

THE WATER WHEEL

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CLIMATE RESILIENCE

Growing resilience in Giyani: How climate-smart water projects are transforming rural livelihoods

IRRIGATION WATER

Raising a glass to innovation: The science behind water-wise vineyards

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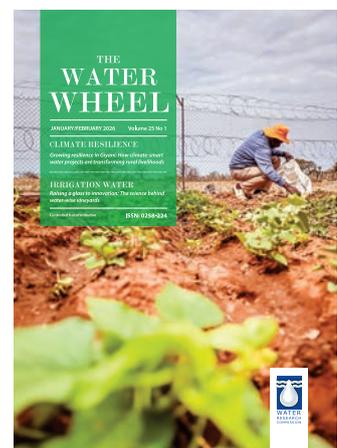
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The Giyani Local Scale Climate Resilience Programme has empowered a Limpopo community and placed success in their hands. See article on page 10.

NEWS

WRC Board member takes the helm at NSTF



Chair of the Human Resources Committee of the Water Research Commission, Prof Nnesi Kgabi, has been appointed as the new Chair of the National Science and Technology Forum (NSTF).

Prof Kgabi is the Chief Director of Research and Postgraduate Support at North-West University. She is a seasoned scientist and has distinguished herself through diligence and leadership in research management and governance.

In addition to serving on the WRC Board she also serves as Chair of the Southern African Development Community (SADC) WaterNet Board, and is Vice President for Research Management within the Executive Committee of the Southern African Research and Innovation Management Association (SARIMA).

Her international standing is reflected in her service as a member of the Evaluation Commission of the Swiss Programme

for International Research by Scientific Investigation Teams (SPIRIT) under the Swiss National Science Foundation and as a merit reviewer for the United States National Science Foundation.

NSTF Executive Director, Jansie Niehaus, congratulated Prof Kgabi on her appointment as the chairperson. "We are delighted to welcome Prof Kgabi in a new capacity, and look forward to being led by her as someone who comes with a wealth of experience, as she knows the NSTF and its aims very well too. It is particularly good timing, as NSTF is celebrating its 30th anniversary. We are embarking on the next decade of growth and success with Prof Kgabi at the helm."

Study calls for inclusion of yeast monitoring in South Africa's groundwater safety regulations

When water gushes from a rural borehole, many see purity, but beneath that clear stream could lie invisible fungal organisms capable of causing serious infections. To protect public health, South Africa should introduce inclusive microbial monitoring, according to a North-West University (NWU) study.

Conducted by Rebaone Mofokeng, Prof Carlos Bezuidenhout and Dr Deidré van Wyk from NWU's Unit for Environmental Sciences and Management, the study argues that South Africa's water safety regulations should be expanded beyond bacteria to include fungal pathogens, especially yeasts, found in groundwater. "Despite routine surveillance of bacterial indicators, fungal contaminants, particularly yeasts, have received little attention in South Africa," says Mofokeng. "This gap creates a blind spot in water safety, especially in communities that rely on untreated groundwater for daily use."

Groundwater is the main source of drinking water for millions in rural and semi-arid parts of South Africa. While generally considered safe, the research notes that anthropogenic activities, such as agriculture, waste disposal and climate change, are increasingly contaminating these sources.

The study highlights that traditional monitoring systems mainly focus on bacterial indicators such as *E. coli*, neglecting fungal pathogens like *Candida*, *Cryptococcus* and *Rhodotorula* species. These yeasts can cause mild skin infections or life-threatening diseases in immunocompromised individuals. "Yeasts are increasingly recognised as complementary indicators that capture contamination routes overlooked by bacterial monitoring alone," Mofokeng explains. "By incorporating yeast detection into water quality frameworks, we can achieve a more holistic assessment of

groundwater safety."

The researchers' paper on the study, published in *Total Environment Microbiology*, also links the persistence of pathogenic yeasts in groundwater to changing environmental conditions. Climate change, agricultural runoff and rising temperatures are said to promote the survival of thermotolerant fungi capable of adapting to both environmental and human hosts.

"Global warming may promote the proliferation of thermotolerant pathogens such as *Candidozyma auris* and *Cryptococcus neoformans*," says Mofokeng. "These species have already been identified as critical health threats by the World Health Organisation."

To access the original article, visit: <https://doi.org/10.1016/j.tem.2025.100038>

Nelson Mandela University wins sustainable water management award

Nelson Mandela University (NMU) was named the winner of the Sustainable Water Management Initiative Award at the HEFMA (Higher Education Facility Management Association) 2025 Annual Conference, held late last year.

HEFMA is the flagship association for best practice in facilities and infrastructure management for higher education institutions in southern Africa. This year's conference was hosted by North-West University, with the theme 'Innovating Campus Spaces.'

During the conference, NMU received a Sustainable Water Management Award in recognition of the university's best practice water sustainability plan implemented on all seven of its campuses. "It's really good to have the recognition as we have put considerable effort and finance into implementing it, and it's ongoing," says Dr André Hefer, NMU

Sustainability Engineer.

The multi-faceted water sustainability initiatives implemented according to the plan carried the Gqeberha campuses through the severe drought and threat of Day Zero from 2021 to 2023, when the feeder dams were down to 12%. "Drought cycles in our part of the Eastern Cape occur approximately every eight to ten

years, and we have a five-year strategy to 2029," says Hefer. "This will ensure water resilience and full business continuity to buffer emergencies, including municipal breakages and the next drought, which we are anticipating from about 2029. The strategy is also aimed at reducing our considerable municipal water bill."



Water and Sanitation Ministry reaffirms universal access commitment at AWSISA Dialogue

The Ministry of Water and Sanitation has reaffirmed its commitment to accelerating equitable and sustainable access to water and sanitation services across South Africa, at the AWSISA Africa & Global South Water & Sanitation Dialogue, held in November at Emperors Palace in Johannesburg. AWSISA is the Association of Water and Sanitation Institutions in South Africa.

The Dialogue was formally declared opened by Deputy President Paul Mashatile, supported by the Minister of Water and Sanitation, Pemmy Majodina, through a virtual address, 10 November 2025. In his address, the Deputy President highlighted the urgency of advancing water security and dignified sanitation across all communities, while strengthening partnerships across Africa and the Global South.

More than 1 500 delegates attended the conference, including government

leaders, water utility executives, researchers, civil society organisations, youth innovators and private sector partners.

The Ministry recognises that Africa's water and sanitation challenges are shared, transboundary and deeply interconnected. This is why South Africa continues to work closely with African governments, regional bodies and strategic global partners to advance the Africa Water Vision 2063, which seeks a prosperous and water-secure continent where water is equitably and sustainably managed. The Dialogue's theme, 'Towards Sustainable Water and Sanitation Security in Africa,' reflects and acknowledges the shared exposure to climate shocks, rapid urbanisation and the systemic pressures facing public infrastructure and institutions.

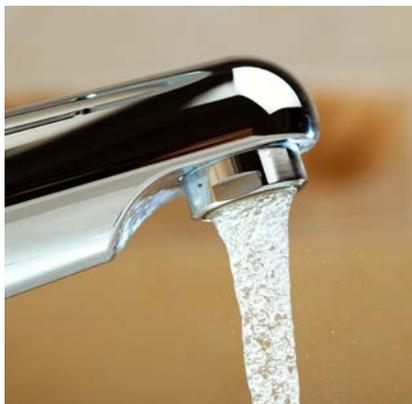
The Dialogue goes beyond knowledge exchange but also creates a strategic platform where policy harmonisation

is pursued, technological solutions are tested for local relevance and cross-border partnerships are strengthened. It also aims to accelerate infrastructure delivery, align regulatory reforms and unlock blended investment models capable of sustaining long-term development. Addressing delegates at the Dialogue, Minister Majodina reiterated and emphasised the Ministry's commitment to enhancing the delivery of water and sanitation services across the country, especially in disadvantaged and underserved communities.

"Our commitment is deeply rooted in restoring dignity to our communities. We are intensifying our work in the most disadvantaged and underserved areas. Every household, every school and every clinic deserves safe and dependable water. This is not just an aspiration; but a right we are actively realising through investment, partnership and accountable delivery," she said.

GLOBAL

New WHO compendium places spotlight on drinking-water systems and technologies



Safe and reliable drinking-water supply depends on effective risk management, appropriate regulation and support, and well-informed technology selection. The World Health Organisation (WHO) *Compendium of drinking-water systems and technologies from source to consumer*

provides a structured reference for local-level engineers, planners, practitioners, and decision-makers seeking to strengthen drinking-water supply systems in diverse contexts.

Taking a whole-of-system perspective in line with water safety planning principles, the Compendium outlines typical supply configurations and disaggregates them into functional components, including source, treatment, distribution, and household-level practices.

By consolidating technical and operational knowledge and good practices, the Compendium enables evidence-based decision-making and supports the selection of solutions that are appropriate to local conditions, resources, and water quality challenges. It links technology choice to health targets

and management approaches, reinforcing the progressive implementation of WHO's Framework for safe drinking-water. Cross-cutting themes such as risk-based management and monitoring, lifecycle considerations, inclusion, and strengthening resilience are addressed to promote sustainable and equitable services.

As a companion to WHO's 2024 *Guidelines for drinking-water quality: small water supplies* and *Sanitary inspection packages*, the Compendium facilitates planning, stakeholder engagement, and capacity development towards safely managed drinking-water services for all.

To download the Compendium, visit: <https://www.who.int/publications/item/9789240113992>

El Niño could soon turn deadly predictable, scientists warn

A new study in *Nature Communications* finds that the El Niño-Southern Oscillation (ENSO), one of the most influential forces behind global climate variability, may change dramatically as the planet continues to warm.

Using advanced, high-resolution climate models, researchers from South Korea, the USA, Germany, and Ireland discovered that ENSO could rapidly intensify over the next several decades and begin to synchronise with other large-scale climate systems. This shift is expected to alter global temperature and rainfall patterns by the end of the century.

The study suggests that within the next 30 to 40 years, ENSO may transition from its current irregular El Niño-La Niña cycles to a more consistent pattern of strong oscillations marked by larger sea surface

temperature (SST) fluctuations.

"In a warmer world, the tropical Pacific can undergo a type of climate tipping point, switching from stable to unstable oscillatory behaviour. This is the first time this type of transition has been identified unequivocally in a complex climate model," says Prof Malte F Stuecker, lead author of the study and Director of the International Pacific Research Centre at the University of Hawai'i at Mānoa, USA. "Enhanced air-sea coupling in a warming climate, combined with more variable weather in the tropics, leads to a transition in amplitude and regularity," he adds.

The high-resolution simulations indicate that a stronger, more rhythmic ENSO could also align with other climate systems, including the North Atlantic Oscillation (NAO), the Indian Ocean Dipole (IOD), and the Tropical North Atlantic

(TNA) mode. This process resembles several pendulums gradually swinging together at the same frequency.

This synchronisation will lead to stronger rainfall fluctuations in regions such as Southern California and the Iberian Peninsula, increasing the risk of hydroclimate 'whiplash' effects," says Prof Axel Timmermann, corresponding author of the study and Director of the IBS Center for Climate Physics at Pusan National University, South Korea. "The increased regularity of ENSO could improve seasonal climate forecasts; however, the amplified impacts will necessitate enhanced planning and adaptation strategies."

To access the original article, visit: <https://www.nature.com/articles/s41467-025-64619-0>

New research reveals what's really hiding in bottled water



Scientists estimate that bottled water drinkers swallow up to 90 000 more microplastic particles per year than those who stick to tap water.

In an extensive review of more than 140 studies, research by scientists at Concordia University reveals that people consume between 39 000 and 52 000 microplastic particles every year, and those who drink bottled water take in roughly 90 000 more than tap water users.

These microplastics are tiny fragments, often invisible to the eye. A typical particle measures between one micron (a thousandth of a millimetre) and five millimetres, while nanoplastics are even smaller. The contamination begins during manufacturing, transportation, and storage, when low-quality plastics release microscopic fragments, especially when exposed to sunlight and fluctuating temperatures. Unlike microplastics from food sources, those in bottled water are ingested directly.

Once consumed, these particles can travel throughout the body. Studies indicate

that microplastics can cross biological barriers, enter the bloodstream, and accumulate in organs. This may cause chronic inflammation, oxidative stress, hormonal disruption, reproductive impairment, neurological issues, and even some cancers. However, the long-term impact remains uncertain due to limited standardised testing and measurement techniques.

The research highlights that current detection tools vary in precision and capability. Some methods can spot smaller particles but cannot identify their composition, while others analyse chemical makeup but miss the tiniest plastics. The most advanced systems are both expensive and difficult to access, hindering consistent global study.

