

THE WATER WHEEL

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WATER CONSERVATION

Keep on saving - Water demand management in a time of plenty

WATER SOURCE AREAS

New national park plan to protect mountain water factory

Controlled free distribution

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THE WATER WHEEL is a two-monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source.

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How do we keep the public from saving water when the dams are full? A WRC-funded study investigated. See article on page 12.

NEWS

Hydrogeology sector mourns the loss of two stalwarts



The South African hydrogeology sector is in mourning following the death of two stalwarts, Rowena Hay and Dr Chris Hartnady, both of Umvoto Africa, following a battle with COVID-19.

Rowena, who founded the Muizenberg-based earth science and groundwater research consultancy in 1992 and served as its managing director, passed away on 8 July. Chris, who was a non-executive director of the company, and her husband, passed away on 23 July.

Rowena was a trailblazer in the truest sense of the word, particularly for women in science and engineering and small business entrepreneurship (of which she and Umvoto Africa won numerous awards and recognition). Rowena and

Chris played an integral role in the understanding and development of the deep fractured aquifer systems of the Table Mountain Group (TMG) and pioneered the drilling of 500 to 1 000 m ultradeep exploration and production boreholes across the Western Cape.

Chris pioneered the use of remote sensing, geothermal, space-geodetic and hydroseismic studies of these unique fractured aquifers. He became a respected legend known as the 'the Professor' with farmers in the Citrusdal and Klein Karoo regions, due to his finding groundwater in the TMG at depths and areas where it was thought not possible.

Rowena was also passionate about communities improving their livelihoods

through the betterment of their surrounding natural environment, and was deeply involved in disaster risk reduction, gender mainstreaming and social hydrogeology projects. Out of this she recently established the Umvoto Foundation, a non-profit organisation aimed at merging art and science to foster mutual learning and co-create sustainable solutions for resilient and empowered communities.

Prior to joining Umvoto Africa, Chris had a storied career as an academic in the earth and geological sciences at the University of Cape Town where he served as an associate professor in structural geology at the geology department from 1987 until his early retirement in 2000. During his academic and consulting career Chris published over 50 peer reviewed papers, book chapters and monographs, over 100 conference abstracts and presentations, and hundreds of technical consulting reports. Chris was internationally renowned in the fields of geotectonics and geodynamics, and made fundamental contributions to understanding the past and ongoing motions of the African plates (including discovering a major new 'Lwandle' plate in the global tectonic system

Rowena and Chris were the loving parents of Mike and Ruth. They will be sorely missed.

Mining firm donates water tanker truck to local municipality

Mining company Exxaro's Belfast mine handed over a R1.3 million water tanker truck to Emakhazeni Local Municipality earlier this year.

Belfast Coal Business Unit Manager, Londolani Rampfumedzi, expressed how, "the water truck will provide the local community with access to potable water,

which is a basic need and human right for all. It is through such initiatives that the communities' livelihoods are restored and sustained."

The water tanker truck was received by the Executive Mayor on behalf of the community. "This came at the right time as the municipality is installing 20 000

litre water tanks in the surrounding farms to provide water to every household. Emakhazeni Local Municipality struggles with the provision of water in farming communities and this water tanker is exactly what the municipality needed to respond to the impact of COVID-19."

Earth observation receives a boost with new e-station

The CSIR – through the Marine and Coastal Operations for Southern Africa (MarCOSouth) consortium – has received one of 12 Global Monitoring for Environment and Security (GMES) and Africa programme e-stations that enable access to critical earth observation (EO) data.

The installation of the European-funded and African Union-managed GMES and Africa programme e-station will enable regional partners and various research, academic, and industry organisations access to EO data and the MarCOSouth portal (www.marcosouth.co.za) to support the implementation of sustainable development policies at continental, regional and national level.

Installation of the e-station at the CSIR Pretoria campus, a leading partner in the Southern African consortium MarCOSouth project, was completed in June. The MarCOSouth project aims to maintain,

further develop and provide a sustainable platform for local, institutional, human and technical capabilities across Southern African countries.

“The e-station is an operational distributable open-source data processing tool that aims to build and strengthen capacities in Africa to receive, process, analyse and exploit EO data for environmental management. The e-station collects data from various sources that include, among others, the EUMETSAT and Copernicus services,” says Riëtte Pretorius, CSIR project manager for the MarCOSouth project.

Copernicus is a European EO programme used to monitor the Earth using satellites and in situ sensors. It provides accurate, timely and easily accessible information to improve the management of the environment, understand and mitigate the effects of climate change and ensure civil security. EUMETSAT provides data,

products and support services to the Copernicus information services and user communities, with a focus on marine life, the atmosphere and climate.

