrictions (2027): Objective 3 of Goal 3 of the Western Cape Integrated Waste Management Plan sets waste landfill diversion targets for organic waste (DEADP, 2018). All Western Cape based municipalities, including the City of Cape Town (CoCT), are required to reduce the landfilling of organics as no disposal of organics to landfill will be permitted by 2027.

Other existing regulations, however, are delaying the uptake of beneficiation of sanitation wastes – most notably, the environmental impact assessment (EIA) process required to obtain a waste licence for processing sanitation wastes (considered hazardous if not stabilised). This process takes at least 1.5 years and requires numerous specialist studies that can accrue to millions of rands. The Department of Environment, Forestry and Fisheries (DEFF) has released National Norms and Standards for Organic Waste Treatment (GN1984 of 2022)[13].

[13] Can be accessed here: https://www.dffe.gov.za/sites/default/files/gazetted_notices/nemwa_organicwastetreatmentnormsstandards_g46169gon1984.pdf

These norms and standards set minimum requirements for a wide range of organic waste treatment activities processing more than 10 tonnes per day[14] .

This red tape reduction regulation replaces the need for undertaking a highly onerous, time consuming and costly waste management licence process, which includes undertaking an associated EIA.

One of these requirements is that organisations undertaking the applicable activities must register the activities with the relevant provincial waste authorities. These norms and standards reduce regulatory barriers for organic waste beneficiation.

3.3. Regulations that pertain to municipal procurement

Municipal procurement is regulated by the Municipal Finance Management Act 56 of 2003 (MFMA) and its regulations, including the Municipal Supply Chain Management Regulations (2005). These regulations specify minimum requirements, but municipalities are allowed to apply stricter standards. The MFMA outlines the competitive procurement processes, and unsolicited bids are not encouraged.

Through the Preferential Procurement Policy Framework Act 5 of 2000 (PPPFA) and associated regulations, municipalities could specify criteria to benefit companies with higher Broad-Based Black Economic Empowerment (B-BBEE) scores, exempted micro enterprises (EMEs) and qualifying small business enterprises (QSEs). However, these regulations have been amended in 2022 (Government Gazette No. 47452 dated 4 November 2022).

In the new regulations, municipalities and state organs must determine their own preferential procurement policies in accordance with section 2 of the PPPFA and the thresholds and formula prescribed in the 2022 Regulations. They are also to consider programmes outlined in the Reconstruction and Development Programme (Government Gazette No. 16085 dated 23 November 1994) and provide for points to be awarded for specific goals in the development of procurement policies. For example, they could set criteria to give points to companies with advanced industrialisation, or that sub-contract to local small and medium-sized enterprises (National Treasury, 2022a).

[14] This range is applicable to most types of organic waste treatment, but for the processing of animal matter, these norms and standards apply to facilities processing over 1 tonne per day; for thermal treatment it is applicable to facilities processing over 10 kg per day.

Municipalities are also allowed to issue directives on emergency procurement procedures when a state of disaster has been declared under Section 55(2) of the Disaster Management Act 57 of 2002. For example, to facilitate emergency procurement of water and sanitation services to prevent the spread of COVID-19, DWS established the National Disaster Water Command Centre led by Rand Water, and permitted direct engagement with manufacturers to provide water tanks, ablution blocks, sanitation packs, and related water services to communities without access to these services.

The procurement of services is permitted for a period of up to three years. If a contract is anticipated to extend beyond this three-year limitation, a municipal department must motivate for such an extension to be granted by its municipal council in accordance with the MFMA (Section 33). The process involves inviting comment from national and provincial treasury, relevant national and provincial departments, and the public.

For the provision of services by an external service provider, the Municipal System Act 32 of 2000 (MSA) (Sections 77 and 78) requires a feasibility study to justify the advantage of external over internal service provision. In addition, for public-private partnerships (PPPs), the MFMA (Section 120) requires a bankable feasibility study. **GreenCape complied an industry brief detailing the steps and procedures to access the municipal market.**

OPPORTUNITIES AND BARRIERS

In this section, business and investment opportunities, together with the associated drivers and barriers, are discussed.


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This year's MIR focusses on the opportunities linked to municipal WWTWs. The three key market opportunities highlighted are:

1. upgrades, repair, replacement, maintenance and expansion of public WWTWs infrastructure;
2. beneficiation, reuse and/or recycling of wastewater sludges; and
3. implementation of clean energy technology solutions and energy efficiency infrastructure at municipal WWTWs.

These represent opportunities for technology and service providers, as well as financiers and investors alike. A summary of the key investment opportunities is provided in **Table 5**.

Table 5: Summary of business and investment opportunities in the South African public wastewater treatment sector

Opportunity	Market size indicators	Main opportunities	Market segment
Infrastructure repairs, refurbishments and upgrades at WWTWs.	R8.14 billion in investment required to restore the WWTWs in the country to a functional state[15] The eight metros make up R2.76 billion of the total investment required.	Various market opportunities related to infrastructure refurbishment, repair, replacement, maintenance, and expansion.	Municipalities with an interest in outsourcing operations or introducing performance-based contracts, and/or creditworthy municipalities with the highest efficiencies in terms of capital spending, asset upgrades and spending on repairs and maintenance.
Wastewater sludge beneficiation.	Landfilling of wastewater sludge costs metropolition municipalities across South Africa an estimated R132 million per annum[16].	Wastewater sludge beneficiation[17] including handling, transportation and off-take agreements.	
Implementation of EE and renewable energy interventions at WWTWs.	The capital investment opportunities in EE and optimisation technologies in metropolitian municipalities is estimated to be ~ R1.1 billion[18].	Various market opportunities related to WWTWs including the supply, installation and operation of energy efficient and renewable energy technologies.	

4.1. Opportunities

4.1.1. Public sector wastewater infrastructure

As shown in **Section 2**, 81% of WWTWs in South Africa are failing to meet the required effluent and sludge standards for compliant wastewater treatment.

[15] Based on the Very Rough Order or Magntitude (VROOM) in the 2022 Green Drop reports. This is an estimation of the investment required to upgrade current WWTWs to a functional state. This does not include the investment required to restore treatment works in eThekwini following the April 2022 floods, which is estimated to be in excess of R1 billion.

[16] Assuming a sludge production rate of 0.025% of plant design capacity: sludge dry solids as percentage of influent (tons / m^3 influent / day).

[17] Processing of wastewater sludge into value-added products as a resource recovery opportunity, for example biogas production, fertilisers or soil conditioners and/or biochar.

[18] Excludes biogas projects using sludge.

The 2022 Green Drop reports include a Very Rough Order of Measurement (VROOM) for the capital costs to return each WWTW across the country to a functional condition. A total budget of **≈R8.14 billion** is required nationally to restore the WWTWs' functionality. This presents a number of business and investment opportunities for wastewater **infrastructure refurbishment, repair, replacement, maintenance and extension**. Restoration of the mechanical and civil infrastructure makes up a large part of the cost, requiring approximately 59% and 25%, respectively, of the estimated total VROOM amount. The WSAs in Gauteng have the largest restoration cost requirement, needing approximately ≈R3.18 billion, followed by the Free State and Mpumalanga provinces, requiring ≈R929 million and ≈R833 million, respectively (DWS, 2022b).

The VROOM estimations per province can be seen in **Table 6**.