Despite growing environmental laws aimed at reducing plastic pollution, most regulations target items such as shopping bags, straws, and packaging. Single-use water bottles often escape similar scrutiny. "Education is the most important action we can take," the researchers say. "Drinking

water from plastic bottles is fine in an emergency, but it is not something that should be used in daily life. People need to understand that the issue is not acute toxicity, it is chronic toxicity."

To view the original study, visit: <https://www.sciencedirect.com/science/article/pii/S0304389425018643?via%3Dihub>

IWMI AT 25: CELEBRATING A QUARTER CENTURY OF WATER INNOVATION IN SOUTHERN AFRICA

On 10 October 2025, the International Water Management Institute (IWMI) held a day of celebration commemorating 25 years since the Southern Africa regional office was established. During this quarter century, IWMI has been at the forefront of innovative water management solutions, advancing sustainable development and climate resilience to enhance water security. Working in partnership with governments, institutions and communities, including the Water Research Commission (WRC), IWMI has endeavoured to drive meaningful change across Southern Africa.

The event was held at the Century City Conference Centre in Cape Town. Dr Inga Jacobs-Mata, who served as the Regional Representative: Southern Africa prior to her current role as Director: Water, Growth and Inclusion, reflected on IWMI-Southern Africa's journey over the past 25 years, from being a "hidden gem" in one of the pre-fab buildings on the Agricultural Research Council campus to the move in 2019 to a more accessible office in Hatfield Gardens.

"That move was not just about the expansion of an office space but was quite symbolic in us being a lot more visible and central in the institutional architecture that makes up the water sector," she noted. Pointing out that IWMI is part of the CGIAR network, she added that the local office has grown into a regional hub, hosting other CGIAR centres such as the International Food Policy Research Institute and Alliance Bioversity & CIAT, as well as several other organisations over the years, including the Global Water Partnership.

The current Regional Representative, Dr Henry Roman, introduced the transformational levers that IWMI-Southern Africa has identified in its strategy for the next 25 years, which include water data science, water governance, gender, youth and social inclusion, and scaling, finance and investment.

Participants were then split into four groups and took part in an interactive visioning exercise based on these transformational levers. After lunch, a panel discussion on the future of water in South Africa yielded insightful perspectives on pressing issues such as institutional management failures, the legacy of inequality, and the ripple effects of climate change.

The first speaker was Jane Reddick, Programme Manager for Water and Agriculture at GreenCape. She noted that the country's water crisis is largely driven by poor governance, political interference, and failed financial models in water services authorities. She stressed that fundamental institutional reform is the necessary first step to unlock financial sustainability, attract private investment, and enable the adoption of technical solutions like water reuse.

Prof Bongani Ncube, who holds the SARChI Chair in Governance and Economics of Water and Sanitation Sector Institutions at Cape Peninsula University of Technology, emphasised

the importance of regional collaboration in tackling shared water scarcity challenges. She drew attention to the need for applied research to co-create and co-produce knowledge with smallholder farmers, ensuring accelerated adoption of technologies that improve water use efficiency.

Dr Khumbulani Dhavu, Research Team Manager for Irrigation and Drainage Engineering at the Agricultural Research Council, focused on technological and management innovations for irrigation, such as low-cost, modular systems and solar-powered solutions to circumvent unreliable grid power. He highlighted the need for soil moisture sensing for scheduling and automating irrigation, and the role of small storage dams in groundwater recharge.

Prof Lyla Mehta, a Professorial Research Fellow at the Institute of Development Studies at the University of Sussex and a Visiting Professor at Noragric, Norwegian University of Life Sciences, discussed ways in which policies and institutions can ensure equity, justice and interlinkages across the water-food-livelihood nexus in a changing climate. She stressed the need to focus on the perspectives, interests and experiences of the most vulnerable and marginalised people, pointing out that land and water access remain highly racialised and unequal in South Africa.

The final speaker was Dr Lewis Hove, FAO Resilience Team Leader for Southern Africa, who said that securing water by 2050 requires substantial transformational investments in the water sector, given that most climate change impacts are mediated through water. He underscored the importance of collaboration and coordination to avoid fragmented and siloed research, and of empowering transboundary river basin organisations so that they can function better and make a difference on the ground.

An awards ceremony followed to honour the achievements and contributions of IWMI staff and partners. The WRC was given the Longstanding Partner Organisation Award.



The Water Research Commission was given the Longstanding Partner Organisation Award, presented by Dr Henry Roman, IWMI's Regional Representative: Southern Africa.

NEW WRC REPORTS

Assessing the social and economic impact of changed water use behaviour in food production: Evidence from selected case studies in South Africa

Managing water effectively in food production has become increasingly important not only from an environmental perspective but also from social and economic perspectives. Understanding the social and economic impacts of variability in the behaviour of water users when using water for food production is important, not only for improving water use but also for developing policies to enhance water resource management and designing effective interventions for behavioural change. This may be achieved by incorporating psychological dimensions of environmental programmes, enabling better predictions of responses to environmental changes, and supporting the scaling of targeted solutions in agricultural water management. This project aimed to develop an integrated model and socio-economic indicators to assess the economic and social impacts of changed water use behaviour in selected irrigation schemes and selected commodities in South Africa. To achieve the objectives of the project, the research team utilised a survey covering 909 smallholder and commercial farmer participants, a literature review, a Social Accounting Matrix (SAM), secondary data, and multiplier analysis.

WRC report no. 3233/1/25

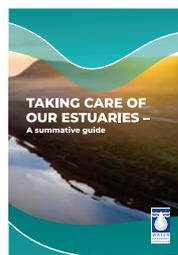
Link: <https://bit.ly/4om50gp>

Assessing the context and priorities for irrigation development and agricultural water management (IDAWM) framework for South Africa

Agriculture is a major driver of the African economy that sustains many livelihoods across the continent. In 2020, the AU endorsed the irrigation development and agricultural water management (IDAWM) framework as a blueprint for advancing agricultural water management (AWM) in Africa. The framework consolidates the most relevant approaches to and priority actions for AWM in Africa and serves as a blueprint to align and harmonise national and regional water management policies. The study set out to conduct context-specific literature search (i.e., desktop study) to expand the knowledge base on AWM in South Africa, to identify farming systems typologies intersected with AWM solutions and document the status for each of the four pathways identified in the IDAWM framework, to document key success factors and lessons learned for sustainable implementation of AWM practices in the country, to assess opportunities, challenges and priorities for implementing the identified pathways through stakeholder engagement and to identify intervention areas for promising AWM development projects to enhance climate resilience, livelihood options and level of food security in South Africa.

WRC report no. 3235/1/25

Link: <https://bit.ly/4plHhyB>



Taking care of our estuaries – A summative guide

Estuaries are vital ecosystems where rivers meet the sea, supporting diverse plants and animals while providing essential services such as water filtration, flood control, and nurseries for fish and invertebrates. They sustain livelihoods through fishing, tourism, and recreation, and act as natural buffers

protecting coastal communities from storms and erosion. However, pollution, overuse, and habitat loss threaten their health and productivity. Collective management is crucial because estuaries connect land and sea, affecting everyone upstream and downstream. By working together, communities, industries, and government, people can ensure estuaries remain healthy, resilient, and productive for current and future generations. This booklet provides a summary of previously published guides by the WRC on estuary management.

Link: <https://bit.ly/3XITWGO>

Assessing the utility of drone technology in monitoring water availability and quality in small reservoirs

Previous work on water quality and quantity in South Africa has typically focused on selected large individual reservoirs, which makes it difficult to extrapolate to small water bodies. Additional research is warranted in light of emerging trends in estimating water level and water quality changes in small waterbodies using satellite remotely sensed data. However, satellite-borne data sets are excessively susceptible to cloud cover, and most of their applications have been for 'snapshot' detecting and predicting optical water quality elements rather than generating seamless monitoring of water quality parameters in large lakes. However, the derivation of high-resolution images using unmanned aerial systems (UAS) has become an alternative form of novel earth observation technologies that could offer accurate, seamless field measurements of surface water level fluctuations and their quality at local scales. The project's general aim was to assess the utility of drone technology to monitor water availability and quality in irrigation canals and dams. In this study, four systematic reviews were undertaken to review the literature on methods and algorithms available for utilising UAVs in monitoring water quality and quantity in small reservoirs

WRC report no. 3224/1/25

Link: <https://bit.ly/48hTqNI>

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click on the web link provided, email: hendrickm@wrc.org.za or visit: www.wrc.org.za

CLIMATE RESILIENCE

Growing resilience in Giyani: How climate-smart water projects are transforming rural livelihoods

In Limpopo's drought-prone Giyani, a water resilience programme is changing lives. From solar-powered pumps to climate-smart farming, local co-operatives like the Ngambas are proving how community-driven innovation can turn water scarcity into opportunity.
Article by Matthew Hattingh.



Teacher-turned-market gardener Delina Ngamba has been on something of a learning curve in recent years and her newly-acquired skills are bearing fruit. Swiss chard, spring onions and other leafy vegetables grow in abundance on the little co-op farm she and her husband run near Giyani, in north-eastern Limpopo.

"We see... modern farming methods and tools are the future [for] our communities because you do not have to worry about removing weeds, having back pains while working, and using too much water and land," says Ngamba.

The bountiful harvests (and relief for weary bones) are thanks to lessons in hydroponics, ridge and furrow techniques, bag-planting, and water-quality testing, made possible by the Giyani

Local Scale Climate Resilience Programme, which also financed the equipment to keep 0.5 ha irrigated on the 7ha Matsambo Ngamba Agricultural Co-operative farm. This included a solar-powered groundwater pump, solar panels, distribution pipes and booster pump, drip irrigation system, a modular wastewater-to-irrigation-water treatment plant, filter, and a reservoir.

The Ngambas are among an estimated 6 620 Giyani beneficiaries of the programme, which ran from January 2022 to December 2024. Funded by the Government of Flanders, Belgium, the programme was managed and implemented by the Water Research Commission, the Association for Water and Rural Development (Award), Tsogang Water and Sanitation, and the University of the Western Cape. It sought to prepare communities and officials in the Greater Giyani Local

Municipality of the Mopani District to better cope with the hotter, drier conditions climate change was expected to bring.

The aim was to help people find ways to use and share the region's limited water resources more effectively and fairly, with initiatives to build skills, engage with policymakers and develop relations with different levels of the government and local water authorities. The programme had three main areas of focus: individual economic development (the Ngambas being a good example); community development, focusing on improving access to more water sources; and helping government institutions to improve water services.

This is detailed in *Building an enabling environment for rural climate resilience within local government Under the Giyani Local Scale Climate Resilience Programme (WRC Report No. 3222/1/25)*. Published in August, the report is the work of the Award's Derick du Toit, Tebogo Mathebula, Thembhani Mabunda and Basani Ngobeni.

Giyani, the former capital of the Gazankulu homeland, is about 30 km as the pied crow flies to the Kruger fence line and roughly equidistant to the national park's Phalaborwa and Punda Maria gates. It falls within the Mopani District Municipality, much of it pretty dry country. In 2009/10, for example, when the level of the Middle Letaba Dam, one of Giyani's most important stores of surface water, plummeted, a disaster area was declared. The crisis reminded "planners of the importance of resilience planning and climate change preparation".

Planning and preparation are sorely needed in the region – implementation and maintenance too. The report shows governance failings and other ills slowing the rollout of bulk water infrastructure and services in Giyani. The municipality's existing dams, reservoirs, reticulation networks and borehole pumps are woefully insufficient for its urban and rural residents and its mostly subsistence farmers. Villages are scattered, and consumers often struggle to pay for water services, with unlawful connections and vandalism a common problem.

With no reliable water sources, most people in Giyani do with less than 25 litres per person per day, barely sufficient for very basic domestic needs. People rely on too few sources of water – a big part of the problem, so finding ways to diversify sources was among the programme's main goals.

Another goal was to promote the Multiple Use Water Services Model, an approach to water planning and provision that emerged internationally in the 1990s. This model says managing water for a single purpose, be it domestic use or irrigation, doesn't make the best use of the resource and sells the poor short. The model focuses on small-scale community practices while encouraging household economic advancement.

Agriculture is the biggest user of water and the biggest employer in Giyani, which is not to suggest formal jobs are plentiful. About 60% of the population is unemployed and 78% have no individual income. The authors felt capacity-building initiatives, including assisting Giyani residents to better understand the model's value as a response to climate change could improve access to water and its responsible use.

"In time, it is hoped these improvements will reflect in the community's ability and willingness to maintain water infrastructure and to pay for (possibly subsidised) water services," they said. The report explained that by securing a reliable water supply, crop and livestock yields could be lifted. Here, the programme intervened directly, providing water-quality testing and by equipping existing boreholes with solar-powered pumps, such as on the Ngamba's co-op.