The e-station installation consists of an outdoor and indoor unit. The outdoor unit is an antenna that allows for the reception of the EUMETCast – Africa data. The indoor unit consists of an acquisition subsystem in the form of a personal computer that operates as the receiver of the EUMETCast data and an uninterrupted power supply, as well as other necessary peripherals. The e-station (a part of the indoor unit) consists of a personal computer that is responsible for the acquisition and processing of the data and one that is responsible for the visualisation and sharing of the data.

There is currently no other active eStation for marine and coastal applications in Southern Africa.

Major skills boost in agri-horticulture for TVET colleges

Motheo Technical and Vocational Education and Training (TVET) College is the first TVET college in South Africa to have established a technology-driven greenhouse tunnel. The objective is to develop the skills of TVET graduates in the agri-horticultural sector and enhance their employability.

This is one of the milestones in the Stellenbosch University (SU) and Maastricht School of Management’s (MSM) three-year Orange Knowledge Programme titled ‘Strengthening skills of TVET staff and students for optimising water usage and climate smart agriculture in South Africa’. The project is funded by the Netherlands Universities Foundation for International Cooperation (NUFFIC), through the Dutch Ministry of Foreign Affairs.

The installation of the greenhouse tunnel is the result of a number of assessment activities which involved

researchers from SU, Dutch greenhouse experts coordinated through MSM, as well as TVET staff from Boland, Motheo, and Vhembe colleges. One of these assessments, conducted from December 2019 to January 2020, highlighted the key industry-driven skills requirement by the private horticulture sector in the domain of water-smart agri-horticulture. The investment in the greenhouse will therefore develop and enhance the skills and employability of TVET graduates.

During the handover on 13 August, Prof Dipiloane Phutsisi, principal of Motheo College, emphasised the need for cooperation and knowledge exchange to ensure successful crop production training in the greenhouse. Dr Rykie van der Westhuizen, a crop production specialist, inspected the greenhouse and approved its operation and functionality by carrying out the official handover and sign-off to Motheo College. Over the next few weeks, Dr Van der Westhuizen will

play a crucial role in the operationalisation of the greenhouse and starting with horticultural training in the greenhouse for college students. Brent Stevens from Vegtech, the suppliers of the tunnel, also introduced a number of TVET staff to the technical aspects of the greenhouse tunnel. Another greenhouse tunnel has since been completed at Vhembe TVET College in Limpopo, and a third tunnel, at Boland TVET College, should be completed by November 2021.



GLOBAL

New compendium on environment risk offers 500 actions to reduce death and disease



Several United Nations (UN) organisations have partnered to create a new compendium of 500 actions aimed at reducing death and disease driven by environmental risk factors.

Environmental pollution and other environmental risks cause 24% of deaths through, for example, heart disease, stroke, poisonings, traffic accidents and others. This toll could be substantially reduced – even eliminated – through bold preventative action at national,

provincial, local and sector-specific level. The *Compendium of WHO and other UN guidance on health and environment* provides easy access to practical actions for practitioners to scale up efforts to create healthy environments that prevent disease. It is designed for policymakers, staff in government ministries, local government, in-country UN personnel and other decision-makers.

The repository presents actions and recommendations to address a comprehensive range of environmental risk factors to health, such as air pollution, unsafe water, sanitation and hygiene, climate and ecosystem change, chemicals, radiation and occupational risks, among others.

“Events like record-breaking high temperatures in North America, massive

flooding in Europe and China, and devastating wildfire seasons provide increasingly frequent, grim reminders that countries need to step up action to eliminate the health impacts of environmental risk factors,” said Dr Maria Neira, Director of Environment, Climate Change and Health, at the World Health Organisation (WHO).

“Implementing the actions in the compendium should be part of a healthy and green recovery from the COVID-19 pandemic and beyond and is essential to attaining the Sustainable Development Goals. The UN is uniting its health and environment expertise to support countries in this endeavour.”

To access the compendium, Visit: <https://www.who.int/tools/compendium-on-health-and-environment>

Handwashing ‘impossible’ for one in three amid COVID-19

Health experts cited frequent handwashing as a key way to prevent the spread of infection as COVID-19 took hold. But a global report has found that three in ten people were unable to do this in their homes.

The joint World Health Organisation (WHO) and UNICEF report also found that nearly half the world’s population in 2020 lacked safely managed sanitation and one in four lacked safe drinking water. Current rates of progress would need to increase four-fold globally — and ten times in the least developed countries — to meet the Sustainable Development Goal (SDG) of universal access to safe water, sanitation and hygiene by 2030, warned the report.

Sub-Saharan Africa was found to have the slowest rate of progress in the world, with

only 54% of people using safe drinking water. The picture is even more bleak in contexts that are considered ‘fragile’ — states facing political, economic and environmental crises and where national systems for monitoring water, sanitation and hygiene services are often weak.

The COVID-19 pandemic has laid bare the gaps in provision, with people confined to their homes during lockdowns worldwide. Maria Neira, director of the WHO department of environment, climate change and health, said: “At the beginning of the pandemic WHO was calling for very good hygienic practices — washing your hands regularly, with soap and water — but for 2.3 billion people who do not have a place to wash their hands, it was impossible.”

According to the report, *Progress on household drinking water, sanitation, and hygiene, 2000 – 2020*, accelerating progress will require prioritisation at the highest levels of decision-making by international agencies, governments, civil society and the private sector. If progress is not accelerated, the report estimates that 1.6 billion people will not have access to safe drinking water at home by 2030, 2.8 billion people will not have safe sanitation services and 1.9 billion people will be living without basic handwashing facilities.

To access the report, Visit: <https://data.unicef.org/resources/progress-on-household-drinking-water-sanitation-and-hygiene-2000-2020/>

Disasters surging but early warning saves lives



Climate change and increasingly extreme weather events have caused a surge in natural disasters over the past 50 years disproportionately impacting poorer countries.

This is according to the World Meteorological Organisation (WMO) and United Nations Office for Disaster Risk Reduction (UNDRR).

According to the agencies' *Atlas and mortality and economic losses from weather, climate and weather extremes, from 1970 to 2019*, these natural hazards accounted for 50% of all disasters, 45% of all reported deaths and 74% of all reported economic losses. There were more than 11 000 reported disasters attributed to these hazards globally, with just over two million deaths and \$3,64 trillion in losses. More than 91% of the deaths occurred in developing countries.

But the news is far from all bad. Thanks to improved early warning systems and disaster management, the number of deaths decreased almost threefold between 1970 and 2019 – falling from

50 000 in the 1970s to less than 20 000 in the 2010s, the report explains.

“Economic losses are mounting as exposure increases. But, behind the stark statistics, lies a message of hope. Improved multi-hazard early warning systems have led to a significant reduction in mortality. Quite simply, we are better than ever before at saving lives”, said WMO Secretary-General Petteri Taalas.

Of the top 10 disasters, droughts proved to be the deadliest hazard during the period, causing 650 000 deaths, followed by storms that led to 577 232 deaths; floods, which took 58 700 lives; and extreme temperature events, during which 55 736 died. Meanwhile, economic losses have increased sevenfold from the 1970s to the 2010s, going from an average of \$49 million, to a whopping \$383 million per day globally.

Storms, the most prevalent cause of damage, resulted in the largest economic losses around the globe. Three of the costliest 10 disasters, all hurricanes that occurred in 2017, accounted for 35% of

total economic disaster losses around the world from 1970 to 2019.

“The number of weather, climate and water extremes are increasing and will become more frequent and severe in many parts of the world as a result of climate change”, said Taalas. “That means more heatwaves, drought and forest fires such as those we have observed recently in Europe and North America”.

More water vapour in the atmosphere has exacerbated extreme rainfall and flooding, and the warming oceans have affected the frequency and extent of the most intense tropical storms, the WMO chief explained.

Among others, the Atlas calls for great investment in comprehensive risk management to ensure that climate change adaptation is integrated in national and local disaster risk reduction strategies.

To access the publication, Visit: https://library.wmo.int/doc_num.php?explnum_id=10769

NEW WRC REPORTS

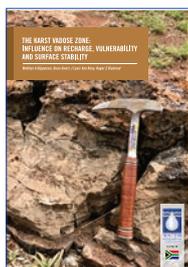
A communication strategy for water reuse in South Africa

The National Water and Sanitation Master Plan of the Department of Water and Sanitation notes that South Africa can avoid a projected 17% water deficit by 2030 by taking bold action. As part of its action plan, the Master Plan promotes the diversification of the water resources mix to include alternative sources such as water reuse. Lack of public acceptance is a major barrier to the implementation of water reuse, particularly direct potable reuse. The need for a communication strategy has become more urgent over the past few years as national water and sanitation planning is looking towards water reuse as a mechanism to augment current water resources. This study developed such a communication strategy for water reuse. The strategy was developed in consultation with the Department of Water and Sanitation and a range of stakeholders from the water sector.

Report no. 2805/1/20 (Vol 1) and 2805/1/20 (Vol 2)

Web link Vol 1: <https://bit.ly/3nStx1d>

Web link Vol 2: <https://bit.ly/2XC3Wix>



The karst vadose zone: Influence on recharge, vulnerability and surface stability

Karst systems are intrinsically complex. Surface instability in the form of sinkholes and subsidences affects infrastructure, and groundwater is vulnerable in areas where karst features promote quicker and more direct connection to the land surface. The

project emanated from a series of projects focused on the role of the vadose zone in the hydrological and geotechnical behaviour of materials, as well as those exacerbated by anthropogenic change. The karstic tertiary vadose zone remained after completion of the projections on the interstitial primary, and fractured secondary vadose zone, as well as a study on the contaminant transport through the vadose zone with the emphasis on cemeteries and burial sites.

Report no. TT 779/19

Web link: <https://bit.ly/3zprN1v>

Measurement of water pollution determining the sources and changes of microbial contamination and impact on food safety from farming to retail level for fresh vegetables

Worldwide governing bodies, fresh produce industries and food processing companies have realised the urgency of implementing control measures to ensure the microbiological safety of food products. Subsequently, the need for commodity-specific supply-chain management systems and guidelines, based on scientific data (including natural microbial levels and pathogen presence/absence) has been identified. The main aim of this project was to determine the link between water

pollution and crop contamination, and to determine sources of potential microbial contamination and assess the impact on food safety from farming to retail for selected fresh vegetable supply chains.

Report no. 2706/1/21

Web link: <https://bit.ly/2XBV7Vd>



A study to enhance water and sanitation insights through censuses and household surveys

All over the world, governments use information emanating from data collected through a national census or large-scale surveys to measure progress on service delivery goals. These strategic decisions

rely on the integrity of the census and survey data. Research has shown that target audiences of quantitative research do not necessarily understand, and respond to questions as the questionnaire designers intended. This study applied Cognitive Action Research, an innovative methodology, to, among others, test if South African consumers understand the current census water and sanitation questions, and analyse, revise and re-test the questions in several rounds to maximise understanding and minimise inappropriate answering.

Report no. TT 849/21

Web link: <https://bit.ly/3IJIsln>

Towards sustainable exploitation of groundwater resources along the West Coast of South Africa

Recent droughts that occurred in the Southern African region (2015–2017) exacerbated issues of water scarcity and equitable water allocation. Intervention measures aimed at mitigating the impact of the drought included the implementation of water conservation and demand management measures (water use restrictions) and triggered the consideration of alternative water supply options, e.g. groundwater and managed aquifer recharge and storage (MARS). The Western Cape is one of the provinces which had been declared a disaster area during the 2015–2017 drought. The Western Cape Water Supply System (WCWSS) is currently stretched past its limit. The logical source to increase water supply to the West Coast area is deemed to be groundwater. The overarching aim of this project was therefore to investigate the sustainable exploitation of groundwater resources on the West Coast of South Africa.

Report no. 2744/1/21

Web link: <https://bit.ly/3CvFm1l>

Exploring the evidence of water-energy-food nexus linkages to sustainable local livelihoods and wellbeing in South Africa

Following the global trend, the water-energy-food (WEF) nexus has been identified as an important perspective in South Africa for achieving sustainable and integrative natural resource management. Responding to the need for a better understanding of the interdependencies of water, energy and food at multiple scales, the Water Research Commission (WRC) has established a WEF Nexus Lighthouse. This aims to champion integrated planning and development of the three resources for South Africa. This project set out to address the identified knowledge gap, exploring how the nexus plays out in affecting local livelihoods in South Africa, and how this understanding can support more equitable sustainable development outcomes at the household level. The general aim of this study was to provide foundational and ground-tested evidence that can inform community development and empowerment as well as the WRC Lighthouse theme on WEF security, and to identify knowledge gaps so as to inform the direction of future WEF nexus research to support equitable sustainable development in South Africa.

Report no. 2718/1/21

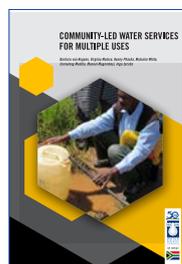
Web link: <https://bit.ly/3Ay2A6s>

Development and application of passive samplers for determining the fate of toxic metals in wetlands polluted by mining activities

Monitoring pollutant levels such as metal ions in the aquatic environment is a crucial step in ensuring that good water quality is maintained. Monitoring is through regular sampling and analysis in order to detect levels of pollutants, particularly those considered high risk to life. Passive sampling techniques have been applied in order to monitor pollutants in the environment. The area is getting more popular and recognised as alternative approach for environmental monitoring. In this project, two types of passive samplers for water monitoring of metals were modified, optimised and applied to study the transport and behaviour of metals in wetlands polluted by acid mine drainage. The first passive involved a polymer inclusion membrane (PIM)-based passive sampler. Here a new design was machined. The other work involved modifying the diffusive gradient in thin films (DGT) passive sampler. Current DGT is used once and thrown away but here a new cap was designed making the sampler holder to be reusable.

Report no. 2551/1/21

Web link: <https://bit.ly/3lIXRIV>



Community-led water services for multiple uses

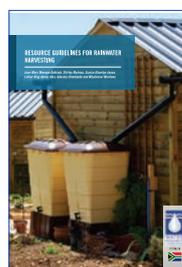
Community-led water services move away from first-time construction to sustainable incremental improvements in longer-term co-management between communities and government. Both agree on sustainable complementarity in roles and responsibilities. Communities become innovators and co-investors and government continues, among others, to fulfil its constitutional duty to subsidise basic service levels, leaving no one behind, and to ensure safety of the 3-5 litres per person per day for drinking. This set of manuals for community-led water services for multiple uses (MUS) are based on the experiences of the demonstration project 'Operationalising community-led multiple-use water services (MUS) in South Africa' from end 2017 to early 2020. Six demonstration communities in low-income rural areas of Limpopo Province differed in: population size, service level of infrastructure for self-supply and public infrastructure, surface and groundwater resources, and in extent of productive water uses. Funded by the African Water Facility of the African Development Bank, the Water Research Commission was the implementing agent. The NGO Tsogang Water and Sanitation demonstrated community-led MUS in the communities as the support agency. The International Water Management Institute (IWMI) led the research, also for these guidelines. The manuals are available in English, Sepedi and Tshi-Venda.

Report no. SP 149/21 (English), SP 150/21 (Sepedi) and SP 151/21 (Tshi-Venda)

Web link for the English manual: <https://bit.ly/2VVUyVS>

Web link for the Sepedi manual: <https://bit.ly/3tYZjdZ>

Web link for the Tshi-Venda manual: <https://bit.ly/3nS6Udb>



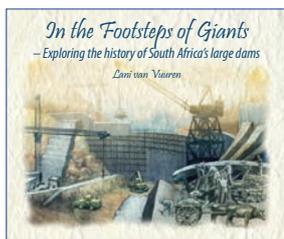
Resource guidelines for rainwater harvesting

South Africa has to prioritise from the mix of available water supply options to supply the huge water demands for development and economic growth. The country is actively pursuing water conservation and water demand management measures and the use of alternative water sources, such as desalination, groundwater, rainwater harvesting (RWH), and water reclaimed from acid mine drainage. Rainwater harvesting is an age-old proven practice; however, an enabling environment and government support is necessary in order to promote the implementation of RWH systems on a larger scale. The implementation of domestic rainwater harvesting is increasing in South Africa. While potable use is possible for harvested rainwater, necessary on-site treatment and perceived public health concerns will likely limit the quantity of rainwater used for potable demands. Irrigation and the non-

potable use of water closets, urinals and heating, ventilating, and air conditioning, make-up the end uses that are generally the best match for harvested rainwater. National rainwater harvesting guidelines that give clear direction as to the routine water analysis and monitoring that needs to be undertaken to ensure constant quality of rainwater, do not currently exist in South Africa. This document is therefore a first attempt to address this need.

Report no. TT 758/18

Web link: <https://bit.ly/3ucgYPy>



Hard copies available – In the footsteps of giants

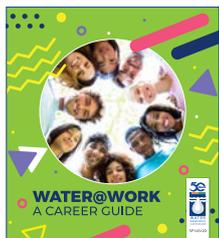
The Water Research Commission has made a limited number of hard copies available of its popular book, *In the footsteps of giants: Exploring the history of South Africa's large dams*.

Launched in 2012, the book takes the reader on a journey

through the history of South Africa's large dams, starting with the traditional attitudes towards water resources prior to European settlement and ending with a glimpse into the future of dam building in the country. The country's estimated 500 large dams hold back millions upon millions of litres of water, allowing us to pursue activities that would otherwise have been near impossible in a semi-arid climate. Dams bring us water for consumption in our large cities, irrigation to grow our crops, water to drive our main economic ventures and to generate power, all while holding back huge volumes of floodwaters that might have otherwise engulfed our settlements. *In the Footsteps of giants* explores the reasoning behind the construction of these massive structures, the laws that guided their development, and the people and institutions that made them possible. Woven in between are the tales behind some of the country's most iconic dams