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WISA Inspiring Passion For Water
The official magazine of the Water Institute of Southern Africa

Water & Sanitation Africa

Complete water resource and wastewater management

School sanitation solutions that go beyond the toilet block

Mendy Shozi, project manager, BORDA South Africa

INDUSTRY INSIGHT

REGISTER OR FACE PROSECUTION: THE 90-DAY DEADLINE EVERY BUSINESS NEEDS TO KNOW ABOUT

WRC champions citizen science for a changing climate

SANS 241 HAS CHANGED, WHAT IT MEANS FOR YOU

NANOTECHNOLOGY: SMALL TECH, BIG HELP

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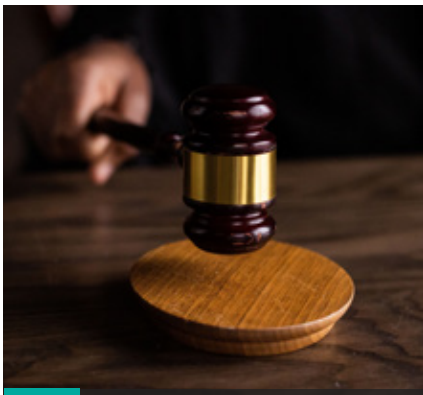

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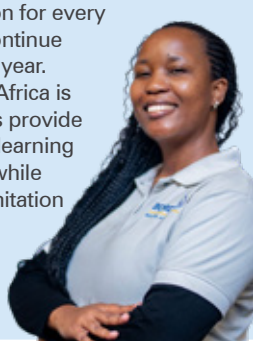
INDUSTRY INSIGHT

Youth Month may have ended, but our commitment to safe, dignified school sanitation for every learner must continue throughout the year. BORDA South Africa is helping schools provide safer, healthier learning environments while showcasing sanitation solutions that can be scaled across South Africa. **P12**



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- Mine Water Lead
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- Modelling and Data Division

EMPOWERMENT PLATFORMS
- Women In Water
- Young Water Professionals

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Beyond the SAFE backlog

The deaths of children such as Michael Komape and Lumka Mketwa shocked South Africa and exposed the deadly reality of unsafe school sanitation. In response, the Department of Basic Education launched the Sanitation Appropriate for Education (SAFE) initiative in 2018 to eradicate dangerous pit toilets in public schools.

Government has now announced that all 3 372 schools identified in the original SAFE audit have received safe and appropriate sanitation facilities. But they have been very careful with their wording. They have not claimed that every pit toilet has disappeared. Minister Siviwe Gwarube herself acknowledged that schools omitted from the audit, new sanitation failures and deteriorating infrastructure still exist

The SAFE programme has faced criticism over the years, with concerns that the original audit did not capture every school in need and that sanitation infrastructure continues to deteriorate as schools grow, systems fail and maintenance falls behind. Completing the SAFE backlog does not mean South Africa has solved its school sanitation crisis.

Because a toilet is only as good as the water flowing into it, the cleaner maintaining it and the budget available to keep it operational.

Over the years, **Water&Sanitation Africa** has published a multitude of school sanitation articles, and one story in particular stayed with me. At Ivory Park Primary School, learners lost around 40 days of teaching because ongoing water shortages left toilets unusable and disrupted learning. As principal Poppy Ngwenya told us, without water, a school cannot function. The lesson is simple: sanitation and water security cannot be treated as separate issues.

Equally compelling is our feature on BORDA South Africa, which highlights another challenge that receives far less attention. Many no-fee schools simply do not have the resources to maintain sanitation facilities. Once textbooks, utilities and other essential expenses have been paid, there is often little money left for cleaning materials, repairs or cleaners. Even the best infrastructure will fail without a realistic operations and maintenance budget. In fact, the Department of Education has placed a moratorium on appointing new cleaners.

There is little point in buying textbooks and stationery if the toilets are not functioning, causing a school to close or if learners are getting sick from dirty toilets.

What are we telling our children when school toilets become so filthy that relieving themselves in the veld seems like the better option?

The irony is that solutions already exist. Waterless and low-water sanitation technologies have advanced significantly in recent years. Properly designed urine-diverting dry toilets and other decentralised systems can provide safe, hygienic and sustainable sanitation where water supplies are unreliable. As our feature on BORDA demonstrates, these systems can even recover valuable resources while reducing pressure on scarce water supplies.

Not every school requires the same solution. The Department of Basic Education should embrace a wider range of fit-for-purpose sanitation technologies instead of relying primarily on conventional flush systems. In water-scarce communities, resilient waterless options should become part of the mainstream conversation, not the exception.

The next SAFE chapter must be about functionality, sustainability and dignity.

Success should not be measured by the number of toilets built. It should be measured by whether every learner can use a clean, safe and functioning toilet every single day.

Our children deserve nothing less. ●

Kirsten

COVER OPPORTUNITY

In each issue, **Water&Sanitation Africa** offers companies the opportunity to get to the front of the line by placing a company, product or service on the front cover of the magazine. Buying this position will afford the advertiser the cover story and maximum exposure. For more information, contact Sindi Moni on +27 (0)82 212 4574, or email sindi@infrastructurenews.co.za.

You said it in *WASA*

The opinions and statements shared by thought leaders in the water industry to **Water&Sanitation Africa.**

"Because a toilet is only as good as the maintenance it receives, the person cleaning it and the budget available to keep it safe, functional and dignified." **Kirsten Kelly, editor, Water&Sanitation Africa Magazine**

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"At its heart, democracy is built on trust. It depends on citizens believing that institutions, and those entrusted to lead them, will act in the public interest. Elections determine who is given the opportunity to lead. Governance determines whether that opportunity is used to create lasting value for society." **Dr Lester Goldman, CEO, WISA**

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"In a sector characterised by fragmentation across institutions and spheres of government, WISA provides a common professional home that supports competence, ethics and continuous learning." **Dr Harisson Pienaar, chairman, WISA**

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"Citizen science has always existed, long before we gave it a name or built digital platforms around it. In many African communities, grandmothers assessed the colour of the river, the taste of the water, the movement of birds, and the flowering of certain plants to read the coming of rain or drought. Farmers measured seasons in the lines on the land and the health of their crops, mothers judged whether fish or vegetables were safe to eat, and elders tracked changes in rivers, wetlands, and soils across generations. This was systematic observation, interpretation, and sharing of environmental knowledge embedded in daily life – in other words, citizen science. What we are doing now with weather stations, WhatsApp groups, and formal training is not inventing something new, but recognising, valuing, and amplifying a practice that has always been there: communities as active observers, interpreters, and custodians of their own environment." **Dr. Jennifer Molwantwa, CEO, Water Research Commission (WRC)**

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"Addressing school sanitation requires more than infrastructure alone. It demands collaboration, education, community ownership and long-term planning. As South Africa continues to tackle the challenge of providing safe and dignified sanitation at schools, BORDA's integrated approach offers a practical and scalable model. By combining decentralised wastewater treatment, hygiene education, resource recovery and local capacity building, the organisation is helping schools create safer, healthier and more resilient learning environments for current and future generations."**Mendy Shozi, project manager, BORDA South Africa**

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"BVi Engineering understands that municipalities are failing on operations, and has responded with a deliberate, responsible engineering shift. By moving from advanced mechanical processes to nature-based general limit treatment systems accepted by Department of Water and Sanitation, BVi is delivering infrastructure that municipalities can actually operate. **Wynand Smit, associate, Bvi Consulting Engineers Central**

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"Property owners, developers and businesses need to rethink their reliance on traditional septic tanks, as these outdated systems are quietly contaminating groundwater and threatening long-term water resilience." **Gerhard Cronje, owner, Maskam Water**

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"Nanotechnology can greatly improve water monitoring. If you are concerned about metals in water, you can develop nanosensors that not only detect metals but also give you concentration data. If you are concerned about chemicals in water, there are nanosensors for that, too. An easy-to-use, immediately helpful nanosensor that changes colour when exposed to certain pollutants can help identify problems faster." **Professor Phiiliswa Nosizo Nomngongo, the South African Research Chair (SARChI) in nanotechnology from the University of Johannesbur**

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"When the company was established in 2016, South Africa relied almost entirely on imported activated carbon, exposing municipalities and industry to fluctuating exchange rates, shipping delays and supply chain disruptions. Today, Rotocarb supplies more than 300 customers with locally manufactured activated carbon, providing greater supply security while supporting local beneficiation." **Richard Oldnall, business development manager, Rotocarb**

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"The revised standard is ultimately designed to support more targeted and cost-effective monitoring. Instead of routinely testing every possible parameter, the risk-based approach focuses resources on the parameters that pose a credible risk to a specific supply system. This means that entities with a strong understanding of their systems and good historical data may not see a significant increase in monitoring costs over the long term. In some cases, costs could even decrease as unnecessary or repetitive testing is reduced. However, systems with limited data, weak monitoring programmes or poor operational control may initially face increased expenditure as additional sampling, risk assessments and monitoring programmes are implemented to close information gaps." **Mariette Swart, water quality specialist at Rand Water and part of the South African Bureau of Standards (SABS) national committee – SABS/TC147, Water**

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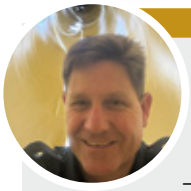

"Most trenchless technologies have distance limitations of up to a few hundred meters. Therefore, Corrocoat adopted another trenchless technology – pipe pigging – that can work across distances as long as 30 km. In terms of trenchless technologies, this is a quantum leap forward. Corrocoat South Africa has become a global centre of expertise for pipe pigging operations and have completed well over a hundred pigging contracts in different countries." **Louis Pretorius, managing director, Corrocoat South Africa**

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"For engineers designing the next generation of treatment facilities, selecting fit-for-purpose pumping solutions is essential to achieving efficient, reliable and sustainable operations. By enabling accurate chemical dosing, robust handling of difficult media and improved operational monitoring, modern pump technologies are helping transform wastewater into a valuable and reusable water resource, while safeguarding freshwater sources." **Darryl Macdougall, managing director, Verder Pumps South Africa**

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"Historically, mobile plants were often viewed as temporary solutions, but that perception is changing. Today, they are increasingly being integrated into long-term water strategies as permanent decentralised infrastructure in underserved areas. In some cases, modular plants are even being deployed alongside traditional infrastructure, creating hybrid systems that combine stability with flexibility. Africa's water future will not be solved by a single approach. Large-scale infrastructure will always have a role to play. But it is becoming increasingly clear that flexibility, speed, and mobility must be part of the equation. Modular, rental water treatment plants deliver exactly that." **Chris Ashmore, CEO Watericon**

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WRC CHAMPIONS CITIZEN SCIENCE FOR A CHANGING CLIMATE

As extreme weather events become more frequent, the Water Research Commission (WRC) and the South African Weather Service (SAWS) are harnessing citizen science to improve local weather monitoring, strengthen early warning systems, and help vulnerable communities better prepare for climate-related disasters.

Dr Jennifer Molwantwa, CEO, Water Research Council (WRC)

The WRC-funded project, led by SAWS in collaboration with researchers from the University of KwaZulu-Natal and the University of Cape Town, examined how citizen science can support early warning systems for weather- and climate-related hazards. The three-year project was implemented in five climate-vulnerable communities: Cofimvaba in the Eastern Cape, Swayimane in KwaZulu-Natal, Malamulele in Limpopo, Cullinan in Gauteng, and Manenberg in the Western Cape.

Michael Mengistu, lead scientist at South African Weather Service (SAWS)

The initiative culminated in a World Environment Day celebration at the Albertina Sisulu Science Centre in Cofimvaba, Eastern Cape, where citizen scientists were honoured for their contributions to climate monitoring and environmental stewardship.

According to project leader Michael Mengistu, lead scientist at SAWS, the initiative was driven by a simple reality: climate change impacts are felt most acutely at the community level, particularly among poor and marginalised populations. Recent floods in KwaZulu-Natal and the Eastern Cape, along with recurring droughts across the country, have

highlighted communities' vulnerability to extreme weather events.

The project therefore sought to place communities at the centre of climate resilience efforts.

"We issue warnings from the South African Weather Service. We need to make sure that the information we issue reaches all members of the community, including communities and citizen scientists," Mengistu explains.

Testing citizen weather stations

One of the project's primary objectives was to assess the reliability of low-cost citizen weather stations by comparing them with SAWS' professional monitoring equipment. These affordable weather stations can be operated by community members, thereby expanding weather observation networks into areas with limited formal infrastructure.

Citizen scientists were trained to install and operate the stations, collect weather data, and interpret climate information. The stations provide near-real-time observations that complement existing monitoring networks and contribute valuable local data for forecasting and verification.

Importantly, the project was not only about technology. It focused equally on building climate literacy, helping communities understand weather forecasts, recognise climate risks, and respond appropriately when warnings are issued.

A comparison between the CWS stations at the SAWS Irene office (left) and the CWS station at Malamulele (EPP Mhinga Highschool)

Co-designing early warning systems

A key feature of the initiative was its collaborative approach. Rather than imposing a solution on communities, researchers worked alongside citizen scientists to co-design community-based early warning systems. Through workshops and engagement sessions, participants identified local hazards, analysed climate trends, evaluated communication channels and assessed response capabilities.

The process centred on four interconnected elements of effective early warning systems:

- Disaster risk knowledge
- Detection, monitoring and forecasting
- Warning dissemination and communication
- Preparedness and response capabilities

Across all five sites, WhatsApp emerged as the preferred platform for sharing weather alerts and impact-based warnings. Dedicated groups were established to distribute warnings issued by SAWS, enabling citizen scientists to rapidly share information within their communities.

This approach reflects a growing recognition that effective early warning systems depend as much on communication and trust as they do on scientific forecasting.

Installation of CWS station at Leadership College in Manenberg, Cape Town

Bridging science and indigenous knowledge

One of the most innovative aspects of the project was its integration of indigenous knowledge systems with conventional meteorological science.

Workshops at the five study sites documented local environmental indicators that communities have traditionally used to predict weather. In Cofimvaba, for example, the appearance of southern ground hornbills, swallows, and hadedas was associated with approaching rainfall, while a red-tinged moon was believed to signal strong winds.

Researchers found that these traditional indicators remain valuable, especially when paired with scientific forecasting. However, many participants noted that climate change is undermining the reliability of long-standing environmental

Learners from schools involved in the project presented practical initiatives that address both climate adaptation and environmental sustainability

cues, underscoring the need to preserve indigenous knowledge while adapting to changing conditions.

The project demonstrated that integrating local knowledge with scientific information can improve hazard awareness, strengthen trust in warnings and encourage community participation in climate adaptation efforts.

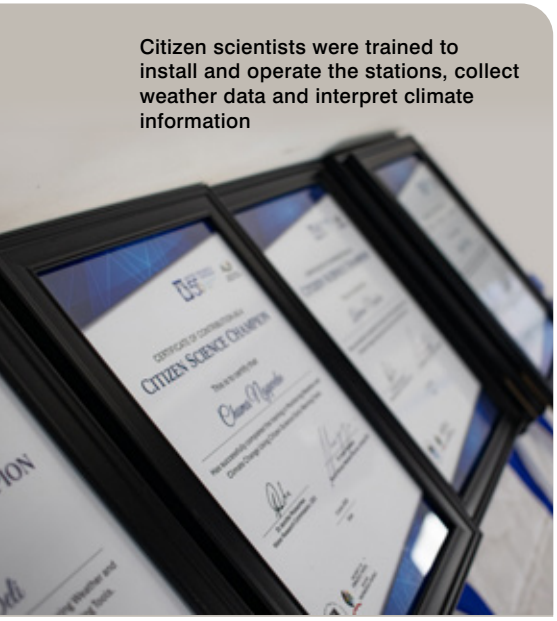
Young people leading local action

The World Environment Day event also highlighted the role of young people in advancing environmental action.

Learners from schools involved in the project presented practical initiatives that address both climate adaptation and environmental sustainability. At Rainbow Preparatory Academy in Cofimvaba, learners established vegetable gardens using discarded tyres and plastic containers after discovering that many households struggled to grow food in the area's rocky soils. The project has since expanded into community outreach and environmental education programmes.

Other learners presented research on climate change impacts, food security and sustainable agriculture, demonstrating how citizen science can inspire environmental leadership among the next generation.

Their presentations reinforced an important message: climate resilience is not solely the responsibility of scientists, governments or institutions. Communities themselves have a critical role to play.



Citizen scientists were trained to install and operate the stations, collect weather data and interpret climate information

Building resilience from the ground up

The World Environment Day celebration recognised citizen scientists as more than data collectors. They are climate ambassadors, trusted communicators, and local champions of resilience.

The initiative aligns with global calls for inclusive climate action and supports several Sustainable Development Goals, including SDG 6 (Clean Water and Sanitation), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).

For the WRC and SAWS, the project has shown that citizen science can significantly strengthen climate monitoring and early warning systems, particularly in data-scarce and underserved areas. Researchers now recommend scaling up similar initiatives nationally and supporting them with long-term funding, technical assistance, and stronger integration with existing disaster risk management programs.

"Often, the right solution does not rest with scientists alone. It rests with the people who live in the environment. Better decisions require better data and information, and citizen science helps us fill important gaps while strengthening environmental stewardship within communities. By combining indigenous and local knowledge with modern tools such as citizen weather stations, our communities are turning everyday wisdom into practical climate intelligence. That is not just science – it is wisdom in action," says Dr Jennifer Molwantwa, CEO, WRC.

She concludes: "Citizen science has always existed, long before we gave it a name or built digital platforms around it. In many African communities, grandmothers assessed the colour of the river, the taste of the water, the movement of birds, and the flowering of certain plants to read the coming of rain or drought. Farmers measured seasons by the lines on the land and the health of their crops; mothers judged whether fish or vegetables were safe to eat; and elders tracked changes in rivers, wetlands, and soils across generations. This was systematic observation, interpretation, and sharing of environmental knowledge embedded in daily life – in other words, citizen science. What we are doing now with weather stations, WhatsApp groups, and formal training is not inventing something new but recognising, valuing, and amplifying a practice that has always been there: communities as active observers, interpreters, and custodians of their own environment."

As South Africa faces an increasingly uncertain climate future, the project offers a powerful lesson: resilience begins with informed and empowered communities. By placing weather stations, climate knowledge, and early warning tools directly in the hands of citizens, the initiative demonstrates that local action can meaningfully contribute to national climate resilience and sustainable development.

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BEYOND ELECTIONS: LEADERSHIP, GOVERNANCE AND SERVICE

Recent reports of increased voter registration among South Africa's youth have generated considerable discussion. While much of the conversation will understandably focus on what this means for the future, there is another perspective worth considering – one that extends beyond elections and speaks to leadership, governance and the responsibility of service.

By Dr Lester Goldman, CEO, WISA

At its heart, democracy is built on trust. It depends on citizens believing that institutions, and those entrusted to lead them, will act in the public interest. Elections determine who is given the opportunity to lead. Governance determines whether that opportunity is used to create lasting value for society.

The growing participation of young people should be welcomed. It reflects a willingness to engage in shaping the future rather than simply observing it. For me, this is not abstract – my own daughter, at 20, will be voting for the first time in the upcoming local government elections. Her participation is a reminder that the decisions made today will be lived by future generations long after current leaders have moved on. That reality places a responsibility on all who hold positions of influence, regardless of sector or profession.

Leadership is often spoken about in terms of authority, responsibility or achievement. Yet at its core, leadership is an act of service. Whether in government, business, academia, professional bodies or civil society, leadership carries an obligation to place the long-term interests of institutions and communities ahead of individual interests. It requires stewardship, accountability and a commitment to leaving organisations stronger than they were found.

This is where governance becomes so important. Good governance creates the conditions for trust, consistency and resilience. It provides the framework within which organisations can fulfil their purpose, make sound decisions and remain focused on those they serve. With good governance, institutions are not only able to adapt and improve, but also to seize opportunities, innovate and create lasting value for society.

Perhaps the greatest test of leadership is not what is achieved during a term of office, but what remains afterwards.

Strong institutions are built over time through ethical conduct, sound decision-making and capable leadership. They require leaders who understand that success lies in creating opportunities for others.

This principle is particularly important in sectors that provide essential services. In the water sector, the opportunities created by strong leadership and governance are especially visible. Water security, sanitation, environmental protection and public confidence all depend on institutions that are well governed, professionally led and supported by competent and committed professionals.

Leadership matters. Governance matters. Strong institutions matter.

As South Africa continues its democratic journey, perhaps the most important question is not who occupies positions of leadership, but how those positions are exercised. Leadership grounded in integrity, accountability, stewardship and service strengthens trust and creates enduring value.

The increasing engagement of young South Africans provide an opportunity for reflection and renewal. Future generations will inherit the institutions we build, the systems we strengthen and the foundations we lay today. They will benefit from the opportunities created by our choices and the investments we make in capable, ethical and resilient institutions.

Our collective responsibility is therefore clear: to lead with purpose, govern with integrity and serve with humility. Because leadership is not about position. Governance is not about power. Both are ultimately about service.

STRENGTHENING YOUTH PATHWAYS THROUGH WATER: THE STRATEGIC ROLE OF WISA

If South Africa is to build a more inclusive and opportunity-rich future for its youth, it must invest in institutions that bridge policy, practice and people. WISA plays a leading role in developing skills, fostering professional excellence and creating career pathways that translate water resource management into long-term employment opportunities. **By Dr Harrison Pienaar, chairman, WISA**

WISA occupies a unique position within the water value chain. As a voluntary professional body representing practitioners across engineering, science, operations, regulation and management, it functions as both a convenor and a standard-setter.

In a sector characterised by fragmentation across institutions and spheres of government, WISA provides a common professional home that supports competence, ethics and continuous learning. This role aligns closely with national priorities articulated in the recent budget vote address by the Minister of Water and Sanitation, Pemmy Majodina, which emphasise institutional capability, infrastructure recovery and skills development as foundations for service delivery.

Young Water Professionals

Through its Young Water Professionals (YWP) network, mentorship initiatives, technical events and knowledge platforms, the institute creates structured spaces where students and early-career professionals can engage with experienced practitioners, employers and policymakers. These engagements are not abstract. They expose young professionals to real-world challenges such as wastewater system failures, climate resilience planning and regulatory compliance, while helping them understand the competencies required to build credible careers.

Professional recognition, continuous professional development and ethical standards are precisely the mechanisms that turn temporary placements into sustainable careers. By supporting professional registration and lifelong learning, WISA helps ensure that youth employment in the water sector is not precarious, but progressive.

WISA's conferences, technical divisions and knowledge-sharing platforms disseminate emerging research, case studies and best practice on water reuse, resource recovery and nature-based solutions. In doing so, the institute helps prepare young professionals for the future of the sector, rather than the systems of the past.

WISA's role also aligns with the service delivery and governance priorities set out in Vote 41 of the 2026/2027 National Budget. Strengthening municipalities, improving operational performance and sustaining infrastructure all depend on human capability. By working collaboratively with government departments, water boards, regulators, academia and the private sector, WISA acts as a bridge between policy intent and implementation reality. For young people, this means clearer career pathways, exposure to diverse roles and the opportunity to contribute meaningfully to national development.

As South Africa marks the end of Youth Month, the importance of institutions that invest in people becomes unmistakable. Water resource management is not only about pipes, plants and policies; it is about professionals equipped to steward a scarce and vital resource. Through its commitment to skills development, professional excellence and sectoral collaboration, WISA plays a decisive role in ensuring that water becomes both a source of life and a source of livelihoods. In doing so, it helps transform the challenge of water insecurity into an opportunity for youth empowerment, economic resilience and a more sustainable future for the country. ●

AYEYE PROCESS CONTROLLERS AYEYE!

uMngeni-uThukela Water (UUW), in partnership with the Water Institute of Southern Africa (WISA), hosted the inaugural KZN Process Controller Day at the Durban ICC under the theme "Empowered Process Controllers – Guardians of Our Water Future."

The event brought together process controllers, engineers, scientists, young practitioners and water sector stakeholders from across South Africa to recognise the vital role Process Controllers play in protecting public health, maintaining water quality and ensuring the reliable operation of water and wastewater treatment facilities.

Opening the conference, UUW chairperson Adv. Khuzwayo and WISA CEO Dr Lester Goldman paid tribute to the dedication and professionalism of process controllers, describing them as the frontline custodians of water quality and environmental protection. The keynote address, "The Backbone of Water Security – The Process Controller's Role in Sustainable Water Management", reinforced the need for continued investment in skills development, operational excellence and innovation.

Over two days, delegates participated in technical presentations, workshops, panel discussions and knowledge-sharing sessions focused on strengthening professional development and improving operational performance. Discussions highlighted the critical contribution process controllers make to treatment efficiency, regulatory compliance and the delivery of safe drinking water.

Technology and innovation featured prominently throughout the programme. A session on smart monitoring tools and data interpretation encouraged delegates to embrace digital technologies and data-driven decision-making to optimise plant performance. Another presentation explored how process controllers can move beyond operating plants to become innovators and problem-solvers who drive improvements in wastewater treatment and sanitation.

Climate resilience was another key focus. Delegates examined how changing raw water quality and increasingly unpredictable weather patterns are affecting treatment processes and discussed the essential role process controllers play in maintaining reliable services under challenging conditions. The conference also reinforced the importance of implementing Regulation 3630 and maintaining high standards across water and wastewater treatment facilities.

Interactive panel discussions and question-and-answer sessions provided a platform for delegates to share operational experiences, discuss challenges and exchange practical solutions. These conversations promoted collaboration, mentorship and peer learning while encouraging the next generation of Process Controllers to pursue leadership opportunities within the sector.

Beyond the technical programme, exhibition stands and networking sessions enabled delegates to engage with technology providers, industry partners and sector leaders, creating valuable opportunities for collaboration.

The event concluded with a gala dinner and process controller excellence awards, celebrating outstanding achievements across categories including best rural/urban plant process controller, innovation in operations, outstanding young process controller, women in water leadership and lifetime achievement. The awards recognised the dedication and expertise of process controllers whose work is fundamental to delivering safe, reliable water services to communities.

The inaugural KZN Process Controller Day reinforced the importance of professionalisation, innovation, mentorship and continuous learning within South Africa's water sector. Through initiatives such as these, UUW and WISA continue to strengthen the profession and invest in the people who safeguard one of the country's most essential resources.

Congratulations to all the award winners and to every process controller whose commitment ensures communities receive safe, quality drinking water every day.

SCHOOL SANITATION SOLUTIONS *that go beyond the toilet block*

Youth Month may have ended, but our commitment to safe, dignified school sanitation for every learner must continue throughout the year. In this article, Kirsten Kelly investigates how BORDA is helping schools provide safer, healthier learning environments while showcasing sanitation solutions that can be scaled across South Africa.

Operating in 14 countries in the African and Asian continents, the Bremen Overseas Research and Development Association (BORDA) is a renowned specialist organisation dedicated to addressing key global challenges such as wastewater treatment, poverty reduction and sustainable resource conservation.

BORDA has supported the construction of more than 3 000 Decentralised Wastewater Treatment Systems (DEWATS) globally, improving the living conditions of more than one million people. Many of these systems have been implemented in African countries where conventional sewer infrastructure is either unavailable or unaffordable. Of all the globally implemented DEWATS, 10% have been built in schools, representing the second biggest application group after residential use.

The DEWATS system is a small-scale approach to on-site sanitation treatment, designed to safely manage wastewater close to where it is generated. Unlike conventional sewerage systems that rely on extensive pipe networks and large centralised treatment works, DEWATS uses a series of nature-based and engineered treatment processes to remove contaminants from wastewater. DEWATS systems are particularly well suited to schools and rural communities because they are robust, energy-efficient, require relatively low maintenance and can operate independently of large municipal infrastructure networks. They are gravitational, require no electricity or chemicals.

In South Africa, a portion of BORDA's funded projects directly addresses one of South Africa's most persistent school infrastructure challenges: providing safe, dignified and sustainable sanitation where conventional sewer networks are unavailable or unaffordable. School sanitation remains a critical issue in South Africa, where inadequate sanitation facilities can affect learner health, safety, dignity and educational outcomes.

Sarasvati Primary School

Sarasvati Primary School in Tongaat, KwaZulu-Natal, was one of BORDA South Africa's earliest school sanitation projects. In partnership with eThekwini Water and Sanitation, the Department of Education and the University of KwaZulu-Natal, BORDA installed an 11-seat toilet block linked to a DEWATS, incorporating rainwater harvesting, biogas production and treated wastewater reuse for food gardens. Designed to treat 5 m^3 of wastewater per day, the project demonstrated a circular economy approach to school sanitation.

Although biogas production was lower than anticipated, the sanitation system proved highly successful. When the school later experienced vandalism, storm damage, water shortages and electricity outages, the largely underground DEWATS continued operating because its concrete construction made it resistant to theft and damage. More than a decade after commissioning, the system remained operational, highlighting the resilience of decentralised sanitation in challenging environments.

Speaking at a BORDA school sanitation breakfast, the school's principal explained that no-fee schools receive limited funding for infrastructure maintenance after essential educational costs are

Alongside the infrastructure improvements, BORDA recognises that long-term success depends on behavioural change. BORDA has facilitated a number of WASH awareness sessions with learners

Learners also received reusable sanitary pads donated by Leafline Washable Sanitary Wear to support menstrual health and dignity

covered. Combined with a moratorium on appointing cleaners, many schools struggle to maintain sanitation facilities, leaving teachers and school management to manage cleaning, repairs and maintenance with limited resources.

Julukandoda Primary School

Located in KwaDulela, KwaZulu-Natal, Julukandoda Primary School serves approximately 900 learners. The area is far from the city centre and is characterised by poverty, with many of the learners living off social grants and feeding schemes.

Pit toilets combined with frequent water shortages posed daily risks to learners. In many cases, these facilities are self-built or constructed without adhering to appropriate engineering and safety standards. As a result, the structures can be unstable, with weakened slabs, inadequate foundations or poorly covered pits. Beyond the immediate safety risks, poorly constructed pit toilets can also expose users to disease-causing pathogens, unpleasant odours and unhygienic conditions, undermining the dignity, health and wellbeing of learners.

To address this challenge, BORDA was approached by University of KwaZulu-Natal (through the RUNRESs project) to design a biological treatment system that would suit the schools need. Other partners involved uMngeni-uThukela Water CSI who funded parts of the project, the Swiss Agency for Development and Cooperation, ETH Zurich, the KwaZulu-Natal Department of Education and uMngeni Local Municipality. Aligned with the Department of Basic Education's Norms and Standards for School Infrastructure, the project combines low-flush urine-diversion toilets with a BORDA-designed Decentralised Wastewater Treatment System (DEWATS) that treats wastewater and recovers valuable water and nutrients for reuse.

At Julukandoda Primary School, wastewater from the sanitation facilities is treated and converted into effluent that can be safely used for irrigation. The recovered water and nutrients support the cultivation of crops and fruit trees, creating a sustainable food production system while reducing the environmental impact of wastewater disposal. The project also produces tree seedlings that are distributed to learners and the surrounding community, extending its benefits beyond the school grounds.

BORDA is continuing to monitor and evaluate the DEWATS to ensure its long-term performance.

Siyalungelwa Senior Secondary

Siyalungelwa Senior Secondary School, located in the Newcastle Local Municipality of KwaZulu-Natal, demonstrates BORDA South Africa's integrated approach to school sanitation. Rather than simply replacing toilets, the project combines safe water, sanitation infrastructure, hygiene education and long-term wastewater management to create a sustainable WASH solution for the school community.

The initiative began in last year after BORDA was invited by the South African Local Government Association (SALGA) KwaZulu-Natal to support Mandela Day activities at the school. Initial work focused on understanding the site's existing infrastructure through an environmental screening study, septic tank assessment and geotechnical investigations to inform the next phase of development. At the same time, the school's borehole was rehabilitated to restore a reliable supply of safe drinking water.

Phase 1 centred on providing learners with modern, water-efficient sanitation facilities. Prefabricated toilet and handwashing modules, designed and installed by Isidima Design and Development, were fitted with Arumloo low-flush toilets, marking the first collaboration between BORDA and Arumloo on a school sanitation project. The innovative 'Arumloo Ablution' system uses less than one-third of the water required by conventional school pit latrines while costing less than one-third to construct, offering a climate-resilient solution that can be installed in just a few days.

The first phase was officially handed over to the school on 14 May 2026. As

The new Sobonakhona High School toilet block for girls

1 Operations and maintenance training for the rehabilitated borehole, equipping school staff and the School Governing Body with the knowledge needed to manage the water supply

2 At Julukandoda Primary School, treated wastewater is reused to irrigate crops and fruit trees, recovering valuable water and nutrients while supporting sustainable food production

part of the handover, OneVoice South Africa facilitated WASH awareness sessions for learners and the School Governing Body to promote good hygiene practices and ensure the long-term care of the new facilities. Learners also received reusable sanitary pads donated by Leafline Washable Sanitary Wear to support menstrual health and dignity.

Sustainability has remained central to the project. In June, Isidima Design and Development conducted operations and maintenance training for the rehabilitated borehole, equipping school staff and the School Governing Body with the knowledge needed to manage the water supply. Representatives from BORDA and the Department of Education attended the training, reinforcing the importance of local ownership and long-term maintenance.

Phase 2 will complete the sanitation service chain through the construction of a BORDA-designed decentralised wastewater treatment system (DEWATS). The treatment plant will manage all wastewater generated on site, creating a fully integrated sanitation system that reduces environmental impacts while providing a resilient solution for schools located beyond conventional sewer networks. Construction is scheduled to begin in July 2026.

Sobonakhona High School

Sobonakhona High School, located in the peri-urban Adams Mission area within eThekwini Municipality, is another example of BORDA South Africa's commitment to delivering integrated water, sanitation and hygiene (WASH) solutions in schools where conventional municipal services are limited. The school has long struggled with an unreliable municipal water supply and has no connection to the municipal sewer network, making alternative sanitation solutions essential.

BORDA's first priority was to improve the school's water security by installing a solar-powered borehole system to supplement the unreliable municipal supply. This provides learners and staff with a dependable source of water while reducing the school's reliance on an inconsistent reticulation network. Existing male and female learner ablution blocks were also refurbished, with outdated toilet pedestals replaced by Eazi-flush Envirosan toilets to significantly reduce water consumption. New handwashing facilities were installed both inside and outside the ablution blocks to improve hygiene and encourage regular handwashing.

Recognising that sanitation extends beyond toilets, BORDA is implementing a complete wastewater management solution. The existing septic tank will be refurbished to provide a reliable backup treatment option, while a new BORDA-designed decentralised wastewater treatment system (DEWATS) will be constructed to treat all wastewater generated on site. The DEWATS is necessary because the existing septic tank cannot accommodate the increased wastewater volumes resulting from the improved water supply, upgraded ablution facilities and additional handwashing stations. Once completed, the system will provide the school with a sustainable, on-site wastewater treatment solution independent of municipal sewer infrastructure.

Alongside the infrastructure improvements, BORDA recognises that long-term success depends on behavioural change. OneVoice South Africa facilitated WASH awareness sessions with Grade 8 to 11 learners, focusing on water conservation, responsible use of the new facilities, proper hygiene practices and the importance of maintaining clean sanitation infrastructure. By combining improved infrastructure with education and community ownership, the project aims to create a resilient sanitation system that can serve the school for many years while providing learners with a safer, healthier and more dignified learning environment.

Together, these initiatives demonstrate that addressing school sanitation requires more than infrastructure alone. It demands collaboration, education, community ownership and long-term planning. As South Africa continues to tackle the challenge of providing safe and dignified sanitation at schools, BORDA's integrated approach offers a practical and scalable model. By combining decentralised wastewater treatment, hygiene education, resource recovery and local capacity building, the organisation is helping schools create safer, healthier and more resilient learning environments for current and future generations.

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THE RESILIENT PIVOT:

Why South Africa's small towns are returning to nature-based wastewater treatment

Aerial view: Existing Warrenton WWTW with Warrenton and Ikhutseng township in the background

The drive to modernise South African municipal sanitation infrastructure has historically gravitated towards complex, highly mechanised wastewater treatment technologies. On the ground, experience tells us a different story: engineering excellence is measured not by mechanical sophistication, but by operational resilience within its socio-economic context.

By Wynand Smit, associate, Bvi Consulting Engineers Central

In the Northern Cape's Magareng Local Municipality, this paradigm shift is transitioning from theory into execution. BVi Consulting Engineers is advancing the conceptual design and implementation framework for the relocation of the Magareng wastewater treatment works (WWTW) in Warrenton, featuring a deliberate, engineered return to oxidation ponds integrated with an artificial constructed wetland polishing stage.

Wynand Smit,
Bvi Consulting Engineers Central

Not a single Northern Cape municipality achieved the ≥90% minimum for Green Drop Certification. The Dawid Kruiper Local Municipality leads the province with just 68%, a score that would be classed as average performance nationally. Fourteen of twenty-six water service authorities (WSAs) regressed from their 2021 baselines.

- **National:** 396 systems in critical state or disqualified (was 334 in 2021)
- **National:** 14 Greendrop certifications awarded, down from 22 in 2021
- **Northern Cape:** 0 certifications for the 3rd consecutive audit cycle

- **Northern Cape:** 65 / 75 systems in critical state (31%), up from 59 in 2021
- **Northern Cape:** A 81.1% cumulative risk rating (CRR), persistently high risk (89.7% in 2021)
- **Northern Cape:** A 40% technical site assessment average upon physical inspection

The image comes together more clearly in the case study of the Warrenton WWTW

2024 Green Drop score: 6.2% (5% in 2021, 34% in 2013)

Critical risk rating: 88.2% unchanged 2022–2023–2024

- **Environmental management key performance area:** 0.0%
- **Technical key performance area:** 4.5%
- **Effluent compliance:** 0 % Microbiological • Chemical • Physical
- **Discharge:** zero treatment compliance for Vaal River discharge

The Green Drop inspector also confirmed that of the four Pasveer Ditch aerators, only one was fully operational. Two had failed motors; one had a broken V-belt. The clarifier scum draw-off was non-functional, the outflow meter was broken, and the inflow appeared blackish-septic. No sludge age, mixed liquor suspended solids, or recycle ratios were monitored. This is not an isolated incident; it is the predictable endpoint of deploying a mechanically intensive, energy-dependent process into a context that cannot sustain it.

Why advanced packages fail in rural contexts

The Green Drop report is unambiguous about root causes: not simply underfunding, but governance failures, mechanical maintenance collapse, severe shortages of qualified process controllers, and unsustainable electricity costs. In rural areas, three structural vulnerabilities make advanced treatment systems a predictable mismatch:

- **Energy insecurity:** Continuous high-kilowatt aeration cycles are incompatible with load-shedding and grid instability.
- **Skills gap:** Optimal sludge age management, return activated sludge/waste activated sludge rate control, and dissolved oxygen sensor calibration require specialist process engineers that smaller municipalities cannot recruit or retain.
- **Supply chain:** Aeration turbines, dissolved oxygen probes, and chlorination systems face months-long procurement lead times in remote areas, leading to direct bypasses and raw sewage discharge.

True engineering excellence matches process configurations to available

ABOUT BVi CONSULTING

- Established in 1967, BVi has grown from a small engineering consultancy into a multidisciplinary engineering and infrastructure solutions company with a footprint across South Africa and the SADC region.
- BVi is a Level 1 B-BBEE company with 55% black ownership.
- The company employs more than 300 professionals and provides services to both public and private sector clients.
- Core disciplines include civil, structural, electrical and mechanical engineering, as well as project and programme management and Engineering, Procurement and Construction Management (EPCM) services.
- BVi has offices throughout South Africa, as well as a presence in Lesotho, Namibia and Mozambique.
- The company is active in a wide range of sectors including water, transport, energy, mining, agriculture, property development and public infrastructure.
- BVi's water portfolio includes dams, bulk water pipelines, reservoirs, rural water supply schemes and river protection projects.
- The company has experience across the full project lifecycle, from feasibility studies and planning through to design, procurement, construction management and implementation.
- BVi has completed numerous projects across Africa and continues to expand its international footprint.
- Its motto is: "Big enough to make a difference, small enough to care."

Warrenton N12 Pumpstation: Raw sewage overflows from a collapsed pump station structure, spreading across open veld while municipal officials stand powerless beside it

Close aerial: Warrenton WWTW showing the Pasveer ditch, stagnant overflow pond, and derelict sludge drying beds, a facility scoring 6.2% on the Green Drop 2025 audit

resources. In rural South Africa, two resources are abundant: land and solar radiation. Reed beds and constructed wetlands have proven to be a viable, low-technology solution requiring minimal energy, manpower, and chemical inputs, exactly the profile that struggling municipalities need.

The preliminary design confirms that the approved oxidation pond and horizontal flow reed bed process can be practically implemented for the relocated Warrenton WWTW.

Oxidation ponds rely on solar radiation and algal photosynthesis, not electrical aerators, making them inherently load-shedding-proof. Even in a partial-failure scenario, passive pond systems continue to deliver a measurable level of treatment, unlike mechanical systems that cease to function entirely when power or components fail. The constructed wetland polishing stage uses sub-surface gravel and aquatic macrophytes to strip nutrients, COD, and pathogens through root-zone nitrification-denitrification, without electrical inputs.

The nature-based track record

BVi successfully implemented these plants across the Northern Cape:

- **Hantam Local Municipality (Calvinia):** 2.4 Mℓ/d reed bed treatment facility, proven municipal compliance with minimal mechanical overhead.
- **KWV and Orange River Cellars:** Pilot 1.5 m^3/d reed bed plant for winery/distillery effluent, validating passive treatment of complex industrial loads.
- **SAN Parks, Nossob:** passive reed bed WWTW for domestic wastewater in a remote eco-tourism reserve, zero grid dependency.

The complexity of Warrenton's existing sanitation situation illustrates exactly why operational collapse was inevitable. The town is served by four completely different sanitation systems operating simultaneously:

1. the central business district relies on conservancy and septic tanks emptied by vacuum tankers
2. Ikhutseng and Warrenvale have waterborne reticulation with gravity mains and pump stations
3. the new station area uses a vacuum sewer
4. the southern areas of Rabatjie, Ditshotshwaneng, and Sonderwater have no waterborne sanitation at all

BVi's master plan completely resolves this fragmented reality. The entire network is redesigned as a single seamless waterborne system, converting all septic tanks, conservancy tanks, and vacuum sewers into conventional gravity reticulation. Through topographic and hydraulic analysis, bulk outfalls are re-routed to exploit natural terrain gradients, eliminating the N12 and Ikhutseng Main pump stations entirely. The full municipal pumping burden is reduced to a single lift node, ending raw sewage from reaching the Vaal River.

A wider opportunity: the Northern Cape and beyond

BVi recognises that municipal operational failure is not unique to Warrenton. Across the Northern Cape and other provinces, the same pattern repeats: advanced mechanical systems are installed, skills and power supply cannot sustain them, and the receiving environment suffers the consequences.

Where land is available, and in the Northern Cape it invariably is, oxidation pond and reed bed systems must be further investigated as the standard of choice for small and medium municipalities. These systems deliver a general limit effluent quality that is accepted by the Department of Water and Sanitation (DWS), without the operational complexity that continues to overwhelm local government capacity.

BVi has made a conscious engineering shift: from specifying advanced treatment processes that look impressive on paper to designing general limit treatment solutions that municipalities can realistically operate, maintain, and sustain. That shift, from ambition to achievability, is what will protect South Africa's water resources for the next generation.

BVi understands that municipalities are failing on operations, and has responded with a deliberate, responsible engineering shift. By moving from advanced mechanical processes to nature-based general limit treatment systems accepted by DWS, BVi is delivering infrastructure that municipalities can actually operate. Where land is available, as it is across the Northern Cape and many rural provinces, these plants are not a compromise. They are the right answer. The Warrenton relocation project is proof of that commitment. ●

Statistics sourced from the Green Drop Report 2025 (Audit Period: 1 July 2023 – 30 June 2024) | DWS Green Drop Report: Northern Cape Province | BVi Consulting Engineers Central

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Maskam Water specialises in retrofit solutions that allow existing septic tanks to be upgraded without full replacement

SEPTIC TANKS UNDER SCRUTINY

As South Africa grapples with mounting water insecurity and failing municipal infrastructure, wastewater expert Gerhard Cronje, owner of Maskam Water, is urging property owners, developers and businesses to rethink their reliance on traditional septic tanks, warning that outdated systems are quietly contaminating groundwater and threatening long-term water resilience.

"People don't understand the pollution that they cause," Cronje says. "Because if you don't see it, you don't think about it." At its most basic, a septic tank provides only primary treatment of wastewater. While solids are broken down by naturally occurring bacteria, many harmful substances remain in the effluent.

"Primary treatment is simply that you break down your solids, what they call your BOD, your biological oxygen demand," Cronje explains. "But you still have all the phosphates in the water. You still have all the ammonia in the water. You still have a lot of your other nasties in the water. You don't see it, but it's there."

That partially treated wastewater is typically discharged into the surrounding soil through French drains, a practice Cronje says is increasingly dangerous in today's high-density environments.

"Eighty years ago, a septic tank was a good option because we had virgin soil and low populations," he says. "Now we have flush toilets, much bigger populations, and we don't have virgin soil anymore. The soil has memory. That's where the problem starts."

According to Cronje, contamination pathways are alarmingly direct. "The *E. coli* starts with the toilet that you flush. It goes through the septic tank. It goes through your French drain, and it ends up in your borehole," he says. "In Stellenbosch, most of the bores had *E. coli* in them, 140 metres below ground. That *E. coli* is coming straight out of the city into the ground."

Once groundwater is polluted, remediation is nearly impossible. "How do you clean up water below ground level? You can't," adds Cronje. He continues to explain that contaminated groundwater can eventually resurface, polluting rivers and wetlands "At some point, this groundwater may rise up above ground or enter a river. Then you pollute your river."

National legislation is often ignored

Cronje points to strict requirements under South Africa's National Water Act, which many property owners unknowingly violate. Disposal sites must be located outside watercourses, beyond flood lines, at least 100 metres from water resources, and no closer than 500 metres from boreholes, including neighbouring boreholes.

Gerhard Cronje, owner, Maskam Water

"If you have a borehole on one side of the house, you can't have a French drain on the other side. It's illegal," he says. "And you must also be 500 metres away from your neighbour's borehole."

Yet illegal and non-compliant installations remain common, particularly in peri-urban and rural developments.

"People discharge all wastewater to french drains, including water from the kitchen, washing machine, dishwasher and shower. The toilet is only 30% of domestic water use. We keep increasing the volume, we keep increasing the number of people, but the soil that's supposed to treat all of that doesn't increase."

Every day, household chemicals, washing machine effluent and kitchen waste are flushed into systems never designed to handle such loads. "That sewage gets carried down into your groundwater forever," Cronje says.

Rather than relying on soil absorption, Cronje advocates for modern on-site wastewater treatment systems that actively clean wastewater before it is discharged or reused. "The new trend is to do on-site treatment to stop the pollution," he says.

Maskam Water specialises in retrofit solutions that allow existing septic tanks to be upgraded without full replacement.

"You cut off the incoming pipe of the septic tank and re-route it through the treatment unit," Cronje explains. "In some cases, you can fit it inside the septic tank. In other cases, you install it upstream and use the old septic tank as storage. Then you can reuse the treated effluent."

Unscrupulous operators sometimes dump wastewater illegally to avoid disposal fees, travel time or long queues at treatment plants

This treated water can be repurposed for irrigation and other non-potable applications, reducing pressure on municipal supplies while preventing environmental contamination.

Cronje compares the shift to advances in everyday technology. "Septic tanks were the best technology once, like the Model T Ford was the best car," he says. "But today, you seldom see a Model T cruise down the street. Technology changes."

He believes the same evolution must happen in wastewater management. "We cannot carry on like this. It's almost a non-option. We must start doing this."

People discharge all wastewater to french drains, including water from the kitchen, washing machine, dishwasher and shower

Water as a resource, not a risk

Beyond pollution prevention, Cronje frames modern wastewater treatment as part of a broader move towards water resilience and circular water use.

"People don't need miserable water stories; they need hope," he says. "There are solutions."

By integrating on-site treatment, greywater reuse and rainwater harvesting, properties can dramatically reduce dependence on external supplies while improving environmental outcomes.

"That technology gives you water resilience at the same time, and it saves you money at the same time," Cronje says. "And for companies, it helps with ESG scores as well."

With infrastructure under strain and groundwater increasingly compromised, Cronje believes it is time for a fundamental mindset shift.

"The main thing is that people don't understand the pollution they cause," he says. "If we start treating water as a resource instead of something to get rid of, everything changes." ●

The first Fusion wastewater treatment plant was installed in Franschhoek in 2010 and today more than 400 units have been installed in 8 different countries on the African continent

NANOTECHNOLOGY: SMALL TECH, BIG HELP

The idea of technology too small to see but having a profound impact sounds like science fiction, but today nanotechnology is not only available, it is increasingly viable for monitoring water quality and treating wastewater.
By Duncan Nortier

Nanotechnology is the science and engineering of manipulating matter at an atomic or molecular level at scales of between 1 and 100 nanometres, which is 100 000 times smaller than the width of a human hair. Professor Philiswa Nosizo Nomngongo, the South African Research Chair (SARChI) in nanotechnology from the University of Johannesburg, explains that this manipulation enhances properties like strength and conductivity, which then allows for specialised applications.

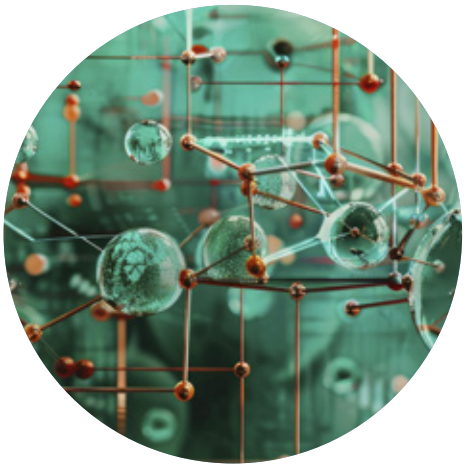
Prof Nomngongo has been a part of the water sector for a long time. Her interest in water stems from experiencing water issues as a child while her focus on nanotechnology developed during her academic journey. She explains, "When I was doing my research for master's degree I needed a way to detect pollutants. My supervisor told me that we needed to make sensors for that."

The concept of nanotechnology traces its theoretical conception to the 1950s, but Prof Nomngongo explains that it wasn't until 1981 that the science caught up for practical use. The use of nanotechnology has been embraced by many fields and has many important uses in the water sector.

Professor Philiswa Nosizo Nomngongo, the South African Research Chair (SARChI) in nanotechnology from the University of Johannesburg

Water monitoring on the nanoscale

Prof Nomngongo says, "Nanotechnology can greatly improve water monitoring. If you are concerned about metals in water, you can develop nanosensors that not only detect metals but also give you concentration data. If you are concerned about chemicals in water, there are nanosensors for that, too. An easy-to-use, immediately helpful nanosensor that changes colour when exposed to certain pollutants can help identify problems faster." This approach is preventative and cost-effective, as it reduces the amount of testing needed to identify problems. Prof Nomngongo also explains that, in some cases, nanotechnology can be



used in solid-phase extraction, where nanomaterials can trap the pollutants to help further analyse them. "This is especially helpful when the pollutants are found in low concentrations. These materials can be made to only interact with specific pollutants, chemicals or metals. If you are concerned about pharmaceuticals, then the material can be designed to trap certain chemicals and avoid others."

Treating water with nanotech

Not a one-trick pony, nanotechnology is also used to treat water, Prof Nomngongo says, "When treating raw water or wastewater, it's the same principles at work." Membrane repair is a prominent example, where the membranes of water molecules are repaired or strengthened to aid in reverse osmosis. Borrowing from the same technology used to trap pollutants for testing, water can be passed through a column packed with nanomaterials, and as it passes through, the pollutants become trapped, and clean water flows out. Prof Nomngongo also explains, "We can also use catalysis to break down certain molecules into less toxic ones. Combining adsorption and catalysis, where some nanomaterial traps pollutants and others break down toxic compounds into safer varieties."

Current projects

Prof Nomngongo's current research involves monitoring the presence of pharmaceuticals in water, specifically antibiotics. "To treat water effectively, we need to understand what is happening within it. I am focused on monitoring pollutants in water with nanotechnology so that the treatment is correct and specific and not broad." This means that dangerous compounds in the water can be treated with context-specific nanomaterials to correctly absorb or break down these toxic compounds.

Another project Prof Nomngongo is working on is the use of nanomaterials to trap E. coli. This is motivated by her research, which indicates an abundance of *E. coli* found in rural parts of South Africa, and complex treatment is often not possible. Nanotechnology offers hope in treating this water through a filter process.

For the professor, the promise of nanotechnology lies in its ability to push beyond current treatment processes and tackle complex problems like antibiotics or *E. coli* in water. She says, "Currently, we are treating for some pollutants and not others, but with nanotechnology, we can create advanced treatment processes that offer safer water." This is especially important in the South African context, where Prof Nomngongo sees decentralised solutions as a practical way to overcome water issues in rural South Africa.

She does add that "the cost is still a prohibitive barrier. Producing effective nanomaterials can be expensive and difficult to scale." Despite this, she remains optimistic about future uses, saying, "The development of simpler, more accessible tools that are easy to use, similar to litmus paper, would be transformative and enable non-specialists to monitor water." This would empower people across South Africa, especially in rural areas where water monitoring and treatment are still difficult. ●

FROM COMPLIANCE TO SUSTAINABILITY:

Why wastewater measurement matters in modern mining

Accurate wastewater measurement is essential for safe, compliant and efficient mining operations. Continuous monitoring of levels, flow and chemistry prevents accidental discharges, protects equipment and ensures regulatory compliance, critical priorities as Africa expands its water and wastewater infrastructure.

Sludge dewatering reduces disposal volume but depends on precise level control to avoid overflows, pump damage and blockages. Point level devices such as the VEGASWING 63 vibrating switch deliver dependable detection in sludge heavy tanks because vibration sensing resists buildup and density changes. For discharged dewatered sludge, the VEGACAP 65 capacitive sensor paired with the VEGATOR 141 conditioner prevents blockages and keeps material flowing smoothly.

Mixing and equalisation ponds

Mixing and equalisation ponds stabilise influent quality and flow to protect downstream treatment. Non contact radar sensors like the VEGAPULS C 21 supply continuous, weather proof level data that is unaffected by foam or changing water quality, deal for harsh outdoor mining environments.

Why this matters for mining in Africa

The Middle East and Africa water and wastewater market is growing rapidly, driven by tighter regulations, infrastructure investment and the need for water security. Investing in robust instrumentation reduces environmental risk, cuts regulatory costs, prevents downtime and improves profitability, helping mines balance economic growth with environmental responsibility.

Reliable level measurement underpins sustainable wastewater management in mining. By enabling early contaminant detection, preventing accidental releases and ensuring treated effluent meets standards, precision instruments help mining operations protect water resources and local communities while maintaining operational efficiency.

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FROM WASTE TO TREATED WATER

Rotocarb operates two core production sites, supported by a dedicated crushing, sizing and packaging facility in Midrand

Across industries, innovative thinking is transforming by-products into valuable resources, reducing environmental impacts, conserving natural resources and creating new economic opportunities. One such example is the conversion of agricultural waste into a high-value product that helps provide safe drinking water.

Richard Oldnall, business development manager at Rotocarb

For South African activated carbon manufacturer Rotocarb, macadamia nut shells that were once discarded as waste are now transformed into high-performance activated carbon used to purify drinking water and industrial process water. This approach not only reduces waste but also strengthens local manufacturing, supports water security and lowers the environmental footprint associated with imported treatment media.

"Historically, macadamia shells were simply a waste stream," explains Richard Oldnall, business development manager at Rotocarb. "Today we're purchasing that material from nut processors, converting it into a high-value filtration product and using it to help purify water. It creates a genuine cradle-to-grave solution where one industry's by-product becomes another industry's essential raw material."

Biomass fuels

South Africa, the world's largest producer of macadamia nuts, generates significant volumes of shells every year. However, ongoing electricity supply constraints, rising electricity prices and carbon tax have accelerated the demand for biomass fuels, transforming this agricultural residue into a valuable resource.

Carbon tax and corporate decarbonisation targets have encouraged energy-intensive industries to replace a portion of their Eskom-supplied electricity or on-site coal consumption with biomass fuels. As a result, macadamia nut shells are increasingly being used as a renewable fuel for boilers and industrial heating systems.

While Oldnall acknowledges the motivation behind these initiatives, he believes greater environmental value can be created by converting the shells into high quality filtration media.

"We support the move towards lower-carbon energy sources, but sustainability is about maximising environmental value. Burning macadamia shells provides a tiny reduction in coal consumption, whereas converting those same shells into activated carbon creates a high-value

Rotocarb offers more than 20 granular and powdered activated carbon products

As South Africa is the world's largest producer of macadamia nuts, Rotocarb saw an opportunity to beneficiate macadamia shells into high-grade activated carbon

filtration media essential for safe drinking water, cleaner air and numerous industrial purification processes. Ironically, it is a material that enables many of the sustainability outcomes the world is striving to achieve."

Low-grade thermal coals typically have calorific values between 23 to 27 MJ/kg, while macadamia nut shells are typically around 17 MJ/kg. As a result, many companies are effectively paying 20 to 30% more for a fuel that delivers approximately 30% less energy. While this may support decarbonisation objectives, it is difficult to justify on economic grounds.

"That is why we are developing alternative biomass solutions that can meet industry's renewable energy needs while allowing macadamia shells to be used where they deliver the greatest environmental and societal benefit," adds Oldnall.

Fortunately, Rotocarb enjoys long-standing relationships and long-term supply agreements with most of the country's macadamia nut processors and does not believe the long-term use of macadamia nut shells as a biomass fuel will be a sustainable solution.

Sustainability extends well beyond the raw material itself

Unlike many international manufacturers, where carbonisation and activation occur at separate facilities, Rotocarb combines both processes into a single integrated operation. The company has been manufacturing activated carbon sustainably for over a decade.

"Our biggest differentiator is that we carry out both the charring and activation processes in the same facility through what we call an autogenous process," explains Oldnall. "We utilise the energy generated during the first stage to drive the second stage. Once the process is operating, all thermal energy required is generated internally, allowing us to compete effectively with international suppliers."

This significantly reduces reliance on grid electricity, lowers overall emissions, and results in an exceptionally efficient and environmentally friendly activated carbon production process.

"Our Eskom input is limited to running a few motors," he says. "All of the thermal energy required for the process is generated internally, making our manufacturing exceptionally energy efficient."

Furthermore, Rotocarb thermally oxidises the volatile organic compounds generated during production, resulting in exceptionally low process emissions.

The company's sustainability strategy extends further through 120 kW of solar generation at its Midrand facility, electric forklifts and rainwater harvesting.

According to Oldnall, these measures have resulted in an exceptionally low environmental footprint compared with many conventional activated carbon manufacturing processes.

"If you visit some of the larger activated carbon production facilities overseas, you'll often find carbonisation and activation occurring at separate sites, requiring additional transport between facilities and resulting in higher overall emissions. Those emissions are compounded by the maritime shipping and inland transport required to deliver imported activated carbon to South African customers. The activated carbon produced overseas is by no means a green or greener product. By comparison, producing activated carbon locally using an integrated, low-emission process results in a substantially lower environmental footprint."

Rotocarb is also expanding its capabilities to include the reactivation of spent activated carbon, further extending the useful life of the material and reducing the need for virgin carbon in appropriate applications.

For Rotocarb, sustainability is also about building resilient local supply chains.

When the company was established in 2016, South Africa relied almost entirely on imported activated carbon, exposing industry to fluctuating exchange rates, shipping delays and supply chain disruptions. Today, Rotocarb supplies more than 300 customers with locally manufactured activated carbon, providing greater supply security while supporting local beneficiation.

"Our customers know they can access a quality product without waiting months for imports, and we can customise products to meet specific application requirements," says Oldnall. "Local manufacturing gives the water sector greater resilience while creating value from a South African agricultural resource."

Macadamia shells develop both high microporosity and mesoporosity during steam activation

NEW GOVERNANCE MODEL PROPOSED TO SECURE GAUTENG'S WATER FUTURE

As South Africa's economic engine and most densely populated province, Gauteng depends on reliable infrastructure to sustain growth, support development and fulfil every citizen's constitutional right to safe water. **By Duncan Nortier**

Dr Khathutshelo Godfrey Maumela, executive manager of research and development at Rand Water, conducted research focused on Gauteng's water supply system, which argues that fragmented planning, weak stakeholder coordination, and slow climate adaptation are undermining long-term water security. One of the central findings is that South Africa's water infrastructure crisis cannot be solved through engineering alone.

Presenting his PhD research at the Water Services and Mining & Industry Forum, Dr Maumela outlined a proposed "Integrated Water Infrastructure Planning and Management Framework" designed to improve coordination across the province's complex water value chain.

The research, titled *Planning and Management in Urban Water Infrastructure: A Case Study for Gauteng, South Africa*, examines how multiple institutions responsible for water supply infrastructure interact, and where systemic failures are occurring.

Dr Khathutshelo Godfrey Maumela, executive manager of research and development at Rand Water

"Water is the arche," Maumela says, referring to the ancient philosopher Thales of Miletus. "Water is the source of life." He notes that South Africa is already a water-scarce country, while Gauteng's water consumption remains "ridiculously high" compared to both national and global averages. "In South Africa, we use about 237 litres per person per day, and in Gauteng, almost 300 litres per person per day, while the international average is 173 litres per person per day."

Shared responsibility, fragmented execution

His research focuses on the first three stages of Gauteng's water value chain: raw water supply, water treatment and bulk distribution, and municipal reticulation. Maumela compares the system to "a relay race" where multiple institutions are responsible for handing over water supply responsibilities across the chain.

"You can never win a relay race unless the runners are running for the same goal and understand the same objective that needs to be achieved," he says.

The study was motivated by years of recurring water disruptions in Gauteng dating back to 2014 and the El Niño drought period of 2015. "Since then, we have experienced intermittent water interruptions almost every year in Gauteng," Maumela says. "It became quite apparent that there's a need to assess the impact of economic activities, climate change, 4IR technologies, as well as stakeholder management."

According to the presentation, Gauteng accounts for 25.5% of South Africa's population and 37% of the national GDP, making water security in the province a matter of economic as well as social importance.

Planning exists, but implementation fails

The research used a mixed-method approach including surveys, interviews, and Decision-Making Trial and Evaluation Laboratory (DEMATEL) analysis involving

The Department of Water and Sanitation act as "referees" and are not directly involved in provisioning water

municipalities, bulk water utilities, source water institutions, and sector specialists.

One of the study's key findings is that water institutions are generally planning over long-term horizons, but execution remains a major weakness." Maumela explains, "The respondents said there is no problem with planning in terms of it being forward-looking. But project management is a huge challenge."

He says procurement delays; contractor performance issues and infrastructure backlogs continue to undermine implementation.

"The planning gets done, and then there's a stage called delays," he says. "Some of them are delays in awarding the work, some are related to contract management, contractor performance, and poor quality."

The presentation notes that infrastructure backlogs are also limiting effective maintenance and operational redundancy.

Climate resilience remains weak

The study also assessed how prepared Gauteng's water institutions are for climate-related disruptions such as floods, droughts, and fires. Maumela says the results showed that organisations were largely uncertain about their climate resilience strategies.

"Climate change is going to be one of the single biggest challenges that the world will ever see in the years to come," he says.

He points to recent flooding events in KwaZulu-Natal and ongoing international wildfire disasters as examples of growing climate risks affecting infrastructure systems.

If we were to have infrastructure built in such a way that is more resilient to floods, it means we can sustainably supply water even during times of climate change eventualities, he says.

The research also found that adoption of Fourth Industrial Revolution (4IR) technologies – including smart metering, digitalisation and smart city systems – remains slow across the sector.

"Any entity that gets smart metering right automatically reduces the component of non-revenue water," says Dr Maumela.

The presentation identifies "slow adaptation of 4IR technologies" and "poor climate resilience strategies" as major weaknesses across institutions.

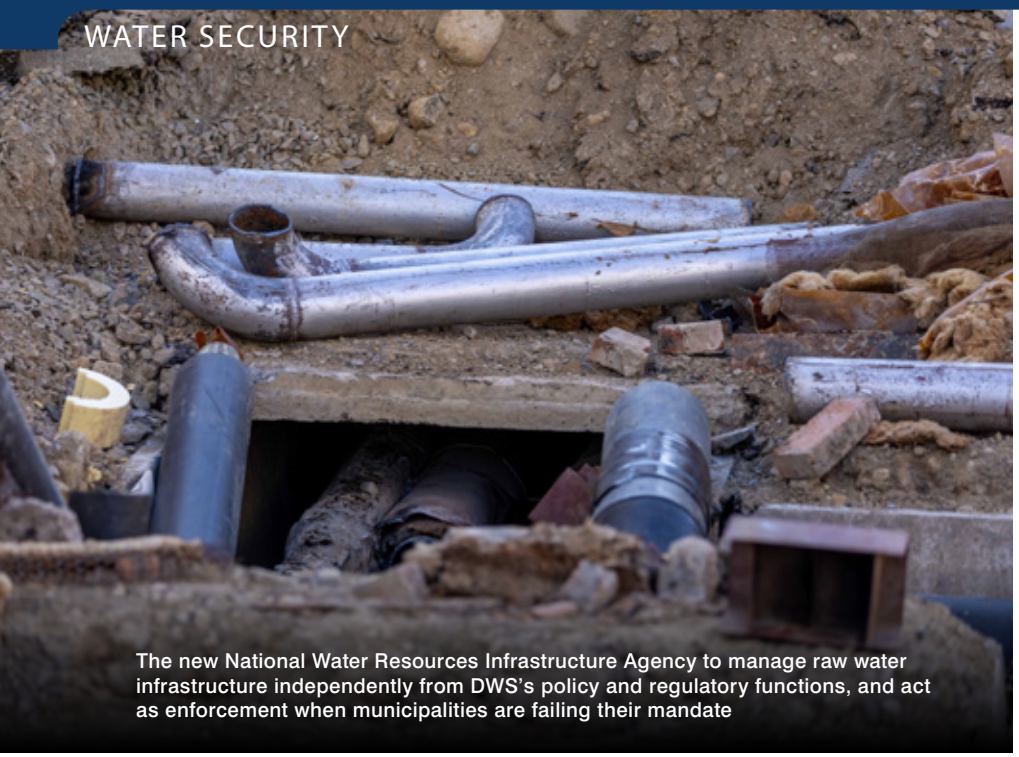
Strategic alignment is identified as a critical weakness

Using DEMATEL modelling, the research analysed relationships between critical success factors in water infrastructure management.

The study found that a "value-driven approach" was the most crucial factor, while "strategic alignment" emerged as the most important determinant of overall effectiveness.

"You would not be able to have effective planning and management of water infrastructure if you are not looking to derive value at all points, as well as if your strategic alignment is not aligned," Dr Maumela says.

He warns that executive leadership decisions often determine whether infrastructure investment succeeds or stalls. "If you've got strategic leadership in an organisation that does not see a need for investment in infrastructure, it means



The new National Water Resources Infrastructure Agency to manage raw water infrastructure independently from DWS's policy and regulatory functions, and act as enforcement when municipalities are failing their mandate

there are going to be major problems," he says.

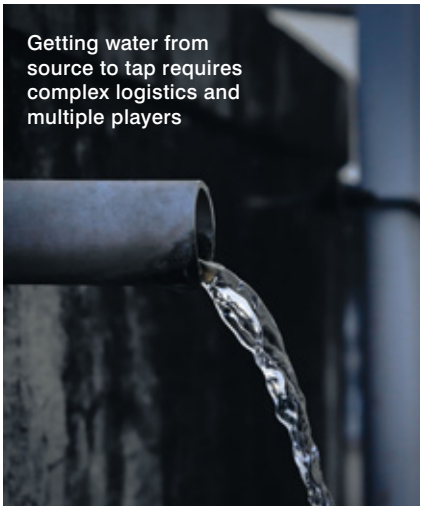
The presentation notes that strategic alignment and value-driven approach in planning and management were the strongest influencing factors identified in the DEMATEL analysis.

Municipalities hold the greatest influence

The stakeholder analysis section of the research identified metropolitan municipalities and the Department of Water and Sanitation (DWS) as the most influential players in Gauteng's water ecosystem when seen through the lens of the bulk water utility.

Dr Maumela elaborates, "We picked up that metropolitan municipalities are very right up there, they actually have the highest impact and the highest influence in their relationship with the bulk water utility."

Finance departments and executive management teams were also identified as key internal stakeholders influencing infrastructure delivery outcomes. "If finance is saying no to infrastructure



Getting water from source to tap requires complex logistics and multiple players

for whatever reason, you will have problems in terms of money going into infrastructure-related projects," he says.

One of the most significant recommendations from the research is the creation of a dedicated National Water Resources Infrastructure Agency to manage raw water infrastructure independently from DWS's policy and regulatory functions.

"DWS is more like a referee and a player," Maumela says. "They provide policy direction, they are the regulators, they are the ones that set raw water tariffs, but they are also the same ones who run the water resources infrastructure."

He argues that separating these responsibilities would improve accountability and oversight. The framework also proposes stronger provincial coordination mechanisms, greater integration between planning and operations teams, ring-fenced municipal water utilities, and deeper consultation across institutions to synchronise infrastructure investments.

"If Rand Water is building a reservoir in a certain area, the question that might be asked is whether that reservoir is aligned with the pipeline that is being built by the municipality in the same area," he says. "That synchronisation needs to be achieved through consultation."

The proposed framework additionally embeds climate resilience and 4IR technology integration into every level of infrastructure planning and operations.

After developing the framework, Dr Maumela returned to industry experts for validation.

"When we finished doing the framework, we went back to the industry experts for them to give us their views as to whether this makes sense or not," he says. "In essence, by and large, they agreed that it makes sense." ●

Water services to households are a municipal responsibility

> **"DWS is more like a referee and a player. They provide policy direction, they are the regulators, they are the ones that set raw water tariffs, but they are also the same ones who run the water resources infrastructure."**

SANS 241 HAS CHANGED, WHAT IT MEANS FOR YOU

The updated SANS 241 (the South African National Standard for Drinking Water) marks a decisive shift from checklist compliance to system-wide risk management, requiring water providers to understand, monitor and actively control water quality from catchment to consumer.

Mariette Swart, water quality specialist at Rand Water, cautions that systems previously deemed compliant under SANS 241:2015 may no longer meet the requirements of SANS 241:2025. She was part of the South African Bureau of Standards (SABS) national committee – SABS/TC147, Water – that prepared the standard. "It is no longer sufficient to simply monitor a set of parameters, collect results, and compare them with the standard to demonstrate compliance."

An integrated system

The new approach embraces an integrated system in which monitoring is only one element. In practice, compliance is demonstrating that the water supply system is understood, risks have been assessed, monitoring is targeted, and appropriate action is taken when results indicate a potential risk."

Compliance is no longer viewed as a once-off or point-in-time result. Instead, SANS 241: 2025 requires an ongoing, system-specific risk assessment process to sit at the centre of drinking water quality management, continuously informing monitoring, operational decisions and risk mitigation measures.

SANS 241: 2015 consisted of two parts; the first stipulated the parameters and numerical limits for drinking water quality, while the second outlined the processes required to achieve compliance. "This created a fragmented approach where there was little integration between testing, reporting and risk management," explains Swart.

SANS 241: 2025 replaces this with a single integrated framework, where numerical limits, risk assessments, monitoring programmes, verification, incident response and corrective actions are all linked within one system. This means compliance is no longer treated as a standalone laboratory result, but as the outcome of an ongoing, risk-based management process designed to demonstrate that water quality is being actively understood, monitored and controlled throughout the entire supply system.

Demonstrating compliance with the numerical limits prescribed in

Mariette Swart, water quality specialist at Rand Water and part of the South African Bureau of Standards (SABS) national committee – SABS/TC147, Water.

the standard is only one part of compliance; equal importance is placed on demonstrating that the systems, processes and controls required to manage drinking water quality are effective and fit for purpose. The standard therefore requires water providers to show that they understand the hazards and risks that could affect the quality of the water they supply, and that appropriate monitoring and management measures are in place to control these risks. As Swart notes, SANS 241:2025 is also explicit that insufficient monitoring data to demonstrate compliance is, in itself, an indication of non-compliance, reinforcing the principle that confidence in water quality depends not only on acceptable results, but also on adequate evidence that quality is being consistently managed and verified.

From catchment to tap

At the core of SANS 241 is the principle that drinking water must remain safe at the point of consumption. "A key misconception under SANS 241:2015 was that compliance could effectively be demonstrated at the treatment plant. In practice, this created a narrow focus on treated water leaving the works, rather than on the quality of water as it moves through reservoirs, pipelines and ultimately reaches the consumer," explains Swart.

The new SANS 241 standard deliberately avoids using the terms water services provider and water services authority. "This is to move away from a siloed view of responsibilities. The standard is not intended to govern how different entities relate or contract with one another – that must be set out in separate agreements. Instead, SANS 241 focuses on the outcome: all parties involved in

SANS 241 has shifted from checklist compliance to system-wide risk management

IMPORTANT TERMS, DEFINITIONS AND CLAUSES

Definitions and key clauses determine how requirements are interpreted, applied and enforced across different types of supply systems. "The definitions are explained once at the start of the standard and, thereafter, the document only refers back to those terms, on the assumption that you already understand what each definition means," explains Swart.

A water supply system (WSS): is an asset system that includes the raw water abstraction point, the water treatment plant (WTP) up to the final water, and the distribution network up to the point of delivery to consumers. Within the same supply area, water quality can vary due to factors such as geographical location, infrastructure age, distance from the WTP, supply from multiple WTPs, or a combination of these. Each distinct water quality zone should therefore be managed as a separate WSS, with distribution network sample points selected to accurately represent each system.

A borehole system: is an asset system that utilises groundwater of low water quality variability, where disinfection is practised, serving a maximum population of 5 000 people. Sampling points in a borehole system include the final water and a limited number of distribution network sample points. Systems that utilise groundwater where water quality varies, or serve populations exceeding 5 000 people, should meet the requirements for a water supply system.

Raw water: untreated surface water, groundwater, or water effluent entering a WTP for treatment.

Final water: drinking water after treatment supplied from the WTP.

Distribution network sample point: sample point within the distribution network after the final water where water quality is monitored to ensure complete representation of the entire geographical distribution network and weighted according to population density. A distribution network sample point can be a reservoir, a dead end, a point of delivery, points of consumption such as a high occupancy building, a hospital, or a school.

Critical distribution network sample point: subset comprising 20% of the distribution network sample points that provide the most information on spatial and temporal risks and where a noticeable deterioration in water quality or increased risk is anticipated. Critical distribution network sample points can include reservoirs, dead-ends, points of delivery, points of consumption such as high occupancy buildings, hospitals, or schools. During the risk analysis, critical distribution network sample points in supply systems are analysed for all the parameters listed in table 1. Monitoring of confirmed risks will continue at the critical distribution network sample points as part of the routine monitoring programme.

The presence of somatic coliphages in drinking water indicates faecal pollution and the potential presence of enteric viruses and possibly other pathogens

Systems that utilise groundwater where water quality varies, or serve populations exceeding 5 000 people, should meet the requirements for a water supply system

TABLE 1: SANS 241 drinking water parameters

Aspect	SANS 241: 2015	SANS 241: 2025
E. coli	Included	Still primary indicator
Intestinal enterococci	Not required	Mandatory only for saline/brackish systems
Protozoan parasites	Listed	More explicit turbidity linkage. Must be monitored at the final water, monthly.
Somatic coliphages	Included	Elevated role as viral indicator
Molecular methods (PCR)	Not addressed	Recognised (with limits)

the supply chain share responsibility for ensuring that the water delivered to consumers is safe," she adds.

Managing non-compliant parameters

Under the previous SANS 241:2015 framework, there was often inconsistency across the sector in how non-compliant results were handled. The revised standard now provides a clearer direction on what entities are expected to do once a water quality result falls outside the prescribed limits.

Clause 8: Management of drinking water quality non-compliant results recognises that a non-compliant result is not simply a laboratory issue or a reporting exercise. It must trigger an appropriate management response. The standard requires entities to investigate non-compliant results, assess the potential risk posed to consumers, determine the need for corrective actions, and verify whether the non-compliance indicates a broader water quality risk. The objective is not only to restore compliance, but also to understand the underlying cause of the non-compliance and prevent its recurrence.

It is also important to realise that non-compliant results cannot be excluded from compliance reporting following a compliant re-sample. "The management clause links directly to the risk-based philosophy of the revised standard. A failed result is treated as evidence of a potentially unmanaged risk. The standard also emphasises that compliance can only be demonstrated where sufficient monitoring data is available. Where required monitoring information is unavailable, compliance cannot be confidently demonstrated and the associated risk remains unmanaged.," says Swart.

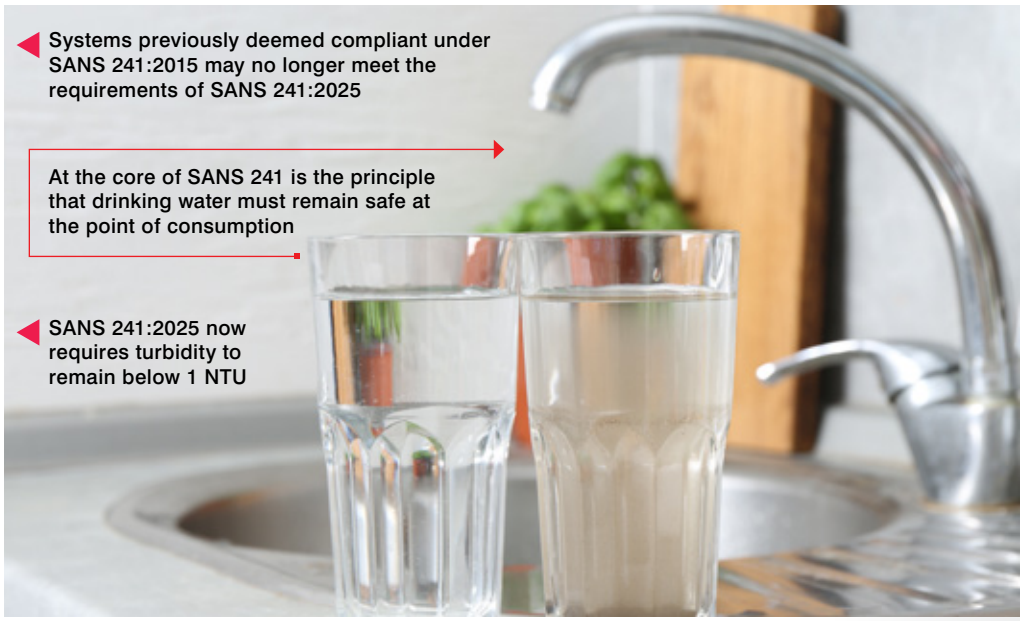
In practice, the management clause requires entities to:

- investigate non-compliant results to determine the actual risk posed to consumers;
- assess the seriousness and urgency of the incident;
- implement corrective actions;
- conduct follow-up monitoring where necessary;
- document decisions and responses;
- communicate risks or advisories where public health may be affected; and
- demonstrate that the incident was properly controlled and managed.

Expanded and clarified microbiological requirements – key changes

Under SANS 241:2025, turbidity is treated as a critical operational risk

"Municipalities should not simply aim to achieve compliance at 1 NTU. Good practice is to maintain final water turbidity well below the limit, typically around 0.5 NTU or lower, to provide an operational safety margin and reduce the likelihood of non-compliant results."



Systems previously deemed compliant under SANS 241:2015 may no longer meet the requirements of SANS 241:2025

At the core of SANS 241 is the principle that drinking water must remain safe at the point of consumption

SANS 241:2025 now requires turbidity to remain below 1 NTU

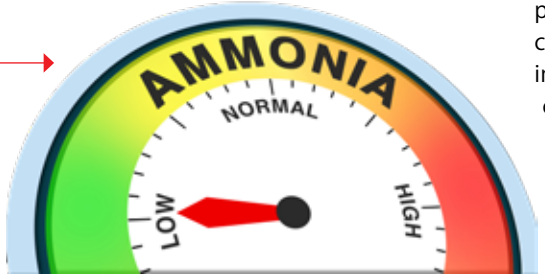
parameter rather than just a compliance value. Elevated turbidity can reduce the effectiveness of disinfection and may indicate inadequate removal of particulate matter, creating conditions where microorganisms can be protected from disinfectants and increasing the risk of microbiological contamination. Swart emphasises that turbidity, together with residual disinfectant and pH, are among the most important operational control parameters at a treatment works. "These are rapid, instrument-based measurements that provide immediate feedback on whether treatment processes are functioning as intended. Frequent monitoring allows operators to identify process deterioration early and take corrective action before water quality is compromised. Without reliable turbidity data, it becomes difficult to demonstrate that treatment barriers are consistently performing as required."

Under the previous edition of SANS 241, turbidity was regulated through both aesthetic and operational limits, with 5 NTU considered acceptable for aesthetic purposes and 1 NTU serving as the operational limit. SANS 241:2025 now requires turbidity to remain below 1 NTU, reinforcing its role as a key indicator of treatment performance. Results exceeding 1 NTU constitute a non-compliance that must be investigated and managed in accordance with the requirements of the standard.

"Municipalities should not simply aim to achieve compliance at 1 NTU" says Swart. Good practice is to maintain final water turbidity well below the limit, typically around 0.5 NTU or lower, to provide an operational safety margin and reduce the likelihood of non-compliant results."

The revised standard also strengthens the link between protozoan parasite risk and turbidity performance. Protozoan parasites are included as mandatory process risk parameters, and their monitoring forms part of the routine monitoring programme. SANS 241:2025 recognises that consistently low turbidity, monitored at an appropriately high frequency and supported by documented process control, provides important operational evidence that treatment processes are functioning effectively and reducing the likelihood of protozoan breakthrough. However, turbidity monitoring does not replace the requirement to manage and verify protozoan risk; rather, it serves as an important operational indicator of treatment performance and process control.

Ammonia is considered an operational parameter because it provides information on the effectiveness of disinfection processes and the stability of disinfectant residuals



Parameters most likely to trigger non compliances

Mariette Swart notes that failures relating to disinfectant residuals are expected to become one of the most common reasons why systems may fail compliance under SANS 241:2025.

The minimum residual disinfectant requirement is now clearly defined. For systems using chlorine as the disinfectant, water leaving the treatment plant should maintain a minimum free chlorine residual of 0.5 mg/ℓ, while a minimum residual of 0.1 mg/ℓ should be maintained throughout the distribution network. These minimum values are intended to ensure that disinfectant protection remains active throughout the reticulation system, particularly where there is a risk of recontamination, long retention times, or chlorine decay.

There is also a tighter limit to aluminium, which has been reduced from 300 µg/ℓ to 200 µg/ℓ. The parameter is no longer viewed purely as an aesthetic concern, but also as an important indicator of treatment performance. Elevated aluminium concentrations in final water may indicate inadequate optimisation of coagulation, flocculation, clarification or filtration processes, particularly where aluminium-based coagulants are used, although aluminium concentrations may also be influenced by source

water quality. The stricter limit is therefore expected to place greater emphasis on process optimisation, including coagulant dosing, pH control and sludge management, to ensure consistent compliance.

Similarly, ammonia is considered an operational parameter because it provides information on the effectiveness of disinfection processes and the stability of disinfectant residuals. In chloraminated systems, ammonia monitoring is particularly important for controlling chloramine formation and preventing nitrification within the distribution network.

The cost

"Knowing your system will ultimately reduce the cost of monitoring. I cannot over emphasize the importance of knowing what parameters must be tested, why they are being tested, where they should be tested and when they should be tested," adds Swart.

The revised standard is ultimately designed to support more targeted and cost-effective monitoring. Instead of routinely testing every possible parameter, the risk-based approach focuses resources on the parameters that pose a credible risk to a specific supply system.

This means that entities with a strong understanding of their systems and good historical data may not see a significant increase in monitoring costs over the long term. In some cases, costs could even decrease as unnecessary or repetitive testing is reduced. However, systems with limited data, weak monitoring programmes or poor operational control may initially face increased expenditure as additional sampling, risk assessments and monitoring programmes are implemented to close information gaps.

The revised standard also recognises South Africa's practical constraints, including limited laboratory capacity and municipal budget pressures. As a result, the technical committee attempted to balance public health protection with what is realistically achievable on the ground. Expensive analyses for contaminants such as protozoan parasites or emerging organic compounds are therefore approached through a risk-based lens, with entities expected to prioritise monitoring where there is a credible likelihood of contamination rather than applying blanket testing requirements across all systems.

Importantly, the standard shifts the conversation around cost from one of simple compliance to one of risk prevention. Poorly targeted monitoring programmes that fail to identify emerging problems can ultimately become far more expensive through operational failures, water quality incidents, emergency interventions and reputational damage.

The intention of the revised framework is therefore not necessarily to increase testing, but to ensure that monitoring programmes are defensible, relevant and capable of protecting public health. Ultimately, the revised SANS 241 reflects a more mature approach to water quality management. ●

REGISTER OR FACE PROSECUTION:

THE 90-DAY DEADLINE EVERY BUSINESS NEEDS TO KNOW ABOUT

On 24 April 2026, the Minister of Water and Sanitation published Government Notice 7408, requiring all unregistered water users to register within 90 days of publication, placing the deadline at approximately 23 July 2026. **By Garyn Rapson, partner and Gwen Mathebula, associate from Webber Wentzel**

The notice carries criminal sanctions for non-compliance and affects a wide range of sectors, including agriculture, forestry, mining, industrial manufacturing and commercial operations reliant on water abstraction or stream flow reduction activities. It also arrives against the backdrop of the National Water Amendment Bill, 2026 (the Amendment Bill), which proposes far-reaching structural reforms, including the prohibition of private water trading, the introduction of a 'use it or lose it' principle and expanded ministerial reallocation powers.

Garyn Rapson, partner at Webber Wentzel

Gwen Mathebula, associate at Webber Wentzel

What the notice requires

For many water users, particularly those who bought properties, restructured their businesses, or started industrial operations without updating their registrations, this notice may have arrived without warning. The consequences of doing nothing are severe: criminal liability, including imprisonment of up to five years, and exposure to a regulatory crackdown that is already well underway. The notice cannot be read in isolation. It forms part of a broader reform agenda that could fundamentally change how water is used, allocated and traded in South Africa.

The notice applies only to two water use categories regulated under section 21 of the National Water Act, 1998 (NWA): the abstraction of water from a water resource (section 21(a)) and stream flow reduction activities, such as large-scale commercial forestry operations (section 21(d)). It does not apply to other water uses, including water storage, the impeding or diversion of watercourse flow, irrigation using wastewater, or waste disposal-related activities. As a result, compliance with the notice will not necessarily address all outstanding regulatory requirements applicable to a water user.

It is worth noting that this call for registration comes remarkably late. The Water Use Registration Regulations were

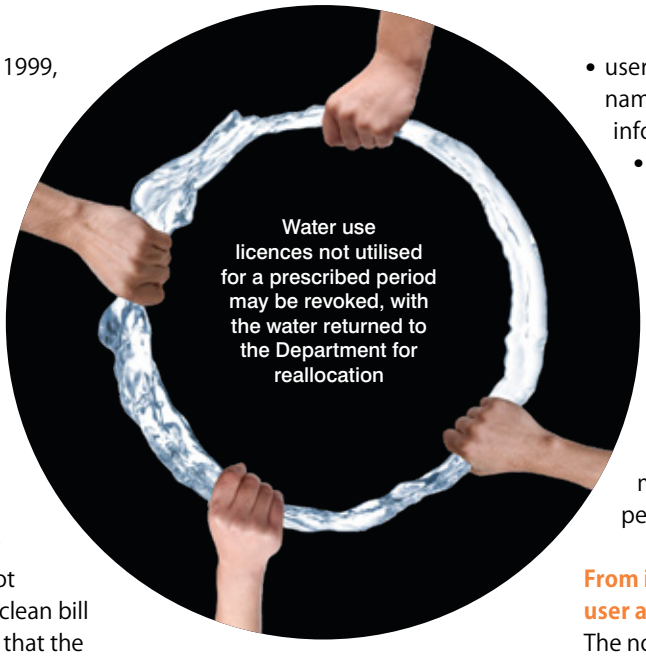
published back in November 1999, and the bulk of registration drives took place in the years that followed. The 2026 notice has therefore been issued more than two decades after water users were first required to register. Its broad reach, capturing users who may have operated for years without registration, is a direct consequence of that prolonged enforcement gap.

It is equally important that water users understand what registration does and does not achieve. Registration is not a clean bill of health. It does not confirm that the water use is lawful or that the volume claimed is correct.

Under the Water Use Registration Regulations, responsibility for the accuracy of submitted information rests with the water user. Registration remains subject to verification by the responsible authority under section 35 of the NWA. During verification, the authority may determine that a water use is unlawful, or lawful only to a lesser extent than claimed, and that determination limits what the user may continue to do.

A user who fails to apply for verification when required, or whose application is refused, may lose the right to continue that water use entirely.

In short, registration opens the door to scrutiny. Water users who have been operating without registration for extended periods should carefully assess the defensibility of their historical use before submitting applications, because the information disclosed may itself trigger a process with consequences extending beyond the registration exercise.



Water use licences not utilised for a prescribed period may be revoked, with the water returned to the Department for reallocation

The categories of unregistered water users captured by the notice are deliberately broad, and many businesses may be affected without realising it. They include:

- property purchasers who never notified the responsible authority of a change in ownership;
- land restitution beneficiaries whose ownership changes were never reported;
- lessees occupying property where the owner did not register;
- users who changed their registered names or contact details without informing the responsible authority;
- commercial borehole users who never registered; and
- users who registered agricultural water use but never separately registered resulting industrial water use.

Registration is free if forms are submitted within the 90-day window. Applications submitted after the deadline may attract a fee of ZAR 300 per property.

From irrigation boards to water user associations

The notice contains an important exemption that warrants scrutiny. Water users falling within the area of operation of a water user association

Boreholes used for commercial purposes must also comply with the notice and register as such

The Amendment Bill's proposed prohibition on private water trading is a direct legislative response to previous court proceedings

(WUA) are exempt from registration, except where such users operate commercial boreholes, which must still be registered with the responsible authority.

The NWA established WUAs under Chapter 8 as permanent statutory vehicles for co-operative local water management and contemplated that irrigation boards would convert to WUAs within a transitional period. That transition remains incomplete. Many irrigation boards continue to operate in practice without having formally converted, and it is those users who should pay close attention to the limits of the exemption.

The exemption refers specifically to WUAs, and the legal protection available to users relying on unconverted irrigation boards is less settled than may initially appear.

Additionally, where a board has not formally approved the conversion of an agricultural water allocation for industrial purposes, there is a credible argument that the industrial abstraction falls outside the scope of any exemption. Commercial boreholes remain registrable irrespective of WUA or irrigation board membership.

The incomplete transition also raises a longer-term strategic concern. Water users operating in stressed catchments where irrigation boards remain unconverted may face reallocation pressures as the regulatory environment tightens.

The prudent approach is to clarify the applicable institutional position, interrogate the basis for any exemption and avoid assuming that an exemption automatically applies.

The proposed regime: according to the Director-General

The registration notice forms part of a broader reform agenda driven by concerns that the current framework has failed to achieve equitable water access.

In engagements with Parliament's Portfolio Committee, the Director-General of Water and Sanitation, Dr Sean Phillips, identified two structural problems: existing lawful water use entitlements do not expire unless replaced through compulsory licensing, leaving unused allocations unavailable for redistribution; and the current licensing framework does not allow

> **"'Use it or lose it' principle, water use licences not utilised for a prescribed period may be revoked, with the water returned to the Department for reallocation."**


Much of the legal pressure is around irrigation boards, which find themselves in a difficult space

equity considerations to outweigh other statutory factors.

According to the Department, this has resulted in water use entitlements being treated as tradeable commercial assets, retained for market value rather than productive use.

The proposed amendments are intended to address these concerns by strengthening the state's ability to regulate, reallocate and transform water use.

These concerns have translated into a clear institutional preference to move away from existing lawful water uses as the primary basis for water entitlement and towards licensed use.

Existing lawful water uses, which derive their authority from pre-NWA entitlements preserved under section 32 of the NWA, do not expire, are not subject to fixed licence periods and are difficult to attach conditions to. From the Department's perspective, this makes them hard to monitor, enforce and reallocate.

Licensed use, by contrast, is time-limited, subject to mandatory review periods of no more than five years and may be amended, suspended or withdrawn under the NWA licensing framework.

The Amendment Bill's 'use it or lose it' principle and expanded reallocation powers are most naturally applied to licences and the Department's push for registration, which opens the door to verification under section 35 and ultimately to compulsory licensing under section 43, should be understood, at least

> **The deadline is real. The criminal sanctions are real. And the regulatory direction of travel is increasingly clear. Water users who act now will be better positioned, legally and strategically, than those who wait.**

in part, as a mechanism for converting existing lawful water uses into a form of entitlement that the state can regulate, condition and reallocate more readily.

The Amendment Bill's principal interventions include:

- **'Use it or lose it' principle:** water use licences not utilised for a prescribed period may be revoked, with the water returned to the Department for reallocation. The Bill also allows users to voluntarily surrender unused entitlements.
- **Ban on private water trading:** the Bill seeks to prohibit private trading of water use entitlements on the basis that water is a public resource that should not be allocated through private market transactions.
- **Expanded ministerial powers to reallocate water:** the Bill introduces a new power permitting the Minister to reallocate water between sectors, provinces and catchments following consultation and consideration of the factors in section 27(1) of the NWA.
- **Stronger transformation requirements:** the Bill establishes criteria intended to address historical racial and gender inequities in water access and allocation.
- **'Fit and proper person' requirement:** authorities may refuse to consider licence applications from persons who have committed serious breaches of water legislation, strengthening accountability for non-compliance.

Water trading: what the courts confirmed and where the law is headed

The most contested legal question in South African water law in recent years has been whether water use entitlements can be transferred to third parties and whether compensation may be charged for doing so.

The Constitutional Court addressed this question in *Minister of Water and Sanitation and Others v Lötter N.O. and Others* [2023] ZACC 09.

For many years, the Department permitted transfers and trading of water use entitlements under section 25 of the NWA before reversing its position in January 2018 through a circular stating that section 25 did not permit such trading.

The resulting litigation reached the Constitutional Court, which held that section 25 permits temporary transfers of water use entitlements to third parties, including transfers involving compensation.

While the court acknowledged the state's legitimate concern regarding historical inequities, it confirmed that the NWA, in its current form, does not prohibit private water trading.

The Amendment Bill's proposed prohibition on private water trading is a direct legislative response to that judgment.

Our recommendation

The 90-day window closes on approximately 23 July 2026. Miss it, and criminal exposure follows.

However, the registration notice is also something more: an early signal of a substantially more intensive regulatory environment that is already emerging. As the Amendment Bill progresses and enforcement capacity increases, the risks associated with unregistered, inaccurately registered or strategically misaligned water use are likely to increase.

Water users should use the 90 days to:

- confirm that existing registrations accurately reflect the current legal entity, ownership structure and contact details;
- assess whether industrial water use linked to historical agricultural allocations has been properly authorised and registered;
- identify and register commercial boreholes, irrespective of WUA or irrigation board membership;
- evaluate the legal sustainability of reliance on any exemptions; and
- ensure that registration submissions align with broader integrated water use licensing strategies.

The deadline is real. The criminal sanctions are real. And the regulatory direction of travel is increasingly clear. Water users who act now will be better positioned, legally and strategically, than those who wait. ●

South Africa's Catchment Management Agencies are becoming increasingly important despite operational challenges

South Africa's catchment management agencies (CMAs) are becoming central to the country's water sector while they confront intensifying pressure from climate variability, rising demand, ecological degradation, pollution and financial constraints. **By Duncan Nortier**

Annual Performance Plan (APP) presentations delivered to Parliament's Portfolio Committee on Water and Sanitation by multiple CMAs, including the Limpopo-Olifants Catchment Management Agency (LOCMA), the Inkomati-Usuthu Catchment Management Agency (IUCMA), the Vaal-Orange Catchment Management Agency (VOCMA), the Pongola-Umzimkulu Catchment Management Agency (PUCMA), the Breede-Olifants Catchment Management Agency (BOCMA), and the Mzimvubu-Tsitsikamma Catchment Management Agency (MTCMA), collectively reveal institutions attempting to operationalise a decentralised water governance model under increasingly difficult conditions.

The presentations outline expanding responsibilities in water use licensing, pollution prevention, ecological restoration, stakeholder engagement, revenue collection, climate adaptation and regional cooperation. At the same time, they expose deep structural pressures facing the sector, including growing water deficits, escalating operational costs and the need for stronger enforcement and institutional capacity.

Together, the APPs provide one of the clearest pictures yet of how South Africa's regional water management system is evolving, despite facing similar issues around financial stability that plague the water sector.

A decentralised system under pressure

South Africa's CMAs were established under the National Water Act to decentralise water governance and move decision-making closer to the catchment level.

The Mzimvubu-Tsitsikamma Catchment Management Agency described itself as a water management institution established under Section 78 of the National Water Act and operating as a Schedule 3A public entity funded through parliamentary grants and water resource charges.

Its mandate includes:

- Protecting and conserving water resources;
- Compiling Catchment Management Strategies (CMS);
- Coordinating water users and water management institutions;
- Promoting implementation of development plans;
- Supporting community participation in water governance.

LOCMA's presentation similarly described CMAs as mechanisms to ensure equitable access, sustainable utilisation and efficient management of water resources while involving local stakeholders in governance processes.

VOCMA stated that its mission is to ensure equitable access to ample, quality water for all through integrated water resource management.

PUCMA's strategic framework is similarly centred on sustainable, equitable and secure water resources for all.

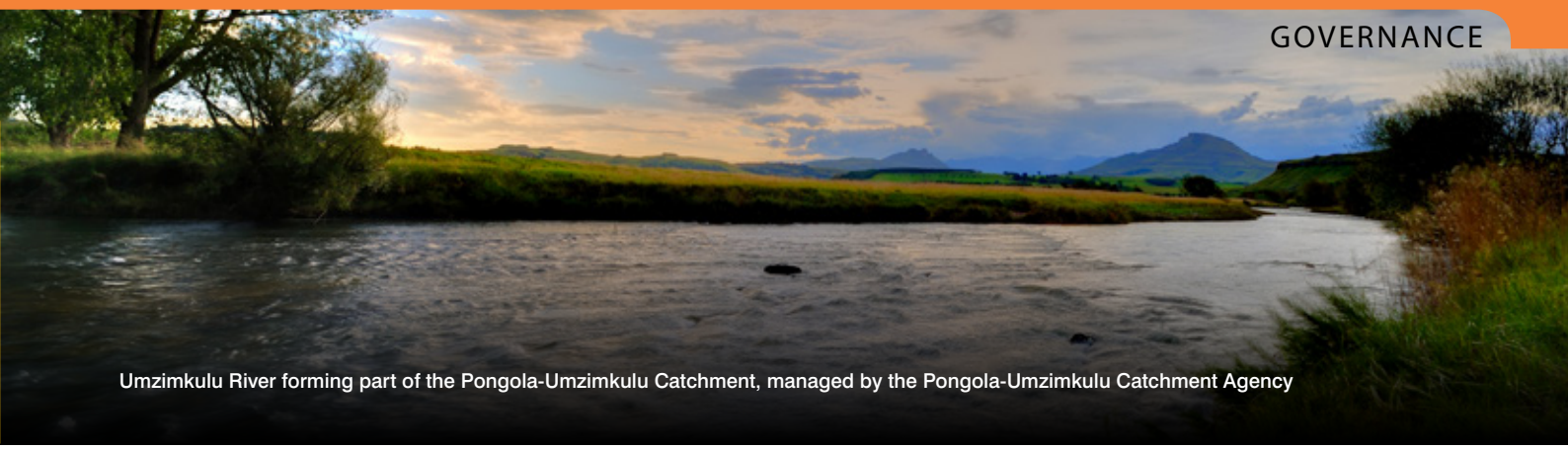
The APPs indicate that CMAs are increasingly functioning as integrated governance institutions responsible not only for hydrological management, but also for economic coordination, environmental protection, stakeholder relations and institutional transformation.

Water scarcity and imbalance intensify

Across the presentations, water scarcity and regional imbalance emerged as dominant concerns.

LOCMA warned that the Limpopo-Olifants Water Management Area is already experiencing demand levels that

Limpopo River part of the Limpopo-Olifants Catchment under management by the Limpopo-Olifants Catchment Management Agency



Umzimkulu River forming part of the Pongola-Umzimkulu Catchment, managed by the Pongola-Umzimkulu Catchment Agency

exceed available water supply in several sub-catchments.

The agency estimated registered annual water use volumes at approximately 3.77 billion cubic metres against available yield volumes of around 2.8 billion cubic metres.

To offset deficits, approximately 500 million cubic metres of water are transferred annually from the Orange-Senqu Basin.

The economic implications are significant. LOCMA noted that the Olifants catchment contributes approximately 5% of South Africa's GDP while supporting mining, agriculture, power generation and heavy industry.

PUCMA similarly acknowledged mounting pressure within its own systems, stating that although the broader water management area still maintains a positive overall balance, "demand in many areas outstrips the yield, indicating a degree of water stress."

The agency noted that reconciliation strategies and national water balance assessments have identified increasing supply challenges, prompting prioritisation of updated water balance studies and intervention planning.

MTCMA's catchment profile illustrates the complexity of water management in the Eastern Cape. The agency operates across a vast 168 966 km^2 region supporting approximately 7.2 million people, with economic activity heavily dependent on agriculture, tourism, forestry and growing agro-processing sectors.

Its revenue profile reflects the agricultural dominance of the region:

- Agriculture accounts for 70% of raw water revenue.
- Local government water services contribute 25%
- Commercial forestry contributes 4%
- Other users contribute 1%

The agency also highlighted the extent to which regional industries rely on municipal infrastructure services, underscoring the interdependence between water governance and broader infrastructure stability.

Ecological restoration and pollution control expand

Environmental rehabilitation and pollution management are becoming increasingly central to CMA operations.

IUCMA currently manages one of the country's largest monitoring systems, including:

- 269 surface water quality sites;
- 31 river flow sites;
- 25 rainfall stations;
- 12 groundwater monitoring sites;
- 25 ecological water requirement sites;
- 10 international obligation monitoring points.

Its targets for 2026/27 include implementing 75% of the Waste Discharge Charge System and taking enforcement action against at least 95% of non-compliant users.

MTCMA has similarly prioritised pollution control and ecological protection.

Its performance targets include:

- Implementing at least 90% of its waste discharge charge strategy
- Processing 85% of high-risk water use licence applications within 74 working days
- Monitoring water users for compliance
- Responding to 80% of pollution incidents within 48 hours
- Monitoring 139 strategic water quality points annually

The agency also plans to implement River Eco-status Monitoring Programmes across 16 rivers while developing a Catchment Management Strategy for gazetting.

PUCMA's planned projects between 2026 and 2029 include major river rehabilitation interventions in the Ncandu, Ngagane and Mgeni systems.

These projects will involve:

- Riverbank stabilisation
- Erosion control
- Ecological rehabilitation
- Water quality restoration

The agency also plans extensive water resource assessment studies across the Usuthu-to-Mhlatuze and Thukela WMAs to support drought response, licensing and sustainable allocation planning.

BOCMA has allocated over R30 million towards water resource management initiatives, including alien vegetation clearing, water quality testing and public engagement programmes.

Collectively, the APPs indicate that ecological restoration is increasingly being treated not as a secondary environmental concern, but as a core water security intervention.

Water licensing and compliance enforcement accelerate

The presentations also show growing emphasis on improving licensing efficiency and compliance enforcement.

BOCMA further aims to take enforcement action in at least 80% of non-compliance cases.

LOCMA and IUCMA have adopted similar targets, reflecting broader national pressure to address illegal water use, improve regulatory turnaround times and strengthen pollution enforcement.

The APPs suggest that water authorisation systems are becoming increasingly central to balancing economic activity with environmental sustainability.

Financial sustainability emerges as a structural risk

Despite growing responsibilities, the agencies continue facing substantial financial pressure.

PUCMA's projected 2026/27 budget totals R149 million, of which 78.2% will come from own revenue generated primarily through water tariffs.

The agency warned that compensation costs are growing faster than revenue, with employee costs projected to

increase at approximately 6.9% annually compared to revenue growth of only 0.4%.

Travel and subsistence alone account for R18.9 million, approximately 32% of all goods and services expenditure.

PUCMA also plans expenditure on:

- River health programmes
- Water resource studies
- River rehabilitation initiatives valued at approximately R8 million
- Water quality testing budgets of approximately R4 million.

MTCMA's medium-term expenditure framework totals approximtely R420 million between 2026/27 and 2028/29. Programme allocations include:

- R180 million for administration
- R240 million for Water Resource Management

The agency expects most funding to come from water resource charges alongside parliamentary grants.

To improve financial sustainability, MTCMA said it is prioritising debt recovery through:

- Credit control enforcement
- Use of National Treasury-appointed debt collectors
- Water debt relief incentive schemes
- Intergovernmental cooperation measures

Its 2026/27 projected revenue includes:

- R101 million from water resource charges
- R32 million from parliamentary grants

Meanwhile, BOCMA has already disclosed a funding shortfall exceeding R20 million for the 2026/27 financial year.

The combined presentations suggest that financial sustainability is becoming one of the defining operational risks for South Africa's water governance institutions.

Institutional capability and transformation remain priorities

The APPs also reveal a strong focus on organisational development, staffing and institutional transformation.

MTCMA plans to fill 90% of vacant positions while implementing new ICT, communications, audit and risk management strategies.

Its procurement targets include:

- 40% expenditure to be directed toward women-owned businesses
- 30% toward youth-owned enterprises
- 7% toward persons with disabilities

The agency additionally plans to implement extensive human resource policy reforms covering occupational health and safety, fraud prevention, employee wellness, disciplinary systems and remote work policies.

The APPs collectively suggest that CMAs are attempting to evolve into fully operational regional institutions with stronger governance systems, workforce capacity and financial controls.

Regional cooperation and strategic infrastructure remain critical

Several WMAs span international river systems, making regional cooperation increasingly important.

LOCMA operates within the Limpopo Basin shared with Botswana, Zimbabwe and Mozambique, while IUCMA manages systems linked to Mozambique and Eswatini.

PUCMA highlighted the strategic importance of the Mgeni system and the Mooi-Mgeni Transfer Scheme, both central to water security in KwaZulu-Natal.

As drought risk, climate variability and infrastructure stress intensify across Southern Africa, transboundary water governance is expected to become increasingly important.

1. **Without catchment management water security becomes a water availability issue**
2. **Environmental protection is a key function of catchment management**
3. **CMA's have started to focus on climate resilience as a core function**

A defining decade for South Africa's water governance system

Taken together, the APPs illustrate a water sector entering uncharted waters where these relatively new organisations are becoming very important, very quickly.

The agencies are simultaneously attempting to:

- Improve ecological resilience
- Expand compliance enforcement
- Accelerate licensing processes
- Stabilise finances
- Strengthen governance systems
- Support economic growth
- Address climate-related risks
- Protect increasingly stressed water resources

Water demand continues to rise across multiple catchments. Pollution and ecological degradation remain persistent. Infrastructure vulnerabilities continue affecting municipalities and bulk systems. Revenue collection pressures are intensifying.

Climate variability is increasing hydrological uncertainty.

At the same time, CMAs are being asked to become financially sustainable, technologically modern, operationally efficient and institutionally accountable.

The APPs suggest that South Africa's CMAs are no longer peripheral administrative bodies. Increasingly, they are becoming some of the country's most important institutions for balancing economic development, environmental protection and long-term national water security. ●

LONG-DISTANCE PIPELINE REHABILITATION THROUGH PIPE PIGGING

Combining specialist coatings with advanced pipe pigging techniques, anti-corrosion engineering company – Corrocoat – is rehabilitating pipelines over distances of up to 30 km while minimising surface disruption and environmental impact.

Corrocoat offers a full turnkey service. The company manufactures its own raw materials (glass flake) as well as formulates and produces a wide range of coatings and lining systems. Corrocoat also has the engineering expertise required to assess and specify the most appropriate solution, and can undertake installation and quality control on site. One such engineering service they offer is trenchless technology.

"Trenchless technology allows us to rehabilitate critical pipelines without digging them up. In many cases, we can restore a pipeline's performance and significantly extend its service life while avoiding the social, environmental and operational disruption associated with replacement," explains Louis Pretorius, managing director of Corrocoat South Africa.

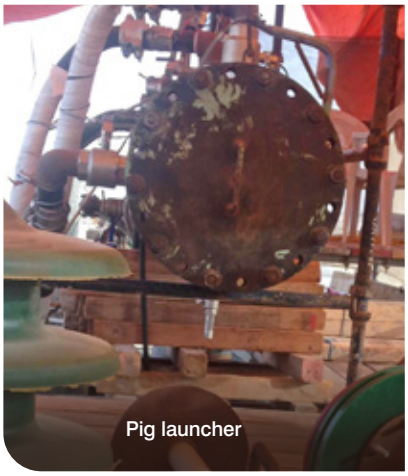
Louis Pretorius, managing director, Corrocoat South Africa

Ian van der Heever, operations manager, Corrocoat South Africa

Corrocoat's involvement in trenchless technologies started in the early 1980s with a series of winched machines that could be pulled through a pipeline where the internal side of the pipes were blasted, cleaned and then sprayed with anti-corrosion products.

"With this method, we achieve higher adhesion and binding strength than using traditional sleeving techniques and find that winched machines are better suited to more corrosive environments found in the mining industry," says Pretorius.

He adds that, however, most trenchless technologies have distance limitations of up to a few hundred meters. "Therefore, Corrocoat adopted another trenchless technology – pipe pigging – that can work across distances as long as 30 km. In terms of trenchless technologies, this is a



Pig launcher

Pig launcher spool

1 Mechanical cleaning
2 Internally coated pipeline by pigging spool flange inspection
3 Originally developed in the oil and gas sector during the 1960s, pigging was used to remove wax deposits, sediment and debris from pipelines

quantum leap forward. Corrocoat South Africa has become a global centre of expertise for pipe pigging operations and have completed well over a hundred pigging contracts in different countries."

Pipe pigging

Originally developed in the oil and gas sector during the 1960s, pigging was used to remove wax deposits, sediment and debris from pipelines. The technology has since evolved into a sophisticated rehabilitation method capable of cleaning, inspecting and coating long sections of pipeline.

A blow-through technique is used where pigs are driven through the pipeline using compressed air provided by large diesel compressors and dehydrated using air dryers/ chillers. Temporary pig traps are fitted at the beginning and end of the pipeline to allow the launching and receiving of the pigs and the batches of chemicals and coating.

In addition to the oil and gas sector, pipe pigging is used in the bulk water and wastewater industry where steel pipes are prevalent and there is aggressive corrosion from chemicals or bacteria that causes pitting.

However, there is a high initial set up cost for pipe pigging. "You need a large air spread with lots of diesel compressors, air dryers, dehumidifiers and tankage. The length of the pipeline is largely irrelevant, whether it is one kilometre, three kilometres or even 30 kilometres, as the same amount of required infrastructure must be located at the launch and receiving points. All that is needed is approximately 10 metres of clear access at each end of the pipeline, together with a flange at both the entry and exit points. Where flanges are not already in place, they can be welded onto the pipeline to facilitate the process. Therefore, the cost of pipe pigging is high for short pipelines and low for longer pipelines. The process can accommodate long-radius bends and can also pass through features such as bearings, tee pieces and off-takes. While these pipeline components may require additional preparation and can add a few hours to the setup process, they can be successfully managed," states Ian van der Heever, operations manager, Corrocoat South Africa.

Pipe pigging minimises surface disruption and excavation, making it particularly well suited to environmentally sensitive areas. By rehabilitating pipelines from within, the technology reduces the impact on surrounding vegetation, watercourses and existing infrastructure, while also limiting the permitting and environmental approvals often associated with large-scale open-cut construction projects. Corrocoat recently upgraded a 1 km pipeline using pigging technology as it ran under a wetland.

According to van der Heever, refurbishing for example a DN 400, 20 km pipeline would take approximately 30 days. "Pipe pigging has been developed and refined over the past 25 years, with advances in materials and application techniques delivering even greater durability and strength. Pigging technology can be applied to pipelines ranging in size from DN 400 to DN 900."

During rehabilitation projects, multiple cleaning stages remove old corrosion products, scale and contaminants before protective coatings are applied to the internal surface.

There are three phases to this pigging technology:

- **Mechanical cleaning** of the pipeline using foam and wire brush pigs to remove loose debris, wax, residual hydrocarbons and corrosion products from the pipeline.
- **Chemical cleaning** of the pipeline, using a range of chemicals batched between two pigs, to ensure a clean, dry metal finish to a visual cleanliness standard of SA2½.
- **Glass flake coating** using specially designed coating pigs. These pigs make several runs, ensuring a multi-layer, continuous coating of the specified thickness, along the complete length of the pipeline.

Advances in coating systems

Corrocoat offers both thin-film and thick-film internal pipeline coating systems, selected according to the condition of the pipeline and the required level of protection. Both types of coating have a formulation that incorporates a pot-life inhibitor, which extends the workable application time of the coating while ensuring consistent performance during installation. "This allows for longer runs needed for pipe pigging," adds van der Heever.

Thin-film coatings typically consist of a two-part solvent-based epoxy system applied at approximately 100 to 150 microns per pass. These coatings are commonly used where the substrate is in relatively good condition and a smooth, protective barrier is required to improve hydraulic performance and prevent corrosion.

"However, there are limitations in environments where there are aggressive chemicals. Corrocoat has therefore also developed a thick-film glass flake epoxy that by contrast, can be applied at substantially greater thicknesses (up to 1000 microns per pass). If required, we build this up in multiple passes to create a structural liner of up to about 5 mm thick on the inside of the pipe. This can be done over significant lengths, depending on pipe diameter, bends, and the number of tees and off-takes," explains van der Heever.

The thick film coating incorporates nano tech glass flake that blends micro-sized glass flakes with nano-additives and has a high temperature rating. Two products used in pipe pigging are the Polyglass VE LPLP, to protect new pipelines and rehabilitate ageing assets and Fibercoat for severely corroded pipelines.

Repair of pitted pipelines

One of the most effective applications of Corrocoat's pipe pigging technology is the rehabilitation of pitted pipelines. Over the past decade, Corrocoat has found that there is an increased need for the rehabilitation of pitted pipelines.

When a pipeline is badly pitted, sleeved liners have limitations. With a plastic liner, small voids or hollows remain between the back of the liner and the uneven internal surface of the steel pipe. A fibreglass sock liner better fills those hollows but still tends to bridge over the hollows rather than filling them completely. In a pressurised pipeline, the process fluid (even if it is only water) can slowly permeate through the internal barrier and accumulate in these pit marks or interstitial spaces between the outer surface of the liner and the inner surface of the pipe. Over time, this trapped fluid can drive further corrosion.

"To avoid this, we use a liquid-applied liner to rehabilitate the internal surface. Because it is applied in a fully liquid state, it achieves extremely intimate contact with the steel substrate, eliminating air pockets and voids," says Pretorius.

On top of the structural benefits, this system offers substantially higher chemical and temperature resistance.

What makes this lining distinctive is its glass-flake technology. The coating is filled with thousands of microscopic, fish-scale-like platelets per square centimetre. In a standard polymer lining (such as a conventional polyester, vinyl ester or epoxy), small molecules like water, oxygen, hydrogen sulphide, chlorine dioxide or hydrogen gas can slowly diffuse through the polymer by osmosis or permeation and eventually end up in the interstitial space on the outside of the polymer. That is why


In pig receiver


3

even polymers are not completely impermeable.

"In our glass-flake system, these microscopic platelets are densely packed in multiple layers, forcing diffusing molecules to take a far more tortuous path. This slows diffusion rates by orders of magnitude, greatly reducing the transport of corrosive molecues to the steel substrate. As a result, it significantly mitigates the pitting and wall-loss mechanisms that eventually cause structural weakness and pipeline failure," explains Pretorius.

This technology is supplied as a specialised liquid polymer in drums and then carefully blended and applied on site. "The application method is part of our intellectual property. In simple terms, we use two specially designed pigs with a charge of liquid polymer – ranging from about 1 to 10 tonnes – contained between them," he states.

For Corrocoat, the evolution of trenchless rehabilitation reflects a broader shift in infrastructure management from replacement to asset preservation. By combining specialist coating technologies with advanced application methods such as pipe pigging, the company is able to rehabilitate pipelines over long distances, address severe corrosion and pitting, and restore critical infrastructure with minimal disruption. As municipalities, mines and industrial operators face growing pressure to extend the life of ageing assets while controlling costs, trenchless technologies are becoming an increasingly important tool in maintaining reliable pipeline networks and safeguarding infrastructure investment.

PRECISION DOSING RESHAPES WASTEWATER TREATMENT PERFORMANCE

As water reuse gains urgency, Verder Pumps is helping treatment plants improve precision and reliability through advanced dosing technologies. From accurate chemical metering to handling aggressive and viscous media, modern pump solutions are playing a critical role in stabilising processes and enabling more efficient, sustainable wastewater treatment. **By Darryl Macdougall, Managing Director, Verder Pumps South Africa**

Untreated wastewater remains a major contributor to global water scarcity and environmental degradation. The World Health Organisation (WHO), estimates that 44% of household wastewater is not treated properly, while only 38% of industrial wastewater is safely treated before discharge. The result is widespread pollution of freshwater ecosystems, increasing pressure on already constrained water resources and growing risks to public health.

Yet wastewater is also one of the underutilised water resources available. The United Nations Environment Programme (UNEP) reports that the untapped potential for wastewater reuse is around 320 billion m^3 annually, more than 10 times the capacity currently produced by global desalination.

Wastewater infrastructure

Achieving this potential depends on reliable treatment infrastructure – and at the centre of every wastewater treatment facility are robust pumping technologies.

For engineers designing municipal and industrial treatment plants, pump selection plays a critical role in maintaining process stability, achieving precise chemical dosing and ensuring long-term operational reliability.

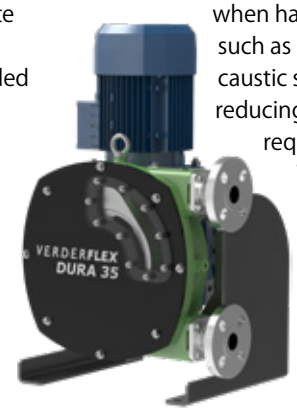
Chemical dosing is fundamental across multiple stages of wastewater treatment. Coagulants, flocculants, pH correction chemicals and disinfectants must be accurately introduced to ensure efficient removal of contaminants and stable downstream processing.

During coagulation and flocculation, for example, chemicals such as ferric chloride, aluminum sulphate and polymer solutions are used to destabilise suspended particles and promote floc formation. Incorrect dosing directly affects treatment performance: underdosing reduces contaminant removal efficiency, while overdosing increases operating costs and sludge production.

Accurate metering pumps are therefore essential to maintain consistent dosing under variable flow conditions.

Peristaltic dosing pumps offer particular advantages in these applications. In pumps such as the Verderflex Ds500 metering and dosing pump, the chemical being pumped remains completely contained within the tube element, meaning that it never comes into contact with the pump's mechanical components. This configuration improves reliability when handling aggressive chemicals such as sodium hypochlorite, acids, caustic solutions or ferric salts, while reducing corrosion and maintenance requirements.

The Ds500 is designed for municipal and industrial



Verder Dura 45 peristaltic pump for dosing and low flow application

The Verderflex Ds4F expands the cased drive peristaltic range by combining the control capabilities of the Ds500 with multiple tube element options

dosing duties where consistent, accurate flow control is required. Because the pumped fluid is isolated from the drive mechanism, the risk of seal failure or contamination is minimised, supporting reliable operation in continuous treatment processes.

The Verderflex Ds4F expands the cased drive peristaltic range by combining the control capabilities of the Ds500 with multiple tube element options. This allows engineers to configure the pump to suit different process conditions, including viscous polymer dosing, lime slurry injection for pH control or chemical transfer within treatment plants.

Flexible solutions for diverse plant requirements

Wastewater treatment plants must manage a wide range of chemicals and operating conditions, requiring dosing systems that offer both flexibility and precision.

Pump ranges such as Microdos and ITC dosing systems provide a variety of technologies, including electromagnetic solenoid diaphragm pumps, peristaltic pumps and motor-driven piston or diaphragm metering pumps. These are used across numerous treatment stages, including coagulant dosing in clarification processes, polymer dosing for sludge thickening and dewatering, pH control using sodium hydroxide or sulphuric acid, nutrient dosing in biological treatment systems and disinfection dosing for final effluent treatment

The ITC DOSmart series, for example, uses stepper motor technology to deliver high-precision chemical metering. With a turndown ratio of up to 1:3000, the pumps can maintain accurate dosing across widely varying flow conditions – a key requirement in municipal treatment plants where influent flows fluctuate throughout the day.

In the Verderflex Ds500 metering and dosing pump, the chemical being pumped remains completely contained within the tube element, meaning that it never comes into contact with the pump's mechanical components

These pumps also offer strong suction capability for handling viscous chemicals such as polymer solutions used in sludge treatment processes. With flow capacities of up to 60 litres per hour, they are well suited to applications including polymer preparation units supplying centrifuges, belt filter presses and dissolved air flotation systems.

Similarly, the ITC Dostec AC series provides motor-driven metering pumps available in both diaphragm and piston configurations. These pumps support multiple operating modes, including manual control, analogue signal input, proportional dosing and batch dosing. This flexibility allows dosing to be directly linked to plant instrumentation such as flow meters, pH probes or turbidity sensors, enabling automated process control.

Digital monitoring and operational visibility

As treatment plants adopt increasingly digitalised operations, remote monitoring and predictive maintenance are becoming essential.

The DOSmart and Dostec AC pump series can be integrated with the Cloud Manager App, allowing operators to remotely monitor pump performance, operational parameters and dosing accuracy. Through a centralised interface, plant operators can access real-time data, receive alerts and track equipment performance across multiple installations.

For utilities operating multiple sites, or remote treatment facilities, this capability improves system oversight and allows early detection of operational issues, helping to reduce unplanned downtime and optimise maintenance schedules.

Handling abrasive and viscous media

Wastewater treatment frequently involves pumping abrasive slurries, viscous chemicals and shear-sensitive fluids. Conventional pump technologies often struggle in these environments due to wear on seals, valves or internal components.

Verderflex peristaltic pumps are particularly well suited to these demanding applications. Their operating principle – compressing a reinforced hose to move fluid through the pump – ensures the pumped medium remains completely isolated from mechanical components.

This provides several advantages in wastewater applications including reduced maintenance due to minimal wear components, improved containment of hazardous or corrosive chemicals and gentle pumping of shear-sensitive polymer solutions. Because the hose is typically the primary wear component, maintenance is predictable and simplified, reducing downtime in continuous treatment processes.

Reliable wastewater reuse

As water scarcity intensifies, wastewater reuse will become an increasingly important component of sustainable water management. Effective treatment requires reliable equipment capable of maintaining precise process control while operating continuously under challenging conditions.

For engineers designing the next generation of treatment facilities, selecting fit-for-purpose pumping solutions is essential to achieving efficient, reliable and sustainable operations. By enabling accurate chemical dosing, robust handling of difficult media and improved operational monitoring, modern pump technologies are helping transform wastewater into a valuable and reusable water resource, while safeguarding freshwater sources. ●

The Dostec piston pump delivers precise liquid dosing through its isolated dosing head, micrometric control and adjustable flow regulation

Mobility is a huge value proposition in the African and South African market

WATER WITHOUT WAITING: THE RISE OF MODULAR RENTAL PLANTS IN AFRICA

Across Africa, the conversation around water infrastructure is shifting, from centralisation to decentralisation, and from capital-heavy investments to agile, service-based models. At the heart of this transformation lies a powerful offering: mobile, rental water treatment plants. **By Chris Ashmore, CEO Watericon**

What was once considered a temporary solution is rapidly becoming a cornerstone of a resilient water strategy.At Watericon, we identified a critical gap while working with a power producer: routine maintenance often forced a reduction in output. Although plants are typically designed with three treatment trains, two in operation and one on standby, the backup unit is frequently brought online to maximise production, leaving no redundancy when it's needed most. This insight led us to introduce rental water treatment plants, enabling maintenance to proceed without disrupting operations.

We soon recognised that the applications for rental plants extended far beyond this initial case, and we developed a fleet of standardised rental units including: ultrafiltration, reverse osmosis, softening systems, and electrodeionisation for ultrapure water (ranging from 100m³/h to 10MLD).

Africa's complex political, economic and geographical environment creates a uniquely challenging operating environment for water infrastructure. Add climate volatility, population growth, and industrial expansion to the mix, and the reality is that traditional, fixed systems cannot keep up.

Africa has 15% of the global population but only 9% of global renewable freshwater resources. Drought cycles are reducing reservoir capacity and placing immense pressure on already-strained municipal systems. At the same time, extreme weather events, from floods to hurricanes, can wipe out existing infrastructure overnight, leaving entire communities without safe water. In these moments, speed is everything.

Mobile, containerised plants are uniquely positioned to respond. Unlike conventional plants that can take years to design and construct, modular systems are factory-built and rapidly deployed, making them ideal for emergency relief and to add extra capacity where it's needed most.

Chris Ashmore, CEO Watericon

The rise of decentralisation

Across much of Africa, rapid urbanisation is creating new demand centres far from existing bulk infrastructure.

Decentralised systems allow water to be treated at the point of need, bypassing fragile distribution networks entirely. Mobile plants can be deployed in remote locations, at new manufacturing facilities, or in housing developments not yet connected to municipal systems.

Rather than waiting years for pipeline expansions or large-scale capital projects, developers and investors can access immediate, localised water security. Our BOOT (Build, Own, Operate, and Transfer) model gives businesses a "rent-to-own" pathway to water treatment infrastructure, either transitioning to full ownership over time or retaining Watericon to continue operating the plant.

Remote mining operations

Africa's resource sector presents a significant opportunity for plug-and-play solutions. Mining operations are often located in remote and water-scarce regions, yet they require reliable, high-quality water


Modular solutions have significant advantages for Africa's water climate

for processing, dust suppression, and workforce needs.

For mining operations, modular rental plants offer a compelling value proposition:

- Rapid mobilisation to remote sites
- Scalability as operations expand or contract
- The ability to treat challenging water sources (e.g. mine-impacted water, brackish groundwater)

Containerised water systems are designed to withstand harsh environments and to operate off-grid, making them ideally suited to these applications.

A flexible financial model

Traditional water treatment infrastructure requires substantial upfront capital. In contrast, rental and lease models convert this into an operational expense.

This shift means that businesses can access world-class treatment without committing to large capital outlays, particularly valuable for new developments or uncertain demand scenarios. At Watericon, ownership models are designed to be flexible, from short-term rentals to long-term leases, offering the ability to scale as demand grows.

Rental plants are powerful tools for optimisation and innovation. Water treatment is rarely one-size-fits-all. Feedwater quality varies dramatically across regions – whether from rivers, boreholes, industrial effluent, or seawater - and selecting the right treatment train is critical.

Rental plants allow operators to:

- Pilot different technologies (e.g. ultrafiltration vs reverse osmosis)
- Optimise process configurations
- Validate performance before committing to permanent infrastructure

This 'test-before-you-invest' approach reduces technical risk and ensures that full-scale plants are designed based on real-world data rather than assumptions. In a continent as diverse as Africa this flexibility is invaluable.

Engineering for speed and simplicity

A defining feature of modern modular water treatment plants is their integration of remote monitoring and smart control systems. At Watericon, our standardised rental units are designed to deliver consistent, data-driven performance across a range of applications.

These systems can also be tailored to specific site conditions and water quality challenges. In practice, this balance between standardisation and flexibility enables faster project turnaround times, often within weeks, while still accommodating more complex or bespoke applications where required.

With real-time monitoring, operators are able to optimise performance and anticipate maintenance needs across distributed or remote installations.

Watericon's rental plants also include ongoing operations and maintenance support. This provides access to technical expertise, 24/7 operational assistance, chemical supply, and in-house laboratory services – offering a more integrated approach to system performance over time. In environments where skilled labour may be scarce and logistics complex, this simplicity is not just convenient, it is essential.

The benefits for customers include:

- Minimal civil works
- Reduced installation time
- Lower reliance on specialised on-site skills
- Ability to scale when needed

Perhaps the most underappreciated benefit of rental plants is mobility, which acts as a strategic advantage


Decentralised approaches to water are quickly becoming more viable with rent-to-own

Modular systems can be redeployed as needs change, creating a fundamentally more efficient model of infrastructure utilisation, where assets are not fixed to a single location but can serve multiple use cases over their lifecycle.

Historically, mobile plants were often viewed as temporary solutions, but that perception is changing. Today, they are increasingly being integrated into long-term water strategies as permanent decentralised infrastructure in underserved areas. In some cases, modular plants are even being deployed alongside traditional infrastructure, creating hybrid systems that combine stability with flexibility.

Africa's water future will not be solved by a single approach. Large-scale infrastructure will always have a role to play. But it is becoming increasingly clear that flexibility, speed, and mobility must be part of the equation. Modular, rental water treatment plants deliver exactly that. ●

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Unlike carbon, water is immensely complex and understanding climate change in relation to water is far more difficult

Democratic Republic of Congo, where abundant water resources exist, but poor quality and limited access undermine their utility, stewardship is not just about quantity, but about quality, equity and human rights

Water has long been deprioritised in the climate change conversation despite its effects being most immediate

WATER IS NO LONGER THE POOR COUSIN IN GLOBAL CLIMATE CONVERSATIONS

For years, climate discourse has been dominated by carbon emissions and global warming, while deprioritising risks related to water that are increasingly threatening business continuity, social stability and ecological resilience.

Today, the idea of 'water as the new carbon' is gaining traction, but the comparison is imperfect, according to Fiona Sutton, principal scientist in water management at SRK Consulting (South Africa). While carbon is relatively simple to quantify and standardise, water is profoundly context-specific.

"This is one of the factors enabling the global focus on carbon – allowing broad application of net-zero targets, emissions reporting and carbon markets which has shaped corporate sustainability agendas worldwide."

By contrast, the significance of water depends on where it is used. The same volume of water has very different implications in a water-abundant catchment than in a water-stressed one.

While greenhouse gas accounting has matured into a globally recognised system, water stewardship remains fragmented and highly localised. Yet this does not diminish its importance, she argued; if anything, it emphasises the opposite.

"Water represents a direct and immediate risk; businesses can survive high emissions in the short term, but they cannot operate without water," she adds.

Importantly, water and carbon are not separate challenges; rather, they are deeply interconnected, she explains. Healthy water systems such as wetlands, forests and aquifers play a crucial role in carbon sequestration and climate regulation. Conversely, degraded water systems undermine these natural carbon sinks.

"By protecting water, you protect the ecological processes that trap and store carbon," she says. "Water stewardship, in this sense, is climate stewardship."

Investors weigh in

This interdependence is beginning to reshape how investors and regulators view sustainability. There is growing recognition that carbon metrics alone provide an incomplete picture of environmental risk.

Fiona Sutton, principal scientist in water management at SRK Consulting (South Africa)

Sutton says, "Investors are increasingly asking not just how much water a company uses, but how that use affects the catchment in which it operates. Reporting frameworks such as the Carbon Disclosure Project (CDP) and evolving global standards are placing greater emphasis on transparency, context and impact."

This shift marks a move away from aggregate metrics toward catchment-level accountability. A company may report reduced water consumption across its operations, but if those reductions occur in water-abundant regions while impacts persist in stressed catchments, the net benefit may be negligible.

While water management focuses on site-level efficiency and compliance, water stewardship considers the broader catchment, recognising that all users are interconnected. Activities upstream – whether industrial discharge or agricultural runoff – directly affect downstream users, ecosystems and communities.

"Frameworks such as the Alliance for Water Stewardship (AWS) standard provide a structured pathway for this transition," she continues. "They encourage organisations to assess both site-specific and catchment-level risks, engage with stakeholders and implement measurable actions."

By recognising the strategic value of water stewardship, and applying frameworks like the AWS, companies can move beyond compliance to view their water-related expenditure as a long-term strategic investment rather than only an operating cost.

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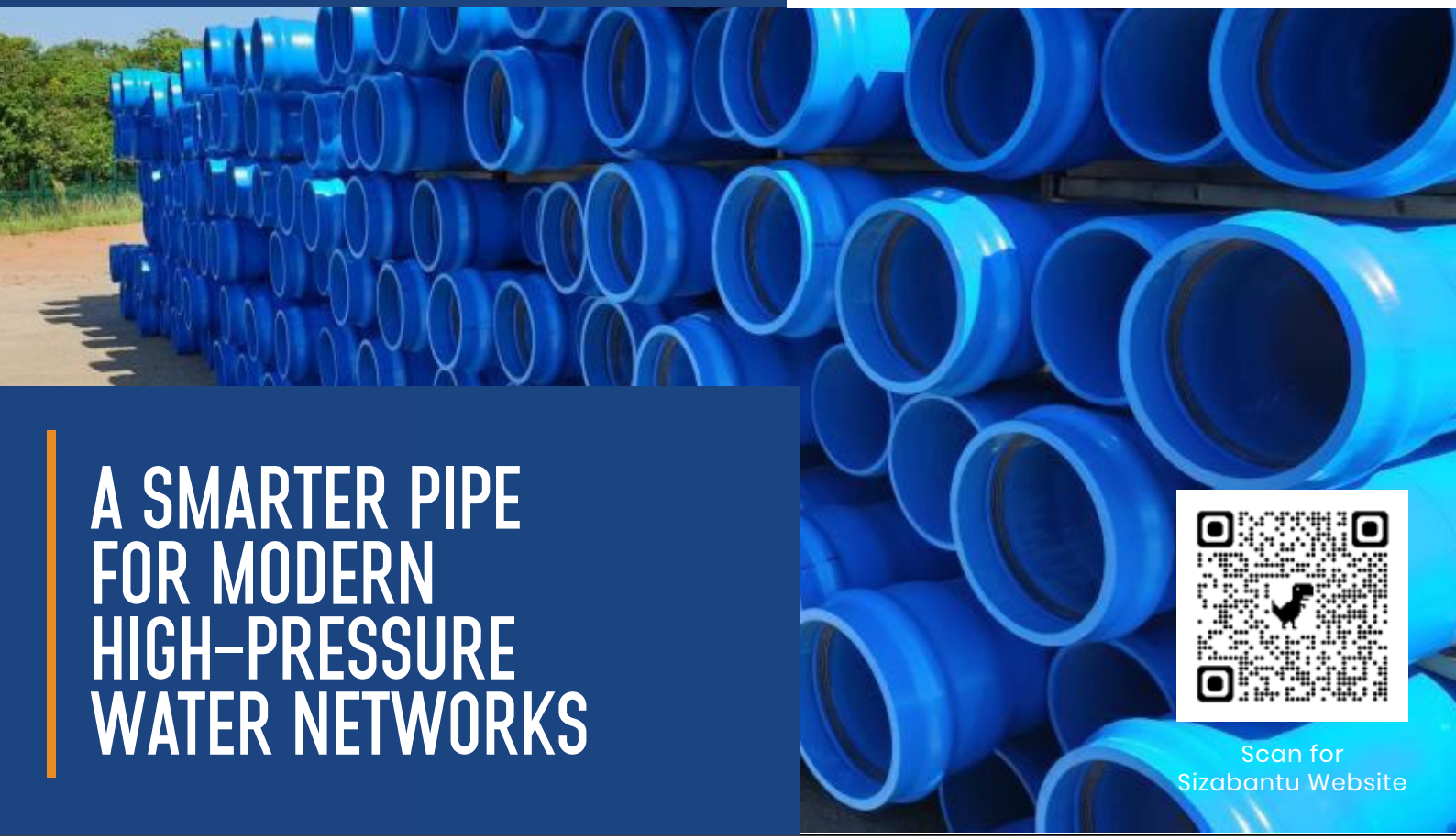

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