Table 6: VROOM cost split for civil, mechanical and electrical estimates[19]
Source: DWS 2022b

Province	Civil cost estimate	Mechanical cost estimate	Electrical & Control and Instrumentation cost estimate	Total VROOM cost
Eastern Cape	R294 515 835	R242 203 637	R126 491 187	R653 719 530
Free State	R328 457 457	R353 453 024	R242 232 267	R929 245 540
Gauteng	R310 056 951	R2 378 470 249	R491 324 099	R3 179 851 300
KwaZulu-Natal	R116 714 627	R307 570 031	R83 985 543	R508 270 200
Limpopo	R87 532 528	R185 659 167	R27 255 957	R300 479 100
Mpumalanga	R387 561 894	R333 960 366	R111 213 099	R832 735 300
Northern Cape	R95 339 134	R394 868 531	R17 790 532	R503 962 740
North West	R136 221 671	R250 822 674	R106 645 155	R493 689 500
Western Cape	R234 593 504	R382 167 028	R123 044 804	R739 691 155
Totals	**R1 990 993 601**	**R4 829 174 707**	**R1 329 982 643**	**R8 141 644 365**
% Distribution	**25%**	**59%**	**16%**	**100%**

The 2022/23 Medium Term Revenue and Expenditure Framework (MTREF) stipulates that a capital budget of ~ R23.31 billion had been secured over the MTREF period (2022 – 2025) to address infrastructural needs (National Treasury, 2022b). Some of the VROOM requirements will be addressed through this budget. However, **it is probable that additional funding will be required to address the full VROOM requirements**. In addition to the estimated R8.14 billion to restore wastewater (WW) infrastructure, it is estimated that a total of R1.55 billion will be required by all WSAs, on an annual basis, to maintain their assets. The maintenance estimate is based on the WATCOST-SALGA[20] model that makes provision for maintenance at 2.14%, annually, of the asset value (DWS, 2022b).

The VROOM estimations and key business and investment opportunities in metropolitan municipalities that have favourable audit outcomes are presented in **Table 6**. The metros make up ≈ 35% of the total VROOM estimation. Further information for all provinces can be obtained from the **Green Drop 2022** report.

[19] VROOM estimates in KwaZulu-Natal are expected to be far higher following the flooding events in April 2021, with more than an additional R1 billion required to restore functionality at WWTWs.

[20] A model developed by the Water Research Commission (WRC) and the South African Local Government Association (SALGA) to estimate first-order capital and operating costs of water supply systems.

Table 7 shows that for each metro, wastewater infrastructure investment is required across the treatment train, with particular focus on screens, primary and secondary sedimentation tanks (clarifiers), disinfection units and sludge treatment technologies. Technical site assessments have revealed that a large number of processes are not operating and that municipalities should prioritise maintenance of critical equipment (DWS, 2022b). In some instances, budgets have been secured for upgrades over the next three to five years.

Table 7: VROOM cost estimation and key investment areas for WWTWs at metropolitan municipalities in South Africa

Province	Municipality	Audit findings[21]	Number of WWTWs	Average Green Drop score (%)	VROOM estimate (R'000)	Key investment areas
Gauteng	City of Johannes-burg Metropolitan Municipality	Unqualified opinion (with findings)	6	73	1 978 460	1. Primary and secondary settling tanks 2. Aerators 3. Belt presses 4. Boiler 5. Gas holder
Gauteng	City of Tshwane Metropolitan Municipality	Unqualified opinion (with findings)	16	60	168 000	Zeekoegat WWTW 1. Disinfection units 2. Belt presses 3. Primary and secondary settling tanks 4. Sludge pumps Rooiwal 1. Primary and secondary settling tanks 2. Biological nutrient removal (BNR) reactor 3. Disinfection units
Gauteng	City of Ekurhuleni Metropolitan Municipality	Unqualified opinion (clean audit)	17	86	30 662	1. Civil structure repairs 2. Corrosion to structures 3. Back-up power to critical units during power failure from main feed from the Eskom grid
Western Cape	City of Cape Town Metropolitan Municipality	Unqualified opinion (with findings)	26	88	171 156	1. Flow meters 2. Corrosion of concrete 3. Clogging of fine bubble aerators 4. Chlorination stations

[21] Audit terminology:
Unqualified with findings: The financial statements contain no material misstatements. Unless a clean audit outcome is expressed, findings have been raised on either reporting on predetermined objectives or non-compliance with legislation, or both these aspects.
Unqualified with no findings: The financial statements are free from material misstatements (in other words, a financially unqualified audit opinion) and there are no material findings on reporting on performance objectives or non-compliance with legislation.

Province	Municipality	Audit findings	Number of WWTWs	Green Drop score (%)	VROOM estimate (R'000)	Key investment areas
Free State	Mangaung Metropolitan Municipality	Unqualified opinion (with findings)	15	33	163 778	Bloemspruit WWTW 1. Primary settling and humus tank 2. Dysfunctional mechanical equipment 3. Motor control centre (MCC), screens, flow meters, digesters steam pipes, sludge pumps, electrical components North Eastern WWTW 1. Degritting
KwaZulu-Natal	eThekwini Metropolitan Municipality	Unqualified opinion (with findings)	27	76	136 076	1. Mechanical equipment 2. Belt presses 3. Sludge pumps, aerators, mixers, clarifiers 4. Sludge treatment infrastructure and chemicals
Eastern Cape	Buffalo City Metropolitan Municipality	Qualified		59	111 960	1. Screening 2. Security issues 3. Dysfunctional biofilters 4. Settling tanks 5. Chlorination 6. Anaerobic digestors 7. Sludge drying beds

4.1.2. Sludge beneficiation

The costs associated with managing wastewater sludge represent a large proportion of the total WWTWs plant operating costs, depending on the size of the plant and wastewater characteristics. Wastewater sludge can be derived from a number of sources, such as primary settling tanks and septic tanks.

There are emerging opportunities for the beneficiation of wastewater sludge. However, for the opportunity to have a good business case, the quality and quantity of sludge produced must be consistent. Therefore, the opportunity exists:

a) in well operating WWTWs; and

b) at WWTWs that are restored to become fully functional and are operated efficiently.

In some WWTWs, wastewater infrastructure restoration and/or setting up of new infrastructure is needed to realise the sludge beneficiation opportunity. A summary of sludge treatment technologies currently used in municipal WWTWs can be seen in **Figure 8**.

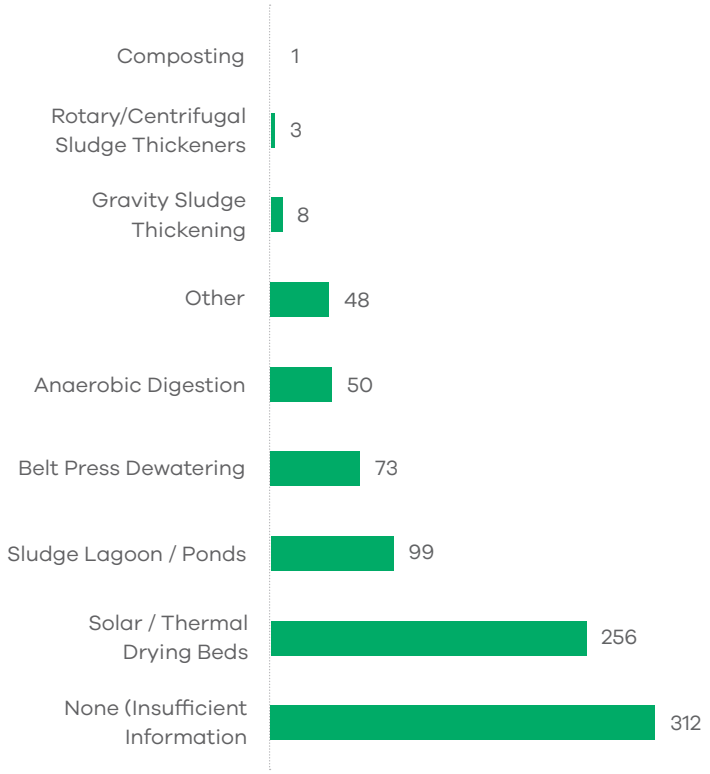

Figure 8: Sludge treatment technologies at municipal WWTWs in South Africa

Source: DWS, 2022b

From the five key performance areas (KPAs) assessed in the Green Drop Report 2022, effluent and sludge quality compliance received the lowest mean score of 19% for all national WWTWs (see **Figure 6** in **Section 2**).