However, if a virtuous development circle is to develop, where investment stimulates economic growth, in turn funding further development, the maintenance and operation of water-supply systems will need to improve. Water dialogue events in the region often highlighted maintenance and operations as key obstacles to improved water services. The report attributed these issues to a shortage of skilled staff, technical resources, and failures in budgeting, planning, and asset management. The report suggests involving communities in water system decisions to foster ownership, boost care, and reduce theft or vandalism. This approach could also increase scrutiny of municipal officials, promoting accountability. Further benefits may come from piloting community co-ownership or co-management schemes, as seen in places like Limpopo.

The Mopani Municipality, the region's water services authority, is hard pressed to meet its responsibilities for the operation, maintenance and efficient use of bulk-infrastructure. Sharing some of the burden with households, small groups and volunteer-run local committees, could ease the strain on the authorities, the report said.

Local committees could monitor neighbourhood water systems, including boreholes, pumps, rainwater harvesting, and small supply schemes. They could handle minor repairs, help collect fees, and enable residents to report issues quickly, reducing downtime and using local expertise. This should help the municipality eke out operations and maintenance budgets further, while it continued to provide technical backup and regulation and remained responsible for major infrastructure investment.

To foster self-supply and increase the role of individuals and communities the programme focused on co-management



Innovative agricultural techniques, such as bag-planting, has boosted agricultural productivity at the Matsambo Ngamba Agricultural Co-operative farm.



Green peppers being prepared for the market at the Ahi Tirheni Mqweka Agricultural Primary Cooperative. Among others, this cooperative benefited from a hybrid solar system, water storage, and pumps for existing boreholes.

agreements; village water infrastructure savings associations; and solar-powered boreholes. We will touch on some of these while drawing on case studies that document the programme's work with agricultural co-ops and community water supply projects.

The Ngambas show that co-ops can respond well to supported self-supply initiatives. Members of the Macena Primary Agricultural Cooperative, 35 km south-east of Giyani, said they were grateful to be part of the initiative and that the solar-powered pump, panels, tanks, piping and drip irrigation lines installed on their 17.5 ha farm had been a boon: "Our solar is working perfectly," said representatives of the co-op. They suggested additional storage capacity and an alarm to alert them to over pumping and to protect the pump from theft would also help. They said the programme taught them the importance of regular water-quality testing, locating cattle kraals away from water sources, and carefully managing water resources.

Patrick Sekhula, director of the Duvadzi Youth Organic Primary Agricultural Cooperative, valued the water quality-testing done on their 5ha family farm, and the installation of a solar-powered pump, reservoir, related piping and equipment, and like all the programme installations, metering. Here, the co-op keeps 0.5ha under irrigation, growing tomatoes, okra, onions, butternut, green peppers, baby marrows, cabbage, spinach and maize. Produce is sold to neighbours and local vendors, Giyani supermarkets and national markets.

"The programme has been good to us. The solar system it provided has been so helpful because we no longer rely on (grid) electricity and we are able to pump during load-shedding," said Sekhula.

He was concerned about sharing a metered borehole with a neighbouring community. A valid concern, as Giyani's rural communities face poverty, limited water infrastructure, and minimal oversight, relying mainly on volunteer borehole operators and nascent water committees. "Whilst farm pilot sites took ownership of the project, village pilot sites found it more challenging to coordinate themselves," the report notes.

At the time of the study, 2 302 residents of Matsotsosela, a village 48 km south-east of Giyani town, relied on two municipal boreholes. Villagers, many of whom survive on social welfare grants and selling mopani worms in season, must take care to purify the borehole water, lest they develop diarrhoea or break out in a skin rash. Thanks to the programme, though, at least one of the working boreholes was more reliable, with a solar-powered pump and a 2 500 litre tank.

In the neighbouring Mayephu, where unemployment stands at 70%, times are tough too. Although the village's 1 940 residents received assistance from the programme, their new system was incomplete when a case study interviewer called. "We can honestly say nothing is working in our solar system and the system needs to be improved," said Lilly Ntlhamu, chairman of the local water committee.

Du Toit told *The Water Wheel* these were installation hiccups that were soon remedied. "Co-management between farmers, communities and the municipal district municipality is crucial where multiple user types are present. This should be formalised with written agreements and supported by the establishment of village water committees," the report said.

Concerns included reliance on the municipality for system upkeep and ongoing infrastructure funding. The report also noted public resistance to innovations like reverse osmosis, metering, tariffs, and technology-based monitoring.

Despite these and other teething problems, the authors were optimistic about supported self-supply: "It is a transformative model that bridges policy with community-led action, ensuring the right to water becomes a reality, even for the most remote communities".

The programme proposed addressing funding difficulties through village water infrastructure savings associations. By pooling small, regular contributions from villagers, associations can fund minor repairs and tackle urgent maintenance. In most cases, committees are doing this anyway.

A model for formalising this is being investigated. The authors felt the model would build resilience to breakdowns and climate change, and suggested the municipality fund mentorship or seed grants to help saving associations get going.

A big part of the programme involved efforts to build institutional backing for the model. The authors pointed out that

introducing innovations in rural municipalities can be difficult for a host of technical reasons, including the sheer distances involved and the way villages are scattered. Tough institutional hurdles included: “entrenched legacy systems; siloed governance structures; professional resistance to non-traditional approaches; political caution; limited resources; leadership turnover; and skills gaps.”

The authors proposed drafting formal co-management agreements with community water committees, ward councillors, and local contractors to clarify roles, build trust, ensure legal recognition, and align with broader water and development plans.

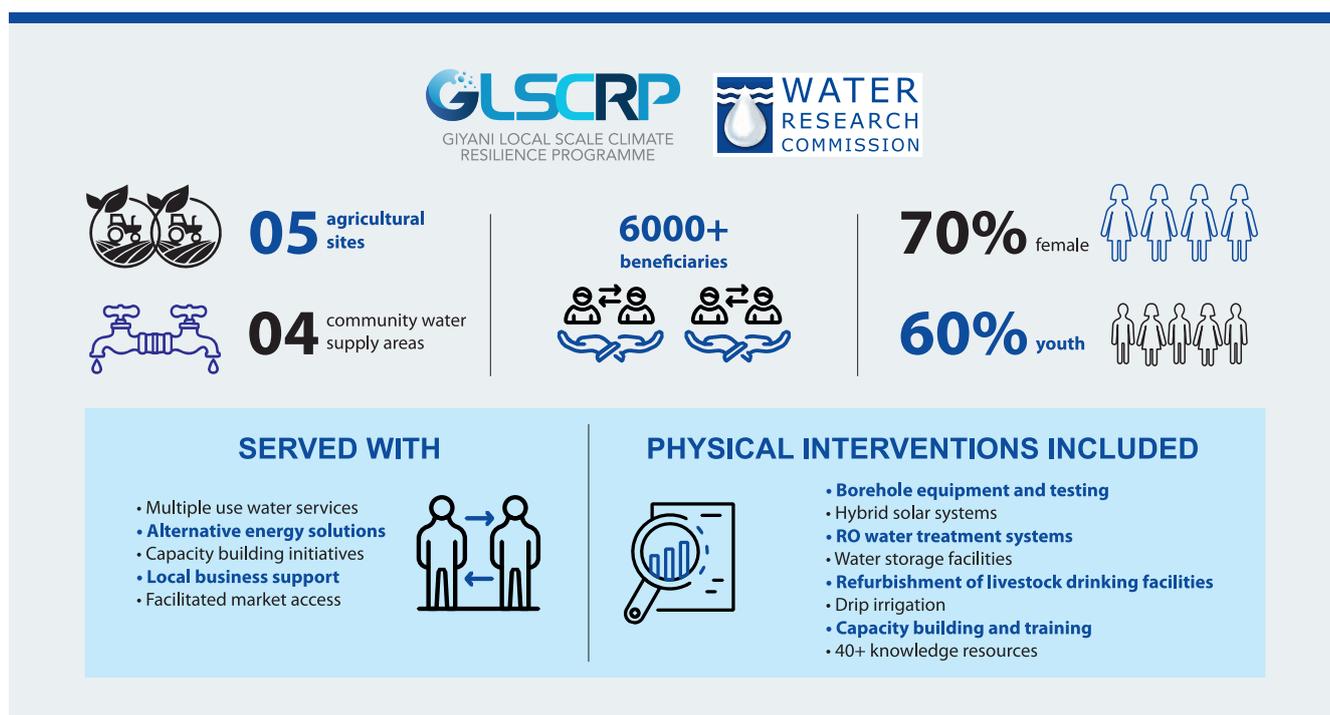
The report highlights that “institutional adoption” is vital for the model’s sustainability, recommending stronger information sharing and collaboration among officials, councillors, water professionals, and communities. It emphasises the importance of securing ongoing political support for technical solutions and calls for regular engagement with political leaders and positive relationships across government and community levels.

Memoranda of understanding, letters of collaboration and terms of reference documents were drafted and signed by the programme partners and different arms of the provincial and local government, including water service authorities. The report

also detailed engagements with council structures, including introductory meetings and sessions with portfolio committees, to build trust and a foundation for collaboration, in other words, to “secure a seat at the table”, for the programme.

This set the scene for a process of innovation research, evidence-building, and protocol negotiation, ensuring alignment with legal mandates. Pilot schemes and formal handovers were seen as important ways to refine new practices and support lasting success. To help establish climate-adapted water management as the norm, the programme engaged with local political and organisational cultures and identified influential champions within key groups to drive change.

“The process of building enabling environments was thus not about dictating change from the outside, but about being a credible partner in the evolution of local governance, providing support to guide officials and decision-makers toward more adaptive and resilient practices.”



The Giyani Local Scale Climate Resilience Programme in numbers.

EMERGING CONTAMINANTS

'If it's brown, flush it down and if it's yellow, let it mellow': Exploring the issues surrounding untreated wastewater

South Africa's rivers are under silent threat from pharmaceuticals and antibiotic-resistant bacteria escaping wastewater treatment works. New research using environmental DNA and global modelling reveals the extent of this pollution and its danger to ecosystems and health. Article by Nick Rivers-Moore, Isabella Gosetto, Miracle Osoh and Leo Quayle.



Whether we thank them or blame them, it is reasonable to say that the Romans probably invented waterborne sewers and that the Victorians perfected them. Their legacy means that our sewage is flushed away, and we no longer need to think about it. However, we should be thinking about it, because through the city sewerage systems (the piping and reticulation systems that take the sewage away), millions of litres of wastewater are concentrated at single points within catchments across South Africa. Even if this wastewater has been treated to meet compliance standards, which, according to the latest Green Drop report, only equates to 36% of wastewater treatment works (WWTWs), this does not automatically mean that the water

discharged back into rivers is 'clean'.

Dr Miracle Osoh, an environmental scientist working on wastewater pollution, explains: "Not all the medications we ingest are completely metabolised by our bodies." This means that every time we go to the toilet, we're also flushing a unique mix of chemicals and bacteria, defined by our gut microflora, the medications we take, and even the probiotics in our diets. Globally, while negligible in small amounts from a single household, the buildup of these products in wastewater can be harmful to freshwater ecosystems, particularly the active components found in most medicines, known as Active

Pharmaceutical Ingredients (APIs). Added to the mix are bacteria from our digestive systems, some of which are antibiotic-resistant and have the potential to negatively alter their receiving environment. The real issue? WWTWs around the world have not been designed to deal with eliminating this cocktail of additives in wastewater, including in South Africa.

As part of a broader Environmental Pollution Programme, funded by UK International Development from the UK government and delivered by the Joint Nature Conservation Committee (JNCC) in collaboration with South African partners, we were able to dig deeper into this challenge. Our action-based research focused on emerging contaminants – pollutants that are only now starting to gain attention but are already affecting our rivers and aquatic life. Studies show that pharmaceutical pollution is an emerging yet major growing threat to freshwater environmental health. A recent study of pollution of the world's rivers due to APIs found that the highest concentrations of sites were in low-to middle-income countries, including sub-Saharan Africa. Most of these occurrences were associated with poor wastewater and waste management infrastructure. Combine this mix of harmful chemicals in freshwater ecosystems, with potentially antibiotic-resistant strains of human bacteria, and we are left with a ticking time-bomb of a breeding ground for strains of bacteria that have become resistant to antibiotics, commonly referred to as “superbugs”.

What we did

We approached this research using two methods: Environmental DNA (or eDNA) sampling and modelling the concentration of pharmaceutical residues downstream of WWTWs. eDNA refers to the genetic material present in the environment, which is found in sediment, water, and air. It can include everything, from whole cells and free-floating DNA to potentially whole organisms. Collecting and analysing eDNA is an efficient method to provide a snapshot of the living organisms present in each location, and this method is becoming a vital tool in modern environmental monitoring.

The aim of our study is to investigate the extent to which a WWTW impacts aquatic life downstream in rivers, especially bacterial communities, due to untreated pharmaceutical pollution such as antibiotics. To explore this, we had two main goals:

- Compare the diversity of aquatic species upstream and downstream of WWTWs by analysing eDNA samples, looking at changes in the makeup of aquatic species, such as invertebrates, fish, bacteria and eukaryotes (organisms with complex cells).
- Link these changes to water quality data, measured upstream and downstream of a WWTW.

We also wanted to answer two key questions: (1) does the level of WWTW compliance (i.e. how well it meets treatment standards) influence the types of bacteria and other life found downstream; (2) given the widespread use of pharmaceuticals and antibiotics in particular, where is the risk to aquatic life highest from these pollutants highest relative to WWTW servicing urbanised areas?. eDNA sampling points were selected from two sites in KwaZulu-Natal, upstream and downstream of the Howick sewage works discharge point on the uMngeni River, and upstream and downstream of the Mooi River WWTW discharge point on the Mooi River.

eDNA samples were collected according to the sampling methods developed by NatureMetrics, a UK-based environmental DNA lab. This included taking a mixed sample from a variety of locations at the site, and syringing the water samples through filters sized to collect the appropriate DNA material for analysis. Three samples were taken at each site: one sample targeting invertebrates and vertebrates in the water column, one sample targeting bacteria and eukaryotes in the water column, and one sample specifically targeting organisms in the sediment. The sediment sample was not filtered and was collected manually from areas where the sediment type differs and put into a sealed and sterilised plastic container. The filters and sediment samples were preserved, sealed and labelled and couriered to the NatureMetrics laboratory in the UK.



Sample collection through syringing sample through a filter.



Filter labelled, sealed and preserved.



Sediment sample labelled, preserved and sealed.

Leo Quyye

Nick Rivers-Moore)

Nick Rivers-Moore)

A complementary study has mapped out which rivers in South Africa are most at risk from a widely used antibiotic called sulfamethoxazole (SMX). This drug, commonly prescribed to treat bacterial infections, has become one of the most frequently detected antibiotics in rivers and streams across the world. The problem? Even at very low concentrations, SMX can fuel antimicrobial resistance (AMR) – a growing global health threat where bacteria evolve to resist medicines that once killed them.

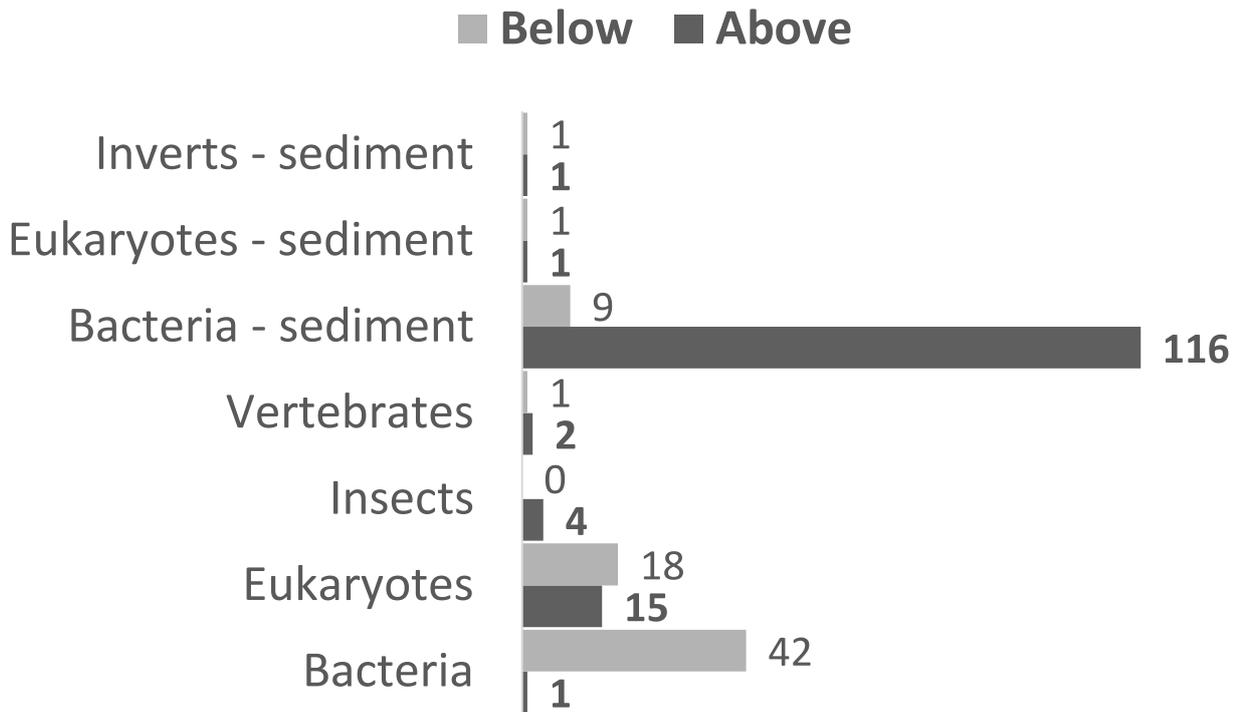
To understand how and where SMX enters South Africa’s waterways, researchers turned to a powerful global modelling tool called HydroFATE. This system pulls together a wide range of information: river maps, wastewater treatment performance, medicine use, population data, and river flow patterns. By combining these layers, the model can estimate how much of the antibiotic is being released into rivers and how long it lingers there.

The approach is detailed but intuitive: it looks at how much SMX people consume, how much passes through their bodies into sewage, how well local treatment plants filter it out, how sensitive aquatic life is to the drug, and how quickly it breaks

down once it enters a river. The results show which stretches of river are most vulnerable, both under normal flow conditions and during dry periods, when low water levels make pollution problems worse.

What we found

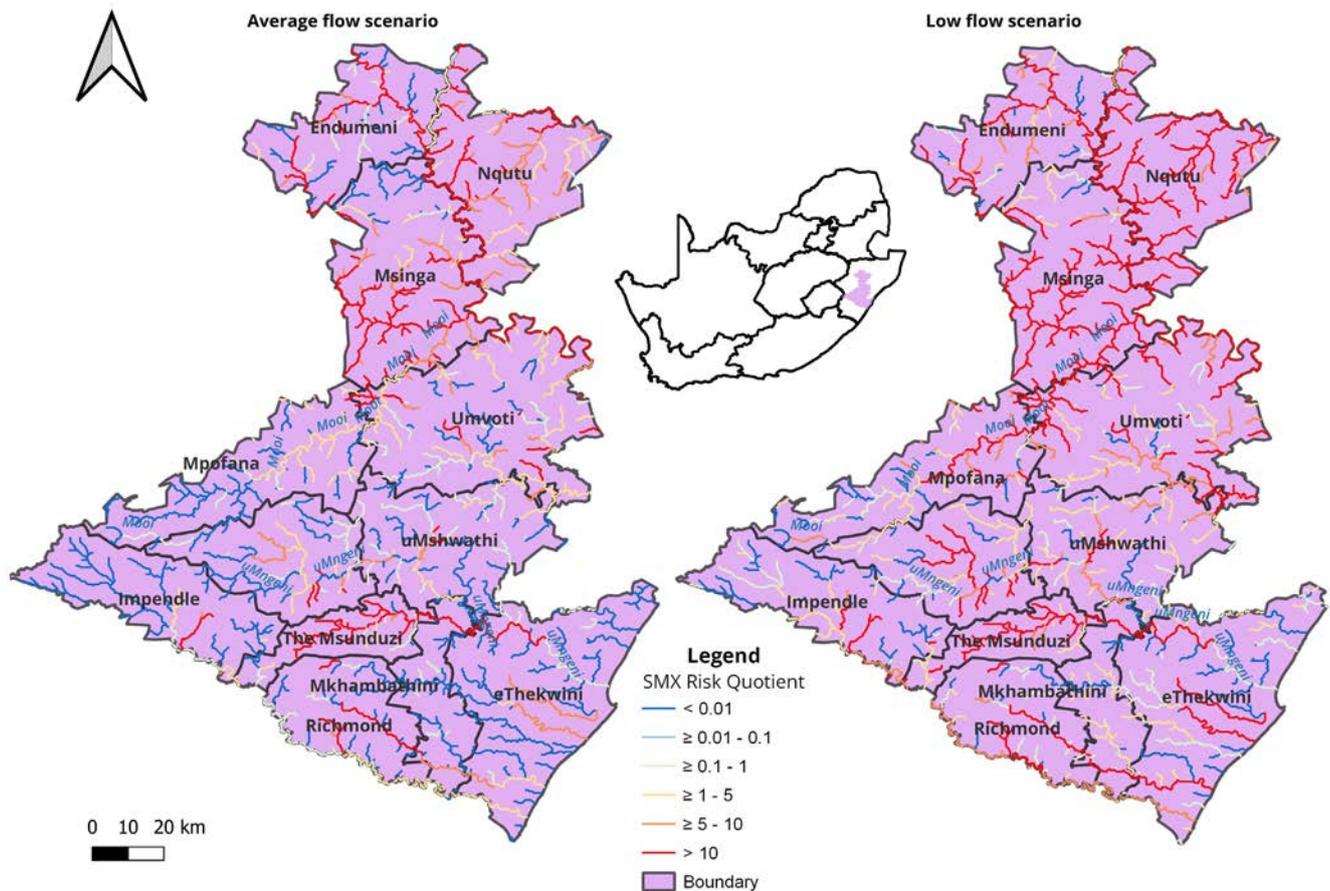
The number of observable taxonomic units (OTUs) that occurred either exclusively above or below the WWTWs in both river systems showed several differences at the lowest levels of the food chain. In the aquatic samples, there were similar numbers of OTUs that occurred exclusively downstream and upstream of the WWTWs (18 and 15, respectively), whereas only one species of bacteria occurred exclusively upstream of both WWTWs, compared to 42 species of bacteria that only occurred downstream of the WWTWs. In contrast, only the bacterial communities from the riverbed samples provided any discriminating power of the impacts of the WWTW on aquatic communities at different levels of the food chain. Here, the pattern was the inverse of what was reflected from the water samples, in that there were 116 OTUs of bacteria that only occurred upstream of the WWTWs, compared to nine species that occurred exclusively below both WWTWs.



The number of OTUs that occurred exclusively above or below WWTWs for the Mooi and Umgeni rivers across a range of living groups for the water and riverbed samples.

Of the 59 122 rivers assessed, about 38% were potentially at risk of sulfamethoxazole during average flow conditions and about 52% were at risk of SMX during low flow conditions. About 116 km of the Mooi River was predicted to be at risk of SMX impact at both average and low flow scenarios, and risk generally increased by about four orders of magnitude higher during low flow conditions.

For the uMgeni River, about 121,2 km of river were at risk of SMX during average flow conditions. The length of the uMgeni River at risk of SMX increased to 168.6 km during low flow conditions. The concentration of SMX and associated risk along the uMgeni River varied significantly depending on the proximity of the river to WWTW effluent, urban centres and input from rural water washing off the land. In various rivers across South Africa, the risk of SMX can be associated with areas remarkable for high human population densities. This calls for further investigation of the socioecological dimensions of pharmaceutical pollution in South Africa.



Maps of Mooi and uMgeni River catchments showing risk of SMX under average and low flow scenarios.

Conclusions

Dr Nick Rivers-Moore, a freshwater ecologist, warns: “Wastewater treatment generally fails to remove antibiotics from entering river systems, where there is the potential for the development of antibiotic-resistant bacteria.” For example, studies in the Msunduzi River in South Africa found high concentrations of several antibiotics downstream of a wastewater treatment plant. This raises concern not only for the environment, where different species may be affected in different ways, but also for human health, as there is a higher presence of antibiotic resistance genes in these areas.

The good news is that these findings don’t just highlight a problem, they point the way to solutions. Thanks to cutting-edge tools like environmental DNA (eDNA) and global models such as

HydroFATE, scientists can now “see” pollution in ways that weren’t possible before. This means we can identify which rivers are most at risk, understand what’s driving the problem, and start developing smarter, more effective ways to protect our water.

“Both of these studies highlight exciting future research avenues,” says Dr Rivers-Moore. “They also show that we finally have the scientific tools to turn awareness into action.” With this new knowledge, South Africa, and indeed the world, has a chance to get ahead of the problem, safeguarding rivers, wildlife, and human health for the future.

IRRIGATION WATER

Raising a glass to innovation: The science behind water-wise vineyards

As South Africa faces increasing water scarcity, researchers from Stellenbosch University's Grape and Wine Research Institute are exploring how vines can thrive under limited irrigation, ensuring sustainable, high-quality grape and wine production for a drier future.

In South Africa, 19 488 ha of agricultural land is planted with table grapes and 87 848 ha with wine grapes. All commercially produced table grapes and 87% of wine grapes receive irrigation water (SAWIS, 2023; Ferreira and Burger, 2024). Between 641 and 1 325 litres of water are needed to produce one kilogram of wine grapes, depending on the cultivar and the cultivation region (Jarman et al., 2020). This is comparable to global figures for other fruit crops, such as apples and citrus (Van der Laan, 2017).

Concerns about water security due to climate change drive worldwide efforts to breed new drought-resistant grape cultivars and rootstocks. However, this is a long-term solution because new cultivars can take many years before they are commercially available and successfully introduced to consumers.

There is thus a present need to know more about the cultivars and rootstocks currently grown in the vineyards of South Africa in the context of climate (water) smart production. We must understand their resilience and adaptability during water-scarce conditions and record the impact on the yields and quality of the grapes if it is assumed that irrigation water will not always be available. A research team from the South African Grape and Wine Research Institute (SAGWRI) at Stellenbosch University is addressing this need through a project called 'Quality Grapes with Limited Water'. Led by Prof Melané Vivier, this multidisciplinary initiative began in Spring 2020 with the establishment of an experimental model vineyard. The project is co-funded by South Africa Wine and the Water Research Commission.

A model vineyard refers to a highly characterised field trial site where experimental parameters and/or sources of variation and confounding variables are experimentally explored before and during the experiment (Alexandersson et al., 2014). This model vineyard has been established against the lower slopes of Stellenbosch Mountain on the Welgevallen experimental farm of Stellenbosch University as a long-term research site to study the adaptation and resilience of grapevine scion-rootstock combinations to water constraint.

Grapevines' responses to water constraint and the influence of rootstocks

Grapevine (*Vitis vinifera*) is a relatively drought-resistant crop that employs several strategies to cope with water scarcity, such as a deep, penetrative root system, stomatal regulation to prevent water loss during transpiration, accumulation of solutes to maintain cell turgor, optimisation of water use efficiency through adjusting hydraulic conductivity and hormones and chemical signals from roots to shoots to coordinate responses to water stress (Gambetta et al., 2020; Medrano et al., 2003; Simonneau et al., 2017).

Previous work funded by the WRC and other funding bodies, such as SA Wine, generated invaluable insights on how grapevines monitor and respond to stressful water-scarce conditions. However, findings showed that these responses are influenced by numerous interconnected factors often referred to as the Genotype X Environment X Management interactions. This study adopts a holistic approach by tracking several of these contributing factors over the lifetime of the model vineyard.

Most commercial grapevines worldwide consist of two distinct genotypes joined by grafting: the scion (typically *V. vinifera* cultivars) providing the vegetative and reproductive materials, including the fruits, and the rootstock (typically other *Vitis* species, or hybrids), which forms the root system. The rootstocks also provide protection against soil-borne pests and pathogens, and increased tolerance against drought and numerous suboptimal soil conditions. Furthermore, it influences plant development, phenology, and biomass accumulation (Ollat et al., 2016). The interaction between the two genotypes (scion and rootstock) is instrumental in modulating the vines' responses against abiotic and biotic stresses.

Layout of the model vineyard

In this study, scion cultivars Cabernet Sauvignon, Pinotage and Shiraz grafted on either rootstocks USVIT 8-7 or Richter 99 are subjected to three different irrigation regimes, i.e. L1 (well-watered), L2 (reduced levels of irrigation) and L3 (dryland). For every scion-rootstock-irrigation combination, there are five

repeats planted in a completely randomised design in the block (Figure 1), and each repeat is a panel with five vines. Between every row of red cultivars, there is a dryland row of Chenin Blanc grafted on either Richter 110, Richter 99, USVIT 8-7, and 1103 Paulsen and on both ends of the vineyard, these rows are repeated as well-watered controls. An automatic weather station next to the block continuously records ambient temperature, incoming solar radiation, precipitation, relative humidity and wind speed and direction, while the soil moisture content can be recorded at three depths (30, 60 and 90 cm) at each representative vine (150 positions throughout the vineyard) using a neutron probe (HYDROPROBE 503DR, CPN®, California).



Figure 1. The vineyard layout has red cultivars and Chenin Blanc planted in alternating rows. Each block represents a panel of five vines, and the different colours indicate the irrigation regime for a specific panel or row. The scion:rootstock:irrigation-level combinations of the red cultivars are in a completely randomised design, while each Chenin Blanc row represents one rootstock and irrigation combination. Each panel has an access point for the neutron probe to determine soil moisture levels at different depths. The 0.7 m buffer areas between panels aid in panel differentiation when high-throughput, remote sensing methods and unmanned aerial vehicles are employed. Pino, Pinotage; Shi, Shiraz; Cs, Cabernet Sauvignon.

A validation study was conducted for the first season (2021/2022) to test the experimental parameters and provide insights regarding the spatial and temporal variability within the vineyard. During this period, the climatic factors, the soil's chemical and physical characteristics and soil water holding capacity were analysed. The different water regimes were implemented and the physiological and phenological responses of the vines were monitored. This confirmed that the irrigation scheduling was successfully creating distinct water stress scenarios in the block without unintended lateral water movement.

Short- and long-term vine adaptations

Stem water potential and stomatal conductance measurements, along with phenological development rate to a lesser extent, are employed to assess the real-time expression of stress. Other

biophysical variables indicate long-term influences, such as stem circumference, pruning weights, lateral leaf area index (LLAI), and grape yield. In this project, LLAi is determined from RGB images of grapevines captured against a white background, using a customized code developed by Prof Poblete-Echeverría, one of the researchers involved in this project. Three distinct approaches are being utilised to determine how vines adapt to water scarcity over time. Firstly, soil pits were dug to document root development and architecture after three summers, and an algorithm was developed to analyse the root photographs. The number of roots, the area covered, and the percentage of coverage are considered alongside other parameters such as above-ground biomass and crop yield to detect the reactions of specific scion: rootstock combinations to different irrigation scenarios.



Figure 2. Students involved in the project measuring stomatal conductance, in the cellar with small-scale fermentations, taking soil samples and bringing in the harvest.

During the soil pit excavations, soil samples from the root zones were taken to study the microbiome at the vine roots. The analysis of the microbiome associated with each scion: rootstock combination under different irrigation scenarios is the second approach that provides insight into the adaptation strategies of the vines. The microbial populations associated with and recruited to the vine root zone play an important role in vine health and adaptation to stress situations such as water scarcity (Naylor & Coleman-Derr, 2018). For example, some bacteria produce plant hormones that regulate stomata to reduce water loss or mycorrhizal fungi that form symbiotic relationships with vine roots and extend the root system and the plant's access to a larger soil volume. Similarly, microbes can help vines access essential nutrients, such as phosphorus, which is critical for root growth and function, particularly during water-scarce periods.

Thirdly, studying the epigenetic regulation of gene expression in the vine renders a glimpse into how the vine "remembers" and possibly adapts to previous periods of water scarcity and how this influences the production of specific metabolites. In this study, DNA methylation (one type of epigenetic regulation) is studied. DNA methylation involves adding a methyl group to DNA, often leading to gene silencing. Under stress, plants may alter DNA methylation patterns to activate or repress specific genes involved in stress responses (Abdulraheem et al., 2024).

Finally, it is crucial to maintain a high standard of grape and

wine quality for a sustainable industry. Therefore, the team also tracks the metabolic composition of the berries during ripening and at harvest. Small-scale wine fermentations are conducted, and the chemical and sensorial characteristics of the wine are determined to know how the different water regimes impact the wine properties.

Innovative technologies

Conventional plant-based approaches for detecting water stress, such as stem water potential (Choné et al., 2001), sap flow sensors, and stomatal conductance (Costa et al., 2012), are well-established but limited by their destructive nature, labour-intensive procedures, and restricted spatial and temporal resolution. To address these challenges, this project incorporates a section dedicated to innovative technologies, led by Prof Poblete-Echeverría. Emerging high-throughput remote sensing techniques, including spectroscopy, high-resolution aerial thermography, and LiDAR (light detection and ranging), are evaluated and integrated with conventional methods to enhance grapevine water stress assessment. These technologies are currently being tested and validated through rigorous field experiments. Figure 3 presents example results obtained from high-resolution aerial thermography, illustrating the level of detail and spatial information that can be extracted.

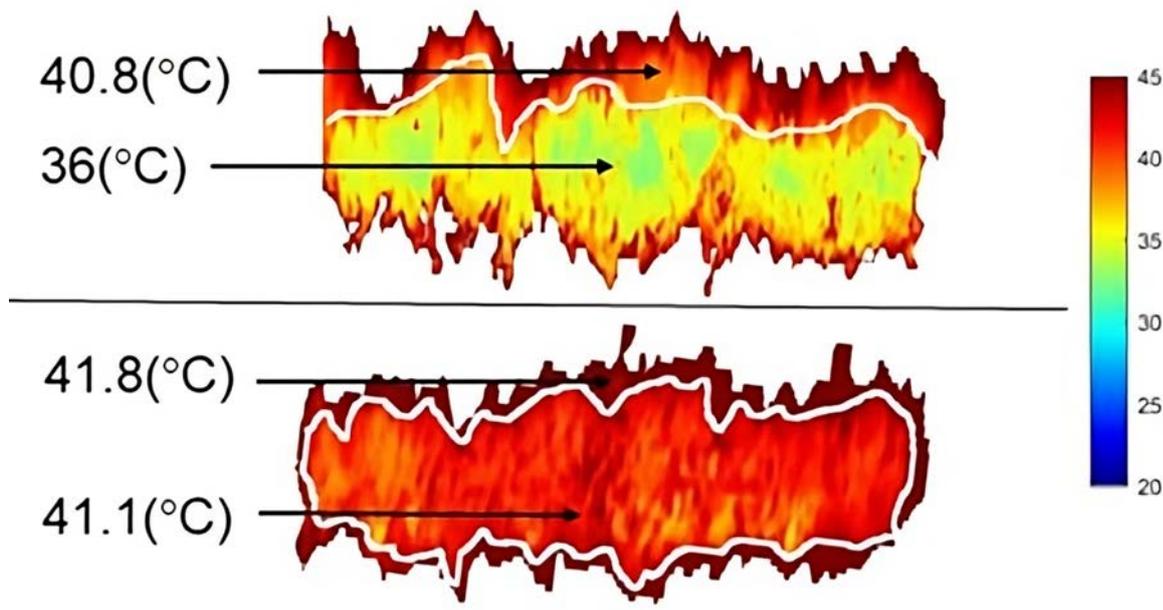


Figure 3. An example panel from the two measurement dates with the average canopy and shadow temperature indicated in each case.

Observations so far

Figure 4 shows the timeline of the project and the different actions that have been completed or are still ongoing. With all the data gathered, cross-seasonal comparisons of key parameters are becoming possible, and some interesting trends are emerging. Specific scion:rootstock combinations are consistently able to maintain stomatal conductance within the mild to no-stress zones even when no irrigation is supplied. These combinations also have the most extensive root structures. However, in general the well-watered vines have bigger root systems and higher pruning mass than their dryland counterparts, while the dryland vines have increased trunk circumferences.

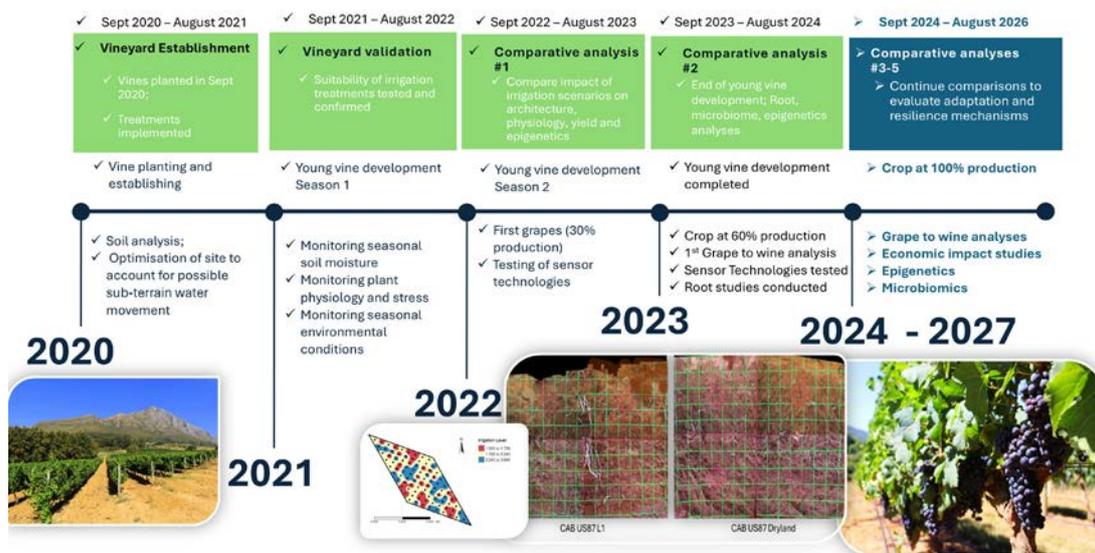


Figure 4. The project timeline showing the different stages of the vineyard development and the parameters that were measured and compared at each stage.

The geospatial characteristics of the vineyard in terms of soil moisture content, lateral leaf area and regulation of stomatal conductance are now well known. This information is being used to identify representable vines for all the scion: rootstock: irrigation combinations to use for further in-depth studies where integrated methods and new water stress indices are to be developed and tested. One example is the “stress distance”, which is proposed as a quantitative value that would represent the amount of time that a particular vine could go without water, under a given set of environmental conditions, until it reached the “critical water potential threshold” (Gambetta et al., 2020).

The study revealed that the developmental stage of the vines and their geospatial location have a strong influence on epigenetic gene regulation, and this will have to be considered for future epigenetic analysis when investigating the scion: rootstock: irrigation effect. Furthermore, the microbiome of the soil in the vicinity of the dryland vines contained root colonizers, saprobes (organisms that can decompose organic material) and organisms that can thrive in arid environments. It was observed that each vine cultivar (not the rootstock) was surrounded by different communities but with similar traits according to the irrigation level. Further analysis will involve the rhizospheres (a narrow region of soil in contact with the roots and the root excretions) of the different rootstocks.

What is the contribution of this study?

This study is unique in that it is the first study that provides data on vines subjected to water-restricted conditions from the day that they were planted. This study is important because it contributes towards ensuring sustainable and profitable production of quality wine grapes in South Africa, even in water-scarce conditions. Furthermore, new tools for the accurate monitoring of plant water stress are being developed and this will help to prevent the wasteful use of irrigation water and inform on the realistic water needs for the grape growing industry. Together, this will support future decisions and policy-making. Both the evaluation of the performance of all the scion: rootstock combinations and the epigenomic

profiling will provide information that could feed into existing breeding programmes for grapevines. It will guide protocols for establishing young vines under challenging conditions. The information on the microbiome constitution and fluctuations as influenced by the scion: rootstock combination and/or the water stress conditions might lead to future applications. For example, specific microbial consortia can be developed to aid young vine establishments under water-scarce conditions. The research vineyard is also a long-term resource to transfer knowledge and skills to the industry and viticulture students on future scenarios of consistent water limitation.



Figure 5. Prof Melané Vivier in discussion with industry members at the workshop in October 2024 at the experimental site.

Sharing with the community and impact

It is clear that a multifaceted approach, as employed by this study, is necessary to improve the resilience of the South African grape and wine industry against future water-scarce scenarios.

The research team regularly shares its findings with the students in the Grape and Wine Sciences programme of the Department of Viticulture and Oenology at Stellenbosch University. They often host visiting academics and interns from the rest of the world and interest groups such as the Masters of Wine. It is their priority to transfer knowledge to the wine industry and therefore a workshop was hosted, together with the WRC and SA Wine, in October 2024.

The workshop was attended by more than 70 representatives from the industry as well as delegates from WRC, SA Wine, Department of Agriculture, Land Reform and Rural Development, Agricultural Research Council and Vinpro. Professors Vivier, Setati and Poblete-Echeverría introduced the research with presentations and shared some of the current key findings. This was followed by an excursion to the vineyard at Welgevallen where the postgraduate students in the research group demonstrated some of the monitoring

techniques that are being used. The enthusiasm and interest shown by all the attendants emphasised the importance of the research questions being addressed and the need to share the information with the community.

Another key outcome of this project is the initiation of a new WRC-funded project focused on developing an innovative, low-cost smart irrigation system. Led by Prof Poblete-Echeverría, this new project addresses the urgent challenge of improving water management in South Africa's viticulture sector. The proposed system integrates advanced sensors and data transmission technologies to provide accurate measurements of crop evapotranspiration (ETc), a critical parameter for optimising irrigation strategies and enhancing water-use efficiency.

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HEALTH AND HYGIENE

New guidelines call on governments to make handwashing a public health priority

In a world still reckoning with the lessons of recent pandemics, two of the world's leading public health agencies, the World Health Organization (WHO) and UNICEF, have joined forces to issue a new global standard on one of humanity's simplest yet most powerful disease-fighting tools: clean hands.



The *Guidelines on Hand Hygiene in Community Settings*, launched in October 2025, lay out the first-ever global framework focused specifically on hand hygiene outside healthcare facilities, namely in homes, schools, workplaces, public spaces and institutions. The message is clear: governments, not individuals alone, must take responsibility for making hand hygiene accessible, affordable and universal.

“Hand hygiene is a public good – one that requires coordinated action, inclusive design and sustained investment,” the joint foreword from WHO and UNICEF declares.

A simple act still out of reach for billions

An estimated 1.7 billion people still lack basic hand hygiene

services at home. Of these, 611 million have no facilities whatsoever – no soap and no running water. Without such basics, the most earnest public health messaging cannot prevent the spread of deadly infections, such as diarrhoea, cholera and pneumonia, which together claim hundreds of thousands of lives every year.

The new guidelines emphasise that the absence of reliable handwashing infrastructure is not merely a matter of personal hygiene but a failure of governance and investment. Ensuring that every person can wash their hands with soap and water where they live, learn and work, the document argues, is a governmental duty rooted in the human right to health.

From advice to accountability

While global health campaigns have long promoted the 'wash your hands' message, this document shifts the conversation from voluntary behaviour to structural responsibility.

Recommendation 1 calls on governments to implement policy, legal, regulatory and fiscal measures that promote and enable hand hygiene as a critical public health intervention. That includes removing barriers, ensuring reliable water and soap supplies, integrating hygiene into national health and education systems, and coordinating cross-sectoral efforts.

"Hand hygiene must move beyond short-term campaigns," said Joanna Esteves Mills, WHO's technical lead for the guidelines. "We need durable systems, from financing and data to governance and design, that make it possible for everyone to practise this basic act every day."

A science-based roadmap for everyday practice

The guidelines distil decades of research into practical, evidence-based recommendations that apply across resource settings, from the poorest rural villages to the busiest city hubs.

Recommendation 2 defines what effective hand hygiene looks like:

- Use plain soap and water, not necessarily antibacterial soap, as antimicrobial additives can be harmful to health and the environment.
- Rub hands thoroughly so that all surfaces are covered for sufficient time.
- Wash at five key times: before preparing food; before eating or feeding others; after using the toilet or handling faeces; after coughing, sneezing or blowing one's nose; and whenever hands are visibly dirty.
- When water is scarce or facilities are lacking, alcohol-based hand rubs (ABHR) with at least 60% alcohol can serve as effective alternatives.

Even so, the document cautions, water and soap remain the preferred option wherever possible. Handwashing with soap can reduce the risk of diarrhoeal disease by around 30% and respiratory infections by 17%, saving an estimated 740 000 lives each year.

Three core requirements for success

At the heart of the guidelines lies Recommendation 3, which defines the 'core requirements' needed to change or sustain hand hygiene behaviour:

- **Minimum material needs** – reliable access to water and soap or ABHR, plus safe disposal of wastewater.
- **Access to information** – clear, consistent communication on why, when and how to clean hands, integrated into health promotion and education programmes.
- **A conducive environment** – both physical (facilities that are convenient, attractive and easy to use) and social (norms, cues and routines that encourage habitual behaviour).

These three elements, the report notes, are interdependent. Without soap and water, education has little effect. Without

public understanding and community ownership, facilities fall into disuse. And without environments that make handwashing effortless and habitual, even motivated individuals may fail to keep up the practice.

A call for systems, not stand-alone projects

One of the report's strongest messages is that piecemeal, project-based approaches are not enough. Instead, governments should establish permanent, system-wide structures that guarantee sustainable access to hand hygiene. This means investing in water and sanitation infrastructure, ensuring the availability of affordable hygiene products, training personnel, and embedding monitoring and evaluation within public health planning.

Local authorities have a particularly crucial role: ensuring equitable access within their jurisdictions, maintaining facilities and engaging communities. National governments, in turn, must set standards, coordinate funding and enforce legal frameworks. The document outlines how these systems can be aligned with international commitments, including the International Health Regulations (IHRs) and the forthcoming Pandemic Prevention, Preparedness and Response Accord, both of which require nations to strengthen water, sanitation and hygiene (WASH) as part of epidemic readiness.

Grounded in evidence, designed for everyone

Developed through a rigorous process managed by WHO's Department of Environment, Climate Change and Health and UNICEF's Water, Sanitation and Hygiene team, the guidelines draw on multiple systematic reviews, expert consultations and a multidisciplinary Guideline Development Group. Contributors include academics, government officials, non-governmental organisations and practitioners from over 20 countries, supported by the UK Foreign, Commonwealth and Development Office.

The document is careful to distinguish between healthcare settings (where WHO has long-established protocols for clinicians) and community settings, which encompass households, public spaces, workplaces, schools, childcare centres, prisons and places of worship, essentially, 'where people live, learn, work, play and love.'

This broader scope recognises that most infectious disease transmission happens outside hospitals. It also acknowledges the social dimensions of hygiene: gender roles, behavioural cues, design aesthetics and the powerful influence of habit and community norms.

Seven guiding principles

To help governments and practitioners translate the evidence into action, the guidelines articulate seven overarching principles:

1. **Prioritise minimum material needs** – ensure soap and water or ABHR are always available.
2. **Understand what drives or hinders behaviour** – tailor interventions to local realities.
3. **Engage communities** – involve citizens in planning, design and monitoring.
4. **Be gender-responsive** – recognise that women and girls

bear the brunt of hygiene responsibilities.

5. **Progressively improve** – build capacity and infrastructure over time.
6. **Strengthen systems** – move beyond one-off projects to long-term governance.
7. **Monitor, evaluate and improve** – learn what works and adapt continuously.

These principles, while simple, represent a shift toward behavioural and structural realism, acknowledging that handwashing habits are shaped as much by design and social context as by individual willpower.

Lessons from history and from COVID-19

The guidelines open with a reminder that the science of hand hygiene is centuries old. In the eighteenth century, physicians such as Alexander Gordon and Ignaz Semmelweis proved that washing hands could prevent deadly infections in maternity wards. Yet even today, despite this well-established principle, millions remain unable to perform this basic act.

The COVID-19 pandemic reinforced how central hand hygiene is to disease prevention, and how fragile access can be. During lockdowns, many schools and public places lacked running water; in informal settlements, families queued for shared taps; and misinformation spread faster than soap. These new guidelines are, in part, a response to those lessons: a blueprint for embedding hand hygiene in the everyday systems that sustain health.

The economics of clean hands

Beyond health, the guidelines make a strong economic case. Promoting domestic hand hygiene is among the most cost-effective child-health interventions, comparable to oral rehydration therapy and routine vaccination. By preventing infections, good hygiene reduces hospital visits, frees up health budgets, cuts antibiotic use and limits antimicrobial resistance. It also keeps children in school and adults at work, protecting household incomes and national productivity.

“Investing in hand hygiene is investing in resilience,” said Ann Thomas of UNICEF’s WASH division. “It’s not charity, it’s smart economics and sound public policy.”

Designing for dignity

The guidelines go beyond the technical to consider how design influences behaviour. Facilities should be safe, visible, and pleasant to use. Public handwashing stations, for example, should be accessible to people with disabilities, children and the elderly, and should account for cultural norms and privacy. A “conducive environment,” the report explains, is both physical and social. The physical environment provides easy, equitable access. The social environment reinforces positive norms — through peer influence, school curricula, community leadership and media.

Consistency, repetition and reward are also highlighted as key behavioural strategies: performing hand hygiene in the same context, repeating it often, and associating it with positive feelings help transform it from an instruction into a habit.



The guidelines point out that promoting domestic hand hygiene is among the most cost-effective child-health interventions.

Bridging development and emergency response

While the recommendations target routine, long-term health systems, they are also applicable in emergencies, from cholera outbreaks to refugee crises and future pandemics. During such events, temporary solutions like mobile handwashing units or ABHR distribution may be necessary. However, the guidelines urge that even emergency measures should feed into long-term system strengthening, ensuring that once a crisis subsides, infrastructure and behaviour improvements remain.

Global momentum toward 2030 goals

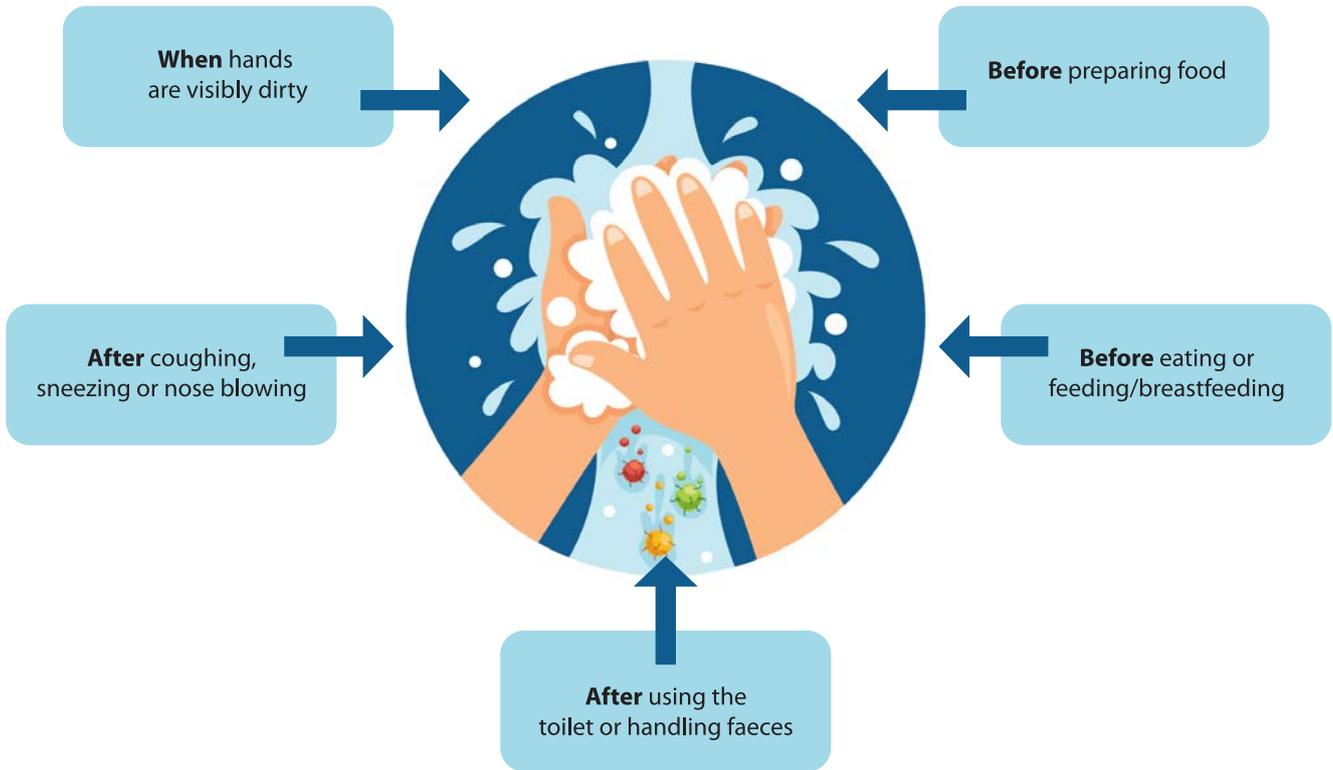
The publication aligns with global efforts to achieve the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being) and SDG 6 (Clean Water and Sanitation), both of which remain off track. Achieving universal access to hand hygiene by 2030, the report warns, will require doubling current progress rates worldwide, and in some low-income and fragile countries, increasing them more than eightfold. The guidelines are thus both a technical manual and a moral call to action. They urge leaders to integrate hygiene into national development agendas, pandemic preparedness frameworks and climate adaptation plans. “Without clean hands,” the authors note, “no health system, however advanced, can protect its people.”

A catalyst for change

WHO and UNICEF hope the new framework will serve as a

5 key times for practising hand hygiene in community settings:

WHO/UNICEF



catalyst for sustained national action. Pilot programmes are already planned in several “Champion Countries,” including Ghana, South Africa, Nepal and the Philippines, where governments, researchers and NGOs are testing context-specific strategies, from locally produced soap and ABHR to community-led design of public facilities.

For governments seeking guidance, the document provides step-by-step tools for assessing needs, setting targets, financing systems and engaging communities. For donors and civil-society partners, it offers an evidence-based foundation for advocacy and funding.

The future in our hands

As the world faces rising health threats, from antimicrobial resistance to climate-driven outbreaks, the call to institutionalise hand hygiene feels both urgent and achievable. The science is solid, the costs modest, and the potential benefits immense.

The guidelines close with a simple but profound reminder: clean hands save lives, but only if every person, everywhere, can wash them. Turning that ideal into reality will depend not just on individual effort, but on collective commitment, from policymakers to public servants, from engineers to educators, from households to entire nations.

“By embedding hand hygiene into everyday life and policy,” the report concludes, “we can reduce the burden of preventable diseases, strengthen community resilience and advance the

human right to health for all.”

To download the guide, visit: <https://www.who.int/publications/m/item/guidelines-on-hand-hygiene-in-community-settings>

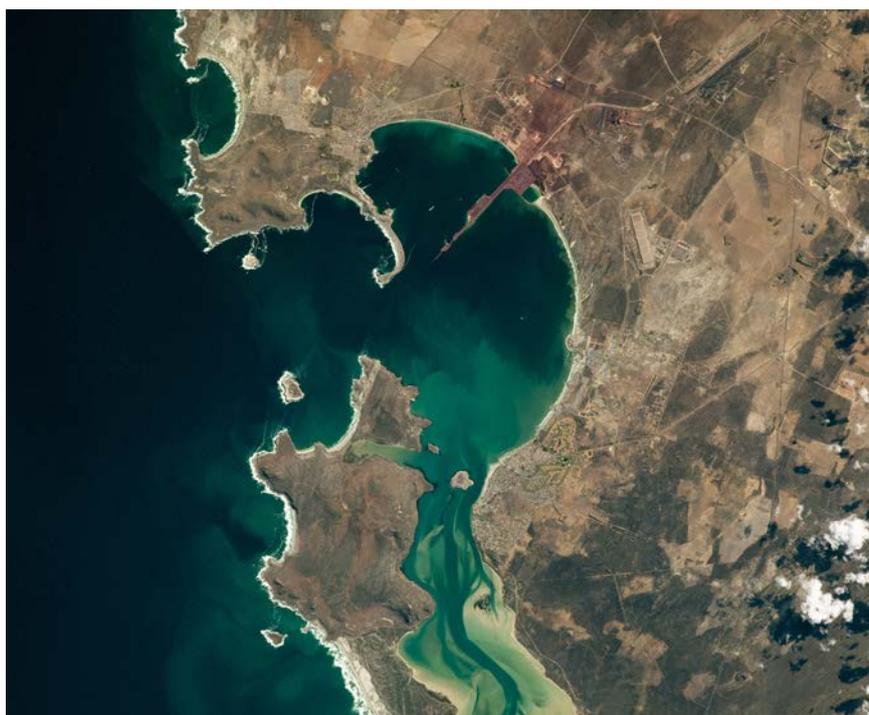


740 000

The number of deaths prevented by handwashing every year.

MUNICIPAL WATER SUPPLY

Saldanha's water tightrope: Balancing industry dreams with scarce supplies



Water supply challenges have long prevented Saldanha Bay – South Africa's largest natural harbour – from realising its full potential. Article by Sue Matthews.

It's been a case of one step forward, two steps back in the years since big industry set its sights on Saldanha Bay. The closure of anchor tenant Saldanha Steel in 2020 dealt a blow to the Industrial Development Zone (IDZ), and a number of other proposed projects have been withdrawn or delayed. Now, with plans to create a green hydrogen hub gaining traction, there is renewed hope that the IDZ will live up to its potential. But can the area's water supply sustain significant economic development and population growth?

Early days

When Captain Samuel Castleton sailed the first ship into Saldanha Bay in April 1612, he went ashore and bartered with the local Khoekhoe for a calf and a sheep, but his crew could find no water apart from a small puddle. For the next three centuries, despite the establishment of small settlements of French, Dutch and British inhabitants at various intervals, the lack of water remained the major constraint to the area's development. It was only during the Second World War, when Saldanha Bay was designated a military and naval port, that the population expanded rapidly enough to warrant government action in securing a water supply.

Construction of a 55 km pipeline from the Berg River began in 1942, and the first water was delivered in February 1943. Initially, the water supply was reserved for military personnel and businesses serving the military, and it took some years before all formal housing in Saldanha had piped water and indoor plumbing. The reasons for that are detailed in the fascinating account "Water for Saldanha: War as an agent of change" by Visser and co-authors, published in the journal *Historia* in 2008.

By the early 1970s, the town had a thriving fish-processing industry served by trawlers, purse-seiners and rock lobster boats operating from a small harbour within the bay, but the approval of the Sishen-Saldanha project in April 1973 brought rapid change. A deep-water port was constructed to accommodate the bulk carriers that would transport iron ore – delivered to Saldanha Bay from the mine at Sishen via an 861 km purpose-built railway line – to offshore markets. The railway and port were both completed in 1976 and the first ore exports left the same year.

In the meantime, work had begun on a new water supply scheme to meet the anticipated increase in water demand, as

Municipal water supply

well as address the water quality problems that were being experienced by abstracting water about 53 km upstream from the Berg River mouth. The river is tidal for almost 70 km, so the water would have been slightly saline from seawater intrusion during summer, but winter runoff from the area's Malmesbury shale soils also causes a natural increase in salinity. This has been compounded by land-use changes and cultivation practices that have a major impact on the mobilisation and transport of salts. Pollution from sources higher in the catchment, such as effluent discharges and agricultural runoff, also rendered the water unfit for human consumption without treatment.

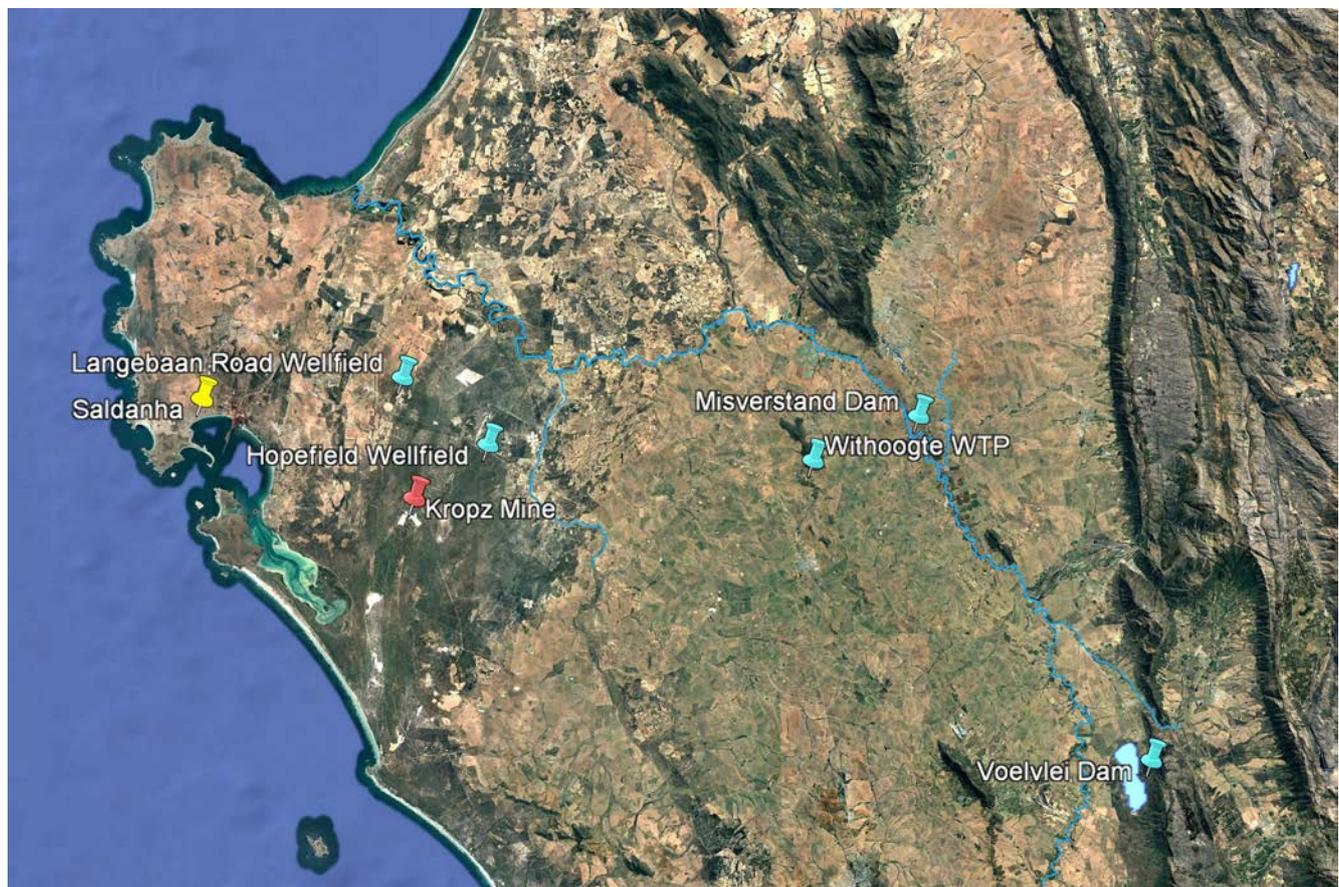
The new scheme, implemented in 1978, involves abstracting water just above a weir built across the Berg River at Misverstand, 70 km upstream of the original abstraction point, and piping it 17 km to the Withoogte water treatment works (WTW) north of Moorreesburg. Treated water is then distributed via various reservoirs to Saldanha, Langebaan, Hopefield, Vredenburg, Paternoster, St Helena Bay and Stompneusbaai in Saldanha Bay Municipality, as well as Velddrif and Dwarskersbos in the Berg River Municipality and Moorreesburg and Koringberg in Swartland Municipality. Nowadays, the WTW is operated by the West Coast District Municipality (WCDCM) under a service delivery agreement with the three local municipalities, but is on Saldanha Bay Municipality's asset register, as the scheme's largest water user. The current water licence permits a total raw water abstraction at Misverstand of 23,440 million m³ per year, of which Saldanha Bay Municipality is allocated 20,427 million cubic m³.

The '90s growth spurt

Water availability became a contentious issue in the mid-1990s, when Iscor and the Industrial Development Corporation (IDC) partnered in a joint venture to beneficiate the iron ore brought to Saldanha by constructing a steel plant capable of producing hot-rolled coils for export. Before it was given the go-ahead, the plant's water demand and potential pollution impacts were significant concerns. An environmental impact assessment (EIA) conducted by the CSIR found that there was no appreciable risk of pollutants reaching the bay through groundwater contamination. This was important because mussel-farming was already well established in the bay, and there were fears that the sensitive ecosystems of the adjoining Langebaan Lagoon – protected within the West Coast National Park and designated a Ramsar wetland – might be affected.

Saldanha Steel's daily water requirement was originally pegged at 16 000 m³, but this estimate was subsequently halved by changing the design of some cooling systems. The groundwater in the vicinity of the site was known to be too saline to use as a water supply, but both the EIA and the Steyn Commission, which was appointed by the Minister of Environmental Affairs and Tourism to assess the plant's environmental threat, recommended that the Langebaan Road Aquifer be investigated as an alternative water source. The aquifer had already been extensively studied through geophysical surveys, exploratory drilling, pumping tests and monitoring as part of consecutive projects initiated by the then Department of Water Affairs

Google Earth



Saldanha's water supply primarily relies on water abstracted from the Berg River at Misverstand weir and treated at the Withoogte plant, but the two wellfields will provide an emergency back-up during droughts.

(DWAF) in 1974, culminating in two reports by Timmerman in 1985. In fact, it was considered so important as a future urban water supply that it had been proclaimed a subterranean water control area by the government in September 1976.

In response to the Steyn Commission recommendations, the CSIR was tasked with further investigations, which initially involved modelling exercises to re-evaluate the results of the earlier studies and additional pumping tests on the existing boreholes. A new wellfield was then established and more tests and monitoring carried out by teams from the CSIR and Toens and Partners between 1998 and 2001. Ultimately, the WCDM was granted permission to abstract 4 000 m³ per day – or 4 ML/day – with various conditions imposed.

MAR and mining

As it turned out, the wellfield in the Langebaan Road Aquifer has been operational only intermittently over the past 25 years, partly due to vandalism. It came into its own as an emergency water supply during the 2016–2018 drought, though. Four new production boreholes were drilled in an extension to the wellfield, bringing the number to eight, and the Department of Water and Sanitation (DWS) issued an amended licence allowing just over 15 ML/day to be extracted for the first six months, stepping down to 12 ML/day for the next six months and then reverting to a long-term allowance of 8 ML/day, which is still in place today. The higher abstraction rate was based on previous research suggesting that groundwater levels would recover through natural recharge once the rains returned.

In addition, a new wellfield targeting the aquifer was established on land owned by the municipality, approximately 7 km west of the town of Hopefield and proclaimed as the Hopefield Private Nature Reserve in 1982. Construction of the so-called Hopefield wellfield only began in July 2018, shortly after the first significant winter rains had started to refill the dams of the Western Cape Water Supply System (WCWSS), and was completed a year later, once the drought had well and truly broken. Nevertheless, the wellfield is very close to the bulk water supply pipeline from Withoogte WTW, and since the groundwater is of potable quality, it only needs to be chlorinated on site before being piped to the main storage reservoir at Besaansklip. The 10 production boreholes are licensed to abstract an annual total of 4.39 ML/day.

The potential for managed aquifer recharge (MAR) in the Langebaan Road Aquifer has been investigated a few times over the years. Preliminary modelling and testing in 2008–2009 showed that injection into the aquifer's confined lower aquifer unit (LAU) caused water to rise to the surface under artesian conditions, resulting in some flooding and waterlogging at farms in the vicinity. Subsequent modelling simulations, carried out as part of a Water Research Commission project (WRC Report No. 2744/1/21) led by Dr Sumaya Israel, indicated that artificially recharging the unconfined upper aquifer unit (UAU) in the vicinity of the Hopefield wellfield is feasible as there is more storage space, but a pilot phase would be needed before full implementation. In September 2021, Groundwater and Earth Sciences consultancy GEOSS conducted injection tests at two of the Langebaan Road production boreholes drilled during the drought, primarily to test whether the installed infrastructure is

fit for purpose. The injection rate and water level were recorded hourly, and it was found that the two boreholes, at depths of 65–80 metres, were able to handle three days of continuous injection before water levels in the aquifer rose too close to the surface.

MAR is already taking place very successfully in the neighbouring Elandsfontein Aquifer, where Kropz uses open-pit mining to extract rock phosphate in an area otherwise undisturbed by agricultural or other development. The phosphate deposit lies below the natural water table in the UAU, so a network of dewatering boreholes surrounding the pit is used to lower the groundwater level. A small portion of this groundwater is used for processing activities within the plant – limited to half a million cubic metres per year – but the rest is channelled to a buffer tank and then gravity fed to 20 reinjection boreholes, in accordance with the stipulation in the water use licence that the dewatered groundwater should have minimal contact with the atmosphere and must be returned to the aquifer.

GEOSS is contracted by Kropz to implement the monitoring programme, which relies on 28 dedicated monitoring boreholes situated up- and down-gradient of the pit. Five of them are close to Geelbek in the West Coast National Park, because this is where the Elandsfontein Aquifer discharges into the southern end of Langebaan Lagoon, providing freshwater flow that supports habitat typical of an estuary.

“Mining is only taking place in the upper aquifer, which is separated from the lower aquifer by an impermeable clay layer approximately 30 metres thick,” says GEOSS Managing Director Julian Conrad. “The lower aquifer has good quality water with high yields, but that's completely hands-off – DWS wanted absolute protection of the lower aquifer.”

Every six months, GEOSS reports back to the Elandsfontein Water Monitoring Committee, which includes representatives from Kropz, DWS, SANParks, Cape Nature, the Saldanha Bay Municipality, the local farming community and groundwater consultancy Umvoto, attending on behalf of an NGO called the West Coast Environmental Protection Agency. The monitoring results have shown that groundwater levels down-gradient of the mine have risen marginally since dewatering and reinjection began in February 2017 but have remained stable at Geelbek, 11 km to the south-west. There is also no significant change in water quality.

“We've got thresholds in place, so red flags are raised if anything happens above those thresholds, whether it be water levels or chemistry,” says Conrad. “Threshold Exceedance Response Plans, or TERPs, have been established and are implemented if the red flags are raised.”

GEOSS also has a three-year contract with Saldanha Bay Municipality to do all their groundwater monitoring as well as some additional modelling of the Langebaan Road and Hopefield wellfields to inform planning and management. The monitoring network has recently been expanded to include 24 DWS boreholes in the vicinity of the two wellfields.

Looking ahead

David Wright, the Senior Manager for Bulk Water and Solid Waste at Saldanha Bay Municipality, says groundwater from the two wellfields is currently not being utilised to a large extent, partly because good rainfall over the past few years means that the WCWSS dam levels are sufficient to meet water supply needs, and also because there was a pipeline issue at the Langebaan Road wellfield extension.

“The boreholes are being pumped to keep the system operational, but at a very low level, so the volume being abstracted is only about 10–15% of what the water use licence allows. But once the pipe has been fixed, we would want to go through a period of pumping it at the full volume to give us better monitoring information about the reaction of the aquifer,” he says. “We intend to get all these wellfields in optimal operation so that we are ready should a future drought occur.”

He adds that the municipality is focusing heavily on upgrades to existing water-related infrastructure at present, but the water augmentation plan will also be updated, taking options such as water reclamation from wastewater and seawater desalination into consideration. Treated effluent from some of the municipality’s wastewater treatment works is already being used for irrigation purposes, and an EIA was undertaken more than a decade ago for the previously mooted 25.5 ML/day Danger Bay desalination plant. The environmental authorisation is valid until 2028, but the project would be too expensive for the municipality to fund on its own. The much smaller 2 ML/day Shelley Point desalination plant, which was originally implemented as a private homeowners’ initiative to irrigate a golf course but fell into disrepair, is a more realistic project and is already on the municipality’s 10-year budget.

“When Saldanha Steel ceased operations, it gave us quite a bit of reprieve in terms of water demand, because they were our largest water user. During the drought, they made use of treated effluent from the Saldanha wastewater treatment works, plus they had their own reverse osmosis plant to treat it further,” says Wright. “We’ve also found that since the drought, domestic and other users are still using water more sparingly, so we haven’t had the full bounce-back that we expected.”

This means that the municipality’s allocation from the WCWSS is more than adequate at this stage. Looking ahead, the CSIR – appointed by Freeport Saldanha IDZ to coordinate phase 1 of the West Coast Green Hydrogen Master Plan – has made it clear that the green hydrogen hub would likely rely on seawater desalination as a source of water for the electrolysis process, which splits water into hydrogen and oxygen. What’s more, the Berg River Voëlvlei Augmentation Scheme, being implemented by the Trans-Caledon Tunnel Authority (TCTA) on behalf of DWS, will increase the yield of the WCWSS by 23 million cubic metres per year, and the municipality has already concluded a Water Supply Agreement to share in the augmented resource. Scheduled for commissioning by July 2029, the scheme involves pumping water in winter from the Berg River into the Voëlvlei Dam, which is currently supplied by diverted runoff from the Klein Berg River, draining the Tulbagh valley, as well as the Twenty-Four Rivers system and the Leeu River. Some of the water stored in Voëlvlei Dam is released into a canal that

discharges into the Berg River, so part of the municipality’s existing WCWSS allocation, abstracted at Misverstand weir, flows via the Voëlvlei Dam.

Asked whether economic development is likely to be constrained by water supply issues in the near future, Wright is optimistic.

“If we’re looking at a medium growth scenario, between our allocation from the Western Cape Water Supply System, optimising the two wellfields and the Berg River Voëlvlei Augmentation Scheme coming on-stream, we should be fine until the late 2030s,” he says. “Obviously, though, our allocation is prone to drought, and I think that’s one of the big challenges for large companies that consider coming to Saldanha. They don’t want to be in a position where they can’t get the full volume they need in a drought, which is why they’re looking at alternatives like desalination.”



GEOSS

Kropz uses open-pit mining to extract rock phosphate from the upper aquifer unit of the Elandsfontein Aquifer, which discharges into Langebaan Lagoon.



GEOSS

A network of dewatering boreholes prevents the pit from flooding. The abstracted groundwater is piped to a buffer tank and then gravity-fed to injection boreholes for managed aquifer recharge.

THE WATER WHEEL

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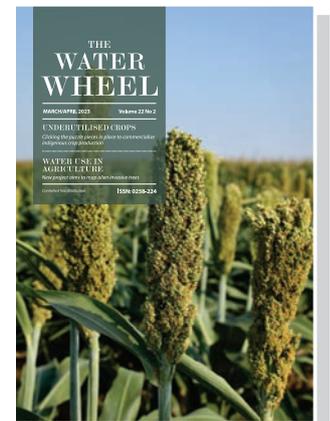
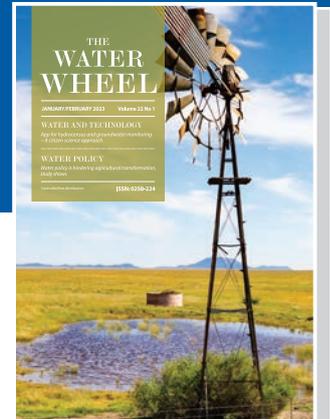
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