This indicates inadequate sludge treatment, a lack of treatment infrastructure and poor data management with little to no data uploaded into the DWS Integrated Regulatory Information System. It has been noted that effluent and sludge seldom comply with discharge standards.

Following these findings, the next Green Drop report (possibly to be released in 2024/5) will have a deeper focus on sludge treatment and sludge treatment technologies. A summary of the available data on sludge compliance is presented in **Table 8**.

Table 8: Sludge compliance for all provinces in South Africa (DWS, 2022b)

Province	Average Green Drop score for effluent and sludge (%)	Total WWTWs	WWTWs that classify biosolids based on WRC Sludge Guidelines	WWTWs that monitor sludge streams	WWTWs that have sludge management plans	Sludge reuse projects in place
Private institutions	75%	30	6 (20%)	5 (17%)	None	None
Western Cape	55%	158	78 (49%)	47 (30%)	42 (27%)	11 (7%)
Gauteng	42%	60	31 (52%)	39 (65%)	21 (35%)	8 (13%)
KwaZulu-Natal	35%	147	35 (24%)	11 (7%)	21 (14%)	8 (5%)
Mpumalanga	20%	76	17 (22%)	1 (1.3%)	3 (4%)	None
Free State	19%	96	None	None	18 (19%)	None
Eastern Cape	19%	120	26 (21%)	6 (5%)	19 (15%)	None
North West	18%	48	2 (4%)	2 (4%)	1 (2%)	None
Limpopo	16%	64	2 (3%)	7 (11%)	None	None
Northern Cape	9%	78	2 (3%)	None	1 (1.5%)	None

This presents a business opportunity for technology providers that are able to beneficiate wastewater sludge, as municipalities can either independently or through funding from financiers invest in these technologies. Additionally, service providers can provide sludge management services to municipalities or enter into a service level agreement or performance-based contract to generate biogas and supply electrical energy onsite. This opportunity is further supported by the need to achieve energy security and sustainable agriculture (organic fertiliser) across South Africa. An estimation of the sludge produced per day in each province is presented in **Figure 9**.

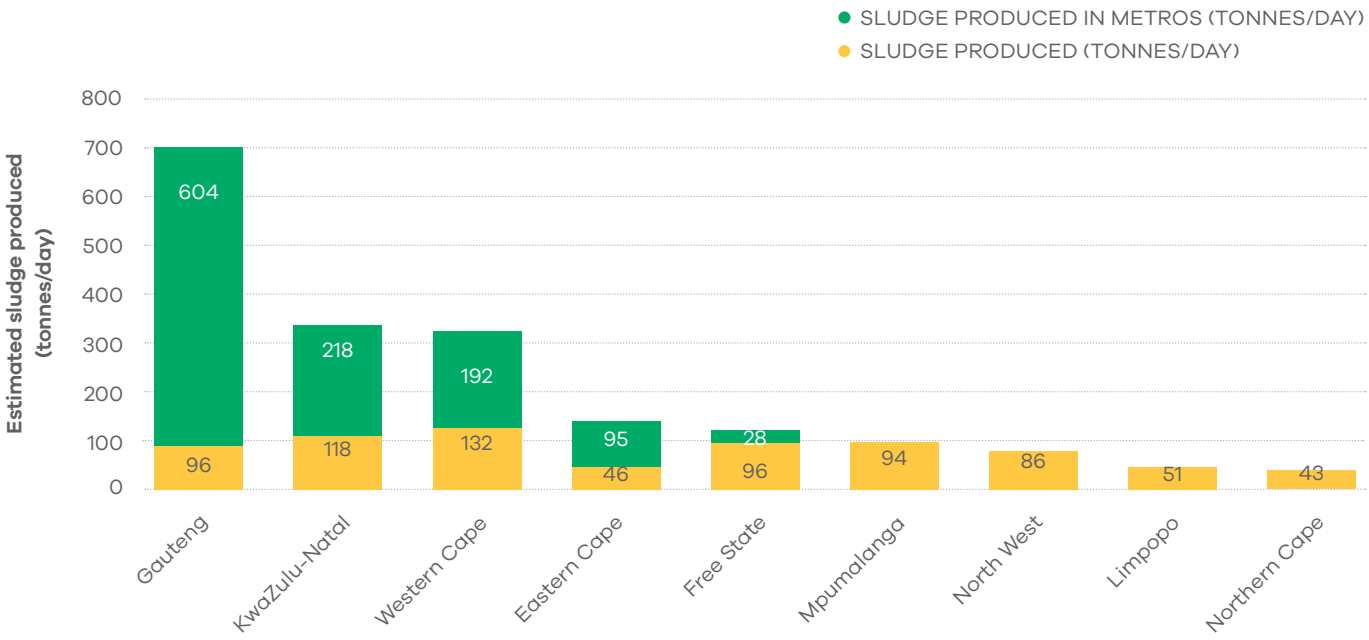

Figure 9: Estimated sludge production across South African provinces (GreenCape analysis based on an estimated sludge production rate)

Total estimated daily sludge production of all the WWTWs combined in the country is **1 900 tonnes per day**[22]. WWTWs in metros produce 60% of the total estimated sludge available nationally. This translates to a spend of about **R100 million**[23] **per annum** by metros for sludge disposal via landfill. Large WWTWs with design capacity of 10 to 25 ML/day and macro with design capacity > 25 ML/day would thus produce sludge at scale and be best placed for potential sludge beneficiation opportunities. The following are the main business and investment opportunities associated with sludge beneficiation that can be implemented:

4.1.2.1. Energy generation

The sustainable treatment of sludge includes electricity generation from biogas. Energy shortages and climate change considerations have increased the appeal to utilise anaerobic digestion for energy recovery and power generation[24]. Although anaerobic digesters make up a significant part of sludge treatment technology in South Africa, many are operating at limited capacity while others face operational issues that restrict biogas production. For this reason, the refurbishment of existing anaerobic digesters and addition of CHP infrastructure is required. There are currently 50 municpial WWTW utilising anaerobic digestion to treat sludge produced.

It is estimated that there is potential to implement 210 MW of installed capacity at WWTWs that show viability for CHP projects (SABIA, 2022).

4.1.2.2. Biofertiliser production

Table 8 shows that there are a limited number of reuse projects in place. Most of the reuse projects are currently underway in metros. There are various other business opportunities relating to sludge beneficiation, such as brick and organic fertiliser manufacturing, that are less complex and may be suitable for smaller municipalities with poor credit worthiness. The value chain can be easily integrated by producing the fertiliser onsite or nearby and supplied to farmers within a few kilometres' radius.

[22] Assuming a sludge production rate of 0.025% of plant design capacity: Sludge dry solids as percentage of influent (tons / m3 influent / day).

[23] Assuming 60% of sludge produced in the eight metropolitan municipalities are sent to landfill.

[24] Anaerobic digestion is a biological process that uses acid forming bacteria to convert organic matter into organic acids which then form a combination of methane and carbon dioxide known as biogas. Biogas can then be used to offset the energy requirements of the WWTWs through the implementation of combined heat and power technology.


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There is a successful project in the City of Tshwane where a third party beneficiates sludge from one of the WWTWs into fertiliser. These opportunities need to be explored on a case-by-case basis as many variables need to be accounted for, such as sludge quality, degree of treatment of sludge, sludge volumes to ensure economies of scale, and (private) off-take agreements.

4.1.2.3. Other products

There are various other innovative products that can be produced from wastewater sludge. Their business case and financial viability will depend on the feedstock (quantity and quality) and availability of a market for such products. The **Industry brief 2021: Circular economy solutions for primary, waste activated and digested wastewater sludge**, written for the CoCT, provides a more detailed description of the beneficiation options available for sludge produced at WWTWs. Examples include:

- energy recovery, such as combustion, anaerobic digestion and bio-diesel;
- agricultural products, such as feed for black soldier fly farmers, fertiliser manufacturers and composters; and
- commercial products, such as bricks and soil enhancers.

4.1.3. Drivers for wastewater infrastructure and sludge beneficiation opportunities

There are several drivers that are common across the wastewater infrastructure and sludge handling opportunities.

Ageing and failing wastewater infrastructure

The historical backlogs in addressing wastewater infrastructure failures and rapid urbanisation are key drivers for new wastewater (WW) infrastructure in South Africa. The operational reality is that ageing WW infrastructure has been stretched due to significant underinvestment and delays in maintenance and renewal. As discussed, the Green Drop 2022 report states that 39% of municipal WWTWs are in a critical state and require urgent intervention. Most municipalities have depleted their capital renewal reserves and are underinvesting in renewal and maintenance of WW infrastructure (DWS, 2018). There are large repair and upgrade backlogs and upgrades in municipal infrastructure, such as treatment works and pump stations.

Operation and maintenance backlog

There are significant maintenance backlogs due to ineffective supply chain management, vandalism and theft, and underinvestment in staff and skills development.

The increased operation and maintenance expenditure associated with ageing WW infrastructure has brought to light the potential lifecycle savings when upgrading or replacing dilapidated infrastructure. Metropolitan municipalities are increasingly considering these long-term savings, where the business case can be proven.

Increased pollution and non-compliance

As per the 2022 Green Drop report, most of the WWTWs discharge non-compliant effluent directly into the environment, making effective treatment critical. DWS is planning to strengthen its role in supporting and intervening in municipalities where water and sanitation services are failing. DWS took over the water service authority (WSA) of some municipalities nationally, as enabled by Section 63(2) of the Water Services Act of 1997, to assume responsibilities for a specific duration and fix wastewater challenges.

Increased cost of sludge handling

Typical sludge handling practices include waste piling, disposal at landfills and outfalls into the ocean. These practices involve logistics and landfill costs which have seen steep price increases, especially due to rising fuel costs. This has resulted in on-site disposal and waste stockpiling becoming the predominant option for sludge disposal at WWTWs.

This has associated risks such as the contamination of water resources through leaching. Municipalities are ultimately liable for large sludge disposal fees (more than R100 million per year in metros), despite the fact that sludge could be regarded as a valuable resource for additional revenue.

Potential for additional revenue stream through sludge beneficiation

Sludge beneficiation is an untapped business opportunity and potential revenue stream for municipalities. There are various circular economy solutions for the beneficiation of sludge, such as energy generation from biogas, heat generation and the recovery of nutrients. As infrastructure is upgraded and the design capacity of plants is increased to match requirements, sludge production will increase substantially. Further to this, the mandate of the National Water Resource Infrastructure Agency (NWRIA) is to develop options to increase the sources of revenue from water and wastewater (DWS, 2022e). This presents an upcoming opportunity for interested service providers offering circular solutions to manage primary and waste activated sludge from municipal WWTWs.

Waste and wastewater discharge regulations

In 2019, all liquid waste was banned from landfill nationally, and in the Western Cape targets have been set to divert organic waste from landfill (targeting 50% diversion by 2022 and 100% by 2027).

These are key drivers for biogas and resource recovery projects at WWTWs. Many WWTWs currently dispose of sewerage sludge at landfills and are looking to find alternative ways to dispose of it. Anaerobic digestion (AD) and biogas generation to power provide a financially viable option, since the beneficiation results in additional revenue and/or cost saving streams that can fund the required upgrades in infrastructure. However, currently these projects are only viable at WWTWs that are ~10 million litres per day (MLD) or larger. AD also results in a higher quality of treated effluent, which helps municipalities comply with standards for disposal. This could reverse the trend of increasing incidences of non-compliance and pollution of water resources linked to municipal WWTWs. Higher quality of treated effluent implies that water reuse projects require fewer additional treatment steps, resulting in lower capital and operational costs for such projects.

Access to global climate funds

In many instances, new technologies have the potential to significantly reduce carbon emissions through improved EE or renewable energy. The ability to trial and roll out newer, more energy efficient or renewable energy technologies at municipal WWTWs can greatly increase the possibility for financing from climate finance initiatives.

4.1.4. Barriers to wastewater infrastructure and sludge beneficiation opportunities

Although public sector water and wastewater projects have been prioritised by National Treasury, and financing opportunities are increasing, significant barriers still exist, as outlined below:

Lack of technical skills and capacity at municipalities

A lack of technical skills and capacity in municipalities to develop feasibility studies and bankable projects as well as to structure appropriate contracts reduces the potential to access funding for projects. Although investors and banks are looking for projects to fund, a pipeline of feasible and well-investigated projects is required to reduce risks and increase investor confidence.

Municipal creditworthiness

Nationally, municipalities and water boards currently owe the DWS ~ R8.5 billion ans R7.6 billion respectively. Municipalities alone owe Eskom and water boards more than R50 billion (Daily Maverick, 2022) and R13 billion, respectively (Auditor-General South Africa, 2022). Municipal-scale projects are capital intensive, and the inability to access funding is a major constraint. According to the Auditor-General's report for 2020/21, irregular, fruitless, wasteful, and unauthorised expenditure totalled R34.58 billion across all municipalities in the country.

WATCH:
CITY OF TSHWANE SLUDGE BENEFICIATION

Thus, only a small number of municipalities (with favourable audit findings) have the capacity and financial standing to access private sector funding or leverage PPPs to enable infrastructure projects.

Limited grant and municipal funding

In areas where the majority of residents are indigent and not able to pay for basic services, municipalities rely on the limited grant funding for new infrastructure, repairs, refurbishment and/or maintenance as well as tariff subsidisation from non-indigent households. Of the 3.6 million identified indigents in South Africa, 2.7 million indigent households have benefited from the free support system for water, while 2.1 million have benefited from free basic electricity provided by municipalities (StatsSA, 2022). The proportion of residents requiring indigent support is expected to further increase due to the deteriorated state of the national economy associated with the COVID-19 pandemic and further constraints on the economy, including a surge in inflation driven by the Russia-Ukraine War. Despite these increasing financial pressures on municipalities, available grant funding is expected to decrease in future rather than increase in line with growth in indigent households. It will be placing even further pressure on municipalities, emphasising the need for private sector funding mechanisms.

Municipality procurement regulations and processes

Municipal procurement processes can be lengthy. Tenders are often poorly specified and legislation can be restrictive, particularly when municipalities wish to trial innovative technologies. Public Private Partnerships (PPPs) in particular are complex, expensive and can take between 8 and 12 years to facilitate.

Based on the above barriers, private sector involvement in the municipal water and sanitation sector has been low to date. To address this, several measures are being put into place, including the following:

- Public-private collaboration agreements with industries, such as mining and agriculture, for the joint funding of infrastructure projects.
- A Water Partnerships Office (WPO) to assist municipalities to contract for PPP and independent water producers (IWPs). The WPO is a ringfenced entity led by the Development Bank of South Africa (DBSA) and assisted by the reforms of the PPP regulatory framework.
- The Sustainable Infrastructure Development and Financial Facility (SIDAFF) is funded by the French Development Agency (AFD) and aims to increase bankable municipalities' access to loan financing for infrastructure projects in order to address the decreasing availability of grant funding;[25]
- DWS has established the National Water Resource Infrastructure Agency (NWRIA) to finance and implement large-scale investments in national water resource infrastructure that are required to ensure that South Africa has sufficient bulk water supply now and in future (DWS, 2022h).

4.1.5. Energy efficiency and renewable energy at municipal WWTWs

WWTWs are large consumers of energy, with water supply and treatment constituting approximately 17% of the total energy consumed by South African municipalities (SALGA, 2020).

Since most WWTWs in South Africa are aged, advances in technology and existing well-proven equipment have raised the potential to improve the EE of WWTWs. **This unlocks several opportunities to supply, install, operate and maintain renewable energy (RE) and EE technology at WWTWs.**

The Green Drop 2022 report notes that 14% of WWTWs have conducted baseline energy audits over the past 2 years, with only 22% of sites being able to report on the specific power consumption (SPC) of the overall plant or of the different steps in the process.

[25] Further information on the Sustainable Infrastructure Development and Financial Facility (SIDAFF) can be obtained from GreenCape (**info@green-cape.co.za**)

Some of the more capacitated WSAs were able to report on the SPC value as the energy consumption (kWh/m^3) or calculate overall costs of treatment (R/m^3).

Limited EE interventions are currently underway, with the majority of the projects occurring in the country's metros. In order to assess the data available, wastewater systems were classified as either basic or advanced depending on the treatment technology employed. A basic system is a treatment works with entry level technology and limited or no mechanical components. An advanced system employs more complex types of technology that comprise of electrical, mechanical and instrumentation components. The SPC values were reported for only 166 advanced systems and 26 basic systems.

It has been noted that the secondary treatment stage, comprising of either trickling filter or aerobic treatment, uses the highest proportion of energy across the different stages of the system. In particular, aerobic treatment such as activated sludge process has a high energy demand, due to the aeration requirements (SALGA, 2020). This means that the largest potential energy savings would be from the implementation of EE and renewable energy in the secondary treatment stage.

In order to identify and assess the opportunities for RE and EE interventions, projects funded by the United Nations Industrial Development Organisation (UNIDO)[26], the Danida Sustainable Infrastructure Finance (DSIF) and the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) are investigating the viability to deploy RE and EE interventions at WWTWs.

For the purposes of the first of these projects, a set of criteria was established to narrow the treatment works with the highest potential to develop feasible, bankable projects. From the information available, the following criteria were selected to be used as a relevant filter when considering RE and EE interventions in WWTWs nationally.

[26] **UNIDO Project ID 190377** – Pipeline development to deploy clean energy technology solutions in municipal WWTWs of South Africa

Table 9: Criteria selection to filter WWTWs for EE and RE interventions

Indicator name	Explanation	Link to EE and renewable energy
System design capacity	System design capacity categorises the WWTW into plant sizes (micro – macro)	Theoretically, the larger the plant size, the more electricity the plant would consume. EE and RE interventions at macro sized plants would have a higher probability of reducing a significant amount of electricity consumption and associated greenhouse gases (GHGs) contributing to total energy consumed by South African municipalities.
Green Drop audit score	The Green Drop score gives a comprehensive understanding of the state of the current WWTW and its management.	Theoretically, the higher the Green Drop score, the better the WWTWs is functioning. This allows for suitable EE and RE interventions to be selected based on the status of operational and technical capacity.
Audit outcome	Municipal audit outcome from the Auditor-General report	The audit outcome is a comprehensive assessment of the financial health of a municipality. A clean audit would allow the municipality to be eligible to access external funding.
Municipality type	There are three types of municipalities in South Africa: metropolitan, district and local	Metropolitan municipalities are larger and generally better equipped to access funding and handle more complex projects.
Treatment technology	A basic system is a treatment works with entry level technology and limited or no mechanical components. An advanced system employs more complex types of technology that comprise of electrical, mechanical and instrumentation components.	Advanced systems are larger consumers of electricity, thus RE and EE projects would have a greater impact as there is more opportunity to reduce the electricity consumption.

Taking the criteria into account, the framework (seen in **Figure 10**) was used to filter the national WWTWs owned by the WSA into a list of systems that would have a higher likelihood of obtaining funding and implementing successful EE and RE projects.

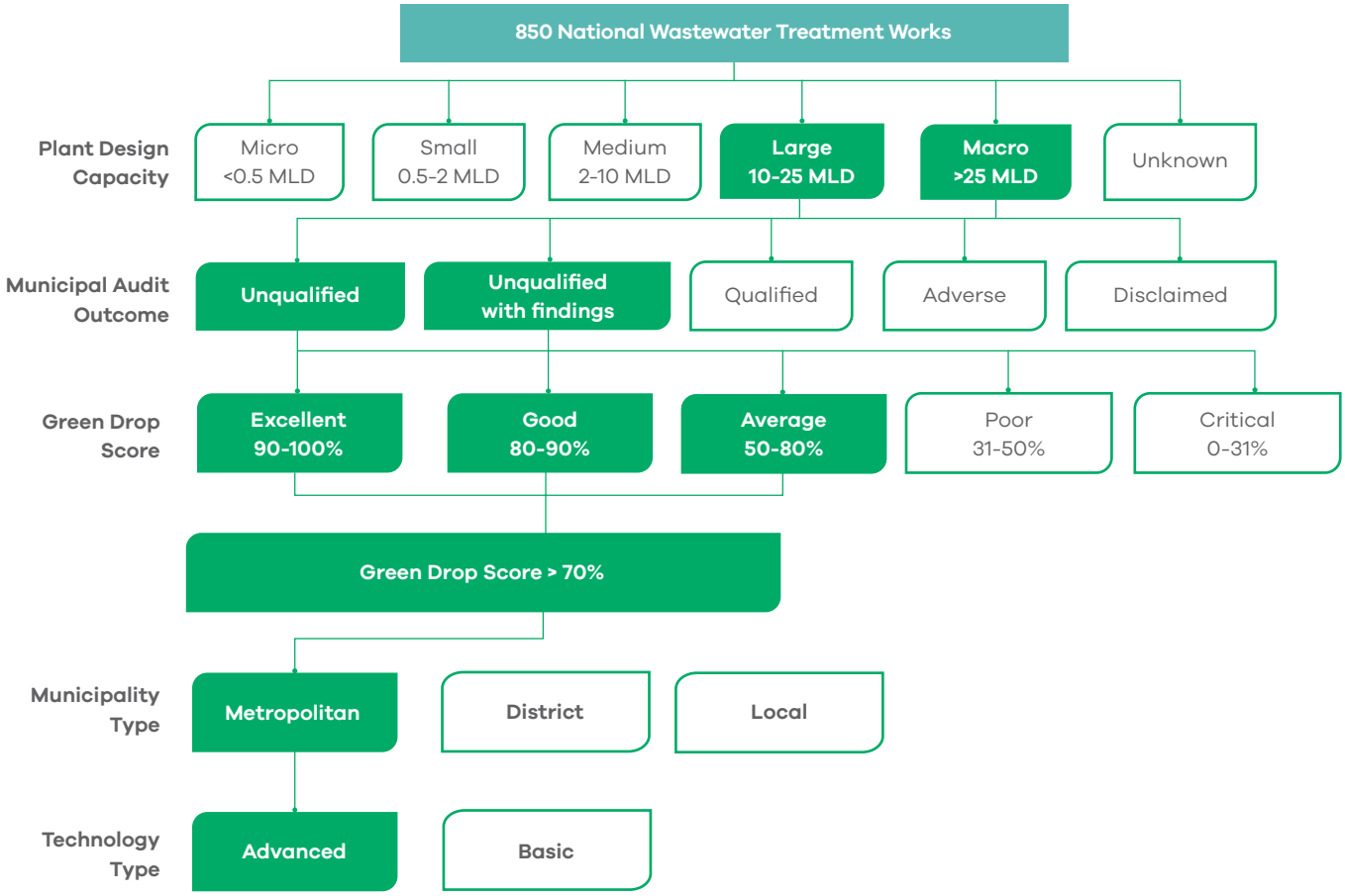

Figure 10: Screening criteria and approach to screening for renewable energy and EE interventions

After filtering all 850 nationwide water services authorities' WWTWs using the above criteria (**Figure 10**), the remaining 34 systems were assessed for their potential for renewable energy and EE interventions based on their system type, technical plant design and specific power consumption (SPC).

The potential EE savings were identified using benchmark SPC values identified in the 2022 Green Drop report, and the plants were mapped against their potential for biogas production and associated use of CHP to generate heat and electricity for onsite consumption.

The plants presented in **Table 10** passed the screening and evaluation outlined above and were deemed feasible for potential CHP projects. The difference between the actual and the benchmark SPC values represent the potential for energy savings through EE interventions.

Table 10: WWTWs that meet criteria for EE and renewable energy implementation and show potential for CHP projects

Province	Municipality	Plant	Biogas potential	Potential electrical power (kWe)	Potential thermal power (kWt)[27]	Actual SPC (kWh/m³)[28]	Benchmark SPC (kWh/m³)	Potential energy savings (%)
Gauteng	City of Ekurhuleni Metropolitan	Hartebeesfontein	Potentially feasible CHP project	606	667	1.02	0.32	69
Western Cape	City of Cape Town Metropolitan	Mitchells Plain	Potentially feasible CHP project	746	821	0.79	0.32	59
Western Cape	City of Cape Town Metropolitan	Cape Flats	Potentially feasible CHP project	2 551	2 806	0.53	0.32	40
Gauteng	City of Ekurhuleni Metropolitan	Olifantsfontein	Potentially feasible CHP project	629	692	0.52	0.32	38
Gauteng	City of Ekurhuleni Metropolitan	Welgedacht	Potentially feasible CHP project	363	399	0.58	0.37	36
Gauteng	City of Johannesburg Metropolitan	Olifantsvlei	Potentially feasible CHP project	1 489	1 638	0.53	0.37	30
Gauteng	City of Johannesburg Metropolitan	Driefontein	Potentially feasible CHP project	328	361	0.52	0.37	29
KwaZulu-Natal	eThekwini Metropolitan	KwaMashu	Potentially feasible CHP project	772	849	0.51	0.37	27
Gauteng	City of Johannesburg Metropolitan	Northern Works	Potentially feasible CHP project	1 848	2 033	0.36	0.29	19
Gauteng	City of Ekurhuleni Metropolitan	Waterval	Potentially feasible CHP project	1 591	1 750	Unknown	0.32	–

[27] Biogas potential, potential electrical power and potential thermal power generation extracted from the Biogas Potential: A Survey of South African Wastewater Treatment Works report completed in 2016 and published by the GIZ GmbH. Available at https://www.sagen.org.za/publications/all-publications/13-assessment-of-biogas-potential-from-wwtp-in-south-africa/file

[28] Actual SPC data available in provincial 2022 Green Drop reports

Province	Municipality	Plant	Biogas potential	Potential electrical power (kWe)	Potential thermal power (kWt)	Actual SPC (kWh/m³)	Benchmark SPC (kWh/m³)	Potential energy savings (%)
KwaZulu-Natal	eThekwini Metro-politan	Northern	Potentially feasible CHP project	713	784	Unknown	0.32	–
Western Cape	City of Cape Town Metro-politan	Athlone	Potentially feasible CHP project	1 042	1 146	0.3	0.37	Actual SPC lower than benchmark by 23%
Gauteng	City of Ekurhuleni Metro-politan	Vlakplaats	Potentially feasible CHP project	599	659	0.1	0.32	Actual SPC lower than benchmark by 220%

The following plants passed the screening and evaluation and were **not** deemed feasible for potential CHP projects:

Table 11: WWTWs that meet criteria for EE and renewable energy implementation but did not show potential for CHP projects

Province	Municipality	Plant	Actual SPC (kWh/m³)	Benchmark SPC (kWh/m³)	Potential energy savings (%)
Western Cape	City of Cape Town Metropolitan	Scottsdene	1.3	0.32	75
Western Cape	City of Cape Town Metropolitan	Kraaifontein	1.44	0.37	74
Western Cape	City of Cape Town Metropolitan	Fisantekraal Wastewater Treatment Plant	1.2	0.37	69
Western Cape	City of Cape Town Metropolitan	Wildevoëlvlei	1.07	0.37	65
Western Cape	City of Cape Town Metropolitan	Bellville	1.04	0.37	64
Gauteng	City of Ekurhuleni Metropolitan	JP Marais WWTW	0.76	0.29	62
KwaZulu-Natal	eThekwini Metropolitan	Umhlatuzana	0.95	0.37	61
Western Cape	City of Cape Town Metropolitan	Zandvliet	0.66	0.29	56
KwaZulu-Natal	eThekwini Metropolitan	Tongaat Central	0.7	0.32	54
Gauteng	City of Ekurhuleni Metropolitan	Daveyton	0.6	0.32	47
KwaZulu-Natal	eThekwini Metropolitan	Phoenix	0.58	0.32	45
Western Cape	City of Cape Town Metropolitan	Borcherds Quarry	0.66	0.37	44
Gauteng	City of Ekurhuleni Metropolitan	Rondebult	0.61	0.37	39
Western Cape	City of Cape Town Metropolitan	Gordon`s Bay	0.59	0.37	37
Gauteng	City of Ekurhuleni Metropolitan	Herbert Bickley	0.39	0.29	26
Gauteng	City of Ekurhuleni Metropolitan	Tsakane	0.37	0.29	22

Province	Municipality	Plant	Actual SPC (kWh/m³)	Benchmark SPC (kWh/m³)	Potential energy savings (%)
KwaZulu-Natal	eThekwini Metropolitan	Umbilo	Unknown	0.32	–
KwaZulu-Natal	eThekwini Metropolitan	Amanzimtoti	Unknown	0.32	–
KwaZulu-Natal	eThekwini Metropolitan	Hammarsdale	Unknown	0.29	–
KwaZulu-Natal	eThekwini Metropolitan	Verulam	Unknown	0.32	–
Western Cape	City of Cape Town Metropolitan	Macassar (Strand)	0.27	0.37	Actual SPC lower than benchmark by 37%

The average SPC for water service authority WWTWs for advanced systems varies from 0.289 to 2.37 kWh/m^3, and for basic systems between 0.07 and 2.94 kWh/m^3. These are reported **as above WWTW industry benchmarks**, thus the opportunity exists to introduce more energy efficient technologies and practices.

To understand where these interventions can be implemented, energy audits are required to create a baseline of the energy consumed in a system. This would allow for improvements to be identified and implemented and for their impact and performance to be evaluated over time.

Energy consumption differs across the different stages of a WWTW, depending on the plant design and specifically the type of installed equipment. Across the system, commonly recommended EE interventions are **alterations to plant design and optimisation**, such as upgrading of pump systems, optimised aeration and maximising gravity feeding. EE interventions for the primary and secondary stages are more targeted towards **energy recovery techniques** and **circular practices**, such as heating and cooling and sludge beneficiation through anaerobic digestion to produce biogas and incineration. A list of potential EE and renewable energy projects that can be implemented in both municipal water and wastewater infrastructure can be seen in the SALGA '**Guideline on Energy Efficiency and Renewable Energy in Municipal Water and Wastewater Infrastructure**' available online[29].

In addition to the interventions listed in the guideline, other EE interventions within buildings' administration blocks can also be performed to reduce overall energy consumption, such as solar water heaters, improving ventilation and energy efficient lighting.

4.1.5.1. Drivers for energy efficiency and renewable energy at municipal WWTWs

The following are the key drivers for EE and renewable energy at municipal WWTWs:

High energy costs and energy insecurity

Increased Eskom electricity tariffs and constrained electricity supply are key drivers to reduce consumption. Electricity consumption (excluding other forms of energy such as liquid fuel for vehicles), makes up ~ 25% of the entire municipality's electricity bill.

[29] This guideline can be accessed online at **https://www.cityenergy.org.za/uploads/resource_264.pdf**

Therefore, the wastewater sector holds large potential to benefit from the investment into clean energy technology to significantly reduce electricity demand. Energy savings of 10% to 30% can be achieved at WWTWs through the implementation of established technologies with payback periods of less than five years (Feng & Ouedraogo, 2012). This would result in a substantial decrease in energy consumption and the associated costs.

National, provincial and municipal water and energy strategies

Already in 2007, the **Energy Security Master Plan** identified water reuse and EE as interventions to improve the country's water and energy security. The 2015 National Energy Efficiency Strategy (NEES) pledged South Africa to achieve a 29% reduction in energy consumption by 2030 based on EE improvements, with a 20% improvement directly from the reduction of energy consumption by municipal services. To support this target, various programmes and strategies have been implemented to support energy usage reduction, such as:

1. The Energy Efficiency Demand Side Management (EEDSM) programme managed by the Department of Energy (now Department of Mineral Resources and Energy)

2. The development of an Energy Service Company (ESCO) to design, construct and operate EE projects managed by the Department of Mineral Resources and Energy (DMRE).

Access to global climate funds and greenhouse gas emission reductions

Technologies that reduce energy consumption and incorporate clean energy have the potential to significantly reduce greenhouse gas emissions when compared to older technologies and the reliance on fossil fuels for energy. There are several international financial institutions that provide technical and financial support to help strengthen capacity and bankability of clean energy projects. This makes EE and renewable energy projects eligible for finance through these climate funds and/or grants.

4.1.5.2. Barriers for energy efficiency and renewable energy at municipal WWTWs

Despite the financial and environmental benefits of EE and RE technologies, there are barriers to their implementation, some of which are the following:

Poorly maintained infrastructure

As discussed, the Green Drop National Report 2022 highlights that 39% of WWTWs nationally are in a critical state. As indicated, this is due to a lack of maintenance, poor planning, a lack of technical expertise and strained municipal finances, amongst other factors. These WWTWs require urgent rehabilitation, with some being completely dysfunctional, which is notably detrimental to the environment. This has resulted in infrastructure upgrades becoming the priority over the implementation of EE and RE interventions. In some cases, EE and RE interventions are only prioritised in well-functioning WWTWs where the technical capacity and financial health of the municipality are strong enough to ensure the success and longevity of the projects.

Limited technical capacity

There is a risk that new infrastructure upgrades may not incorporate EE and RE technologies at municipalities where there is a lack of awareness of the technologies and their associated benefits. Various training programmes have been developed to upskill operational staff and energy management teams, such as the training offered by the Water Institute of Southern Africa (WISA) on the *Energy Efficiency Audit Guideline*, and by the National Cleaner Production Centre South Africa (NCPC-SA) that provides courses in energy management systems and energy systems optimisation, developed in partnership with the United Nations Industrial Development Organisation (UNIDO) (Water Group Holdings, 2020).

Limited procurement pathways and access to funding

Municipal-scale projects are capital intensive, and ability to access funding can be a major constraint. Grant funding for EE and RE projects are limited, and only a small number of municipalities have the capacity and financial standing to access private sector financing or procure infrastructure projects, using public-private partnerships (PPPs), for example.

Municipal procurement processes can be lengthy. Tenders can be poorly specified, and unsolicited bids are typically not entertained. Historically, municipalities have been hesitant to enter into PPPs, which were relatively rare in the South African water sector, and can be complex and difficult to arrange. However, this is changing with reforms in the PPP framework. Furthermore, procurement processes can hinder municipalities' ability to trial innovative technologies and/or conduct in-depth feasibility studies.

FUNDING AND INCENTIVES

A range of general and sector-specific funding solutions and incentives is available to investors, manufacturers, and service companies in the green economy. It covers Development Finance Institutions, local public and private sector financiers and investors, and a considerable range of tax incentives.


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The GreenCape Green Finance Desk (GFD) primarily acts as a facilitator in the financing of green projects and green business. The GFD works across all sector desks at GreenCape. For more support please visit https://www.greencape.co.za/content/sector/green-finance Finance databases

5.1. Finance databases

GreenCape's GFD has compiled and continues to maintain a database of climate finance sources and incentives that could be relevant to companies and projects operating in the South African green economy. A few of the available databases are highlighted below and can be sourced here: https://green-cape.co.za/archives/green-finance-databases/

5.1.1. The Green Economy Climate Finance Database 2022

The database contains information on funding opportunities, the types of funding and institutions providing the funding, and contact details. This includes information on national market players (e.g. commercial banks, microfinance banks, private equity/debt, venture capital, angel investors etc.), as well as international climate finance streams (e.g. climate funds, DFIs, multilateral institutions, bilateral development partners) and domestic sources of finance. The Green Economy Climate Finance Database 2022 analysed ~150 financing solutions valued at ~R25 billion.

The database is ideal for any entity seeking a broad range of funding solutions and financial incentives, with a largely South African focus.

Bilateral development partners, local and international development finance institutions, and government departments/agencies make up the majority of the active financing stakeholders. Still, climate funds, commercial banks, private equity/debt, and venture capital make up most of the capital value available in the database.

Across the more than 150 climate finance opportunities, eight different financial products are available:

Debt [commercial (listed and unlisted) and concessional (listed and unlisted)] – A debt evidenced by a note which specifies, in particular, the principal amount, interest rate, and date of repayment at below-market rates. The concessionality can be achieved either through interest rates below those prevailing on the market, longer maturity or grace periods, or a combination of those.

Venture capital (limited) – Equity capital can be provided at various stages of funding rounds. Common funding rounds include early-stage seed funding in high-potential, growth companies and growth funding.

Mezzanine finance – Subordinated debt or preferred equity instrument representing a claim on a company's assets that is senior only to that of the common shares. Mezzanine financings can be structured either as debt or preferred stock.

Equity – A stock or any other security representing an ownership interest.

Guarantees and Risk Mitigation Instruments (RMIs) – RMIs facilitate access to debt and equity financing by mitigating and transferring risks from project sponsors and private lenders to third parties. Common instruments applied include contractual arrangements, joint ventures, insurance and guarantees.

Grants (very small "ticket size") – Transfers made in cash, goods or services for which no repayment is required.

Government spend – Government development finance or budget spend.

Finance products are available for almost all the sectors (biggest gaps remain in adaptation-focused and new and emerging sectors).

Still, as expected, clean energy is the focus of most of the tracked financial offerings, including energy efficiency and demand-side management and mobility/storage.

How to use the Green Economy Climate Finance Database 2022:

Each sheet is broken down into types of sources of climate finance (public, private and blended). These are covered by the government (local and international), development finance institutions, commercial and others. The diagram below details the five steps you can follow to filter the dataset for the best possible outcome.

STEP 01

Select the relevant source of finance sheet

STEP 02

Sort sheet by sector:

- Clean energy
- Energy efficiency & demand side management
- Low carbon transport
- Water conservation, supply & demand
- Agriculture, food production, fisheries and forestry
- Circular Economy
- Buildings and the built environment
- Material substitution
- General eco-system support
- Cross-sectoral

STEP 03

Sort sheet by investment instrument:

- Grant
- Concessional debt
- Debt / mezzanine debt
- Working capital
- Equity
- Budget expenditure
- Other

STEP 04

Check alignment of the size of investment and investment opportunity information.

STEP 05

Contact relevant financiers (including high-level ask, market size estimate and basic company track record).

For further information and support on any of the content provided here, please get in touch with GreenCape's Climate Finance team at **finance@greencape.co.za**

Additional resources on improving green economy financial resilience are available from: Government Funding and Incentives Database An updated document focused on government funding and incentives is available to view and download **here.**

5.1.2. Allied Crowds Database

This database is ideal for any entity seeking a broad range of financial solutions.

"**AlliedCrowds** is the first complete aggregator and directory of alternative finance providers in the developing world. We help donors, investors, and entrepreneurs navigate the alternative finance space through our reports, data, and Capital Finder, increasing the flow of capital to deserving projects globally."

Sign up to use the Capital Finder is free and allows users to access a global database where you can filter for a sector (including greentech, agriculture and social impact), type of capital (equity, lending, grant) and type of funding (crowdfunding, angel investing, venture capital, impact investing). The Entrepreneur Hub provides important tools and assistance for start-ups, including writing business plans and financial resources.

- In addition, themed databases around the Sustainable Development Goals (SDGs) and the World Green Economy Organization (WGEO) are found **here**. You can also contact Allied Crowds to create a customised funding database for you.
- An Alternative Finance glossary can be found.

ALLIED CROWDS WEBSITE

5.1.3. Finfind Database

Access to finance is the number one challenge experienced by SMEs - Finfind has been specifically developed to address this problem. Finfind is innovative, online access to finance solution that brings the providers and seekers of SME finance with a focus on finance readiness. Finfind has over 250 lenders and almost 500 loan products available to SMEs, and each lender's listing and loan product information are kept up to date daily. This database is ideal for South African SMMEs seeking funding and business advisory services or upskill themselves on finance matters.

FINFIND WEBSITE

5.1.4. RECP Database

The Africa-EU Renewable Energy Cooperation Programme (RECP) is a multi-donor programme that supports the development of markets for renewable energy in Africa. It was launched by more than 35 African and European Ministers and Commissioners under the Africa-EU Energy Partnership (AEEP).

Aside from the Finance Database, the site also hosts the Finance Catalyst, an advisory service geared towards African projects. This is supplemented with market intelligence (including RE potential, country-specific regulatory framework and key stakeholders). This database is ideal for renewable energy project developers looking to work in Africa.

RECP DATABASE

5.1.5. Government Funding and Incentives Database

An updated document focused on South African government funding and incentives is available to view and download online. These incentives cover local manufacturing, critical infrastructure grants, small enterprise development and a diverse set of sector specific incentives (i.e. Aquaculture Development and Enhancement Programme).

GOVERNMENT FUNDING AND INCENTIVE BOOKLET

5.2. South African Climate Finance Landscape

The South African Climate Finance Landscape looks at detailed project-level green economy finance data, understanding source, disbursement, instrument and use. The insights can support public and private role-players with information to shape sectoral strategies and selected policies and improve coherence and coordination between public and private level spending in the sectors. The South African Climate Finance Landscape has tracked R62.2 billion in annual climate finance invested in SA.

ACCESS TO THE SOUTH AFRICAN CLIMATE FINANCE LANDSCAPE

GREEN FINANCE DATABASE

5.3. Further funding sources

Click the buttons below to access the different funding sources.

SA INSTITUTIONS PROVIDING FUNDING FOR ENTREPRENEURS

SA BUSINESS FUNDING DIRECTORY 2016/17

THE GREEN OUTCOMES FUND

GREENCAPE'S SUPPORT TO BUSINESSES AND INVESTORS

GreenCape is a non-profit organisation that works at the interface of business, government and academia to identify and remove barriers to economically viable green economy infrastructure solutions. Our vision is a thriving prosperous Africa, mobilised by the green economy.

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City of Cape Town

Working in developing countries, GreenCape catalyses the replication and large-scale uptake of green economy solutions to enable each country and its citizens to prosper. We work with businesses, investors, academia and government to help unlock the investment and employment potential of greentech and services, and to support a transition to a resilient green economy.

We assist businesses by removing barriers to their establishment and growth and provide our members with:

- free, credible and impartial market information and insights;
- access to networks of key players in government, industry, finance and academia;
- an advocacy platform to help create an enabling policy and regulatory environment for green business.

We assist local, provincial and national government to build a resilient green economy by providing:

- support on the development of standards, regulations, tools and policies
- expert technical knowledge on key sectors in the green economy;
- access to networks of key players across business, academia, and internationally

Since inception in 2010, GreenCape has grown to a multi-disciplinary team of over 40 staff members, representing backgrounds in finance, engineering, environmental science and economics.

Our market intelligence reports form part of a working body of information generated by sector desks and projects within GreenCape's three main programmes – energy, circular economy and resources.

Benefits of becoming a GreenCape member

We currently have over 3 050 members, and offer free membership. Becoming a member of GreenCape will give you access to the latest information regarding developments in the various sectors; access to tools, reports, and project information; and offer you the opportunity – through our networking events – to meet and interact with various stakeholders in the green economy.

We have facilitated and supported ~R42 billion of investments in renewable energy projects and manufacturing. From these investments, more than 19 000 jobs have been created.

Through our WISP (industrial symbiosis) programme, by connecting businesses with waste / under-used resources:

435 000 fossil GHG emissions saved (equivalent to the electrical usage of 117 840 households in SA);

Over R150 million in financial benefits (additional revenue, cost savings and private investments);

398 economy wide jobs.

135 00 tonnes of waste diverted from landfill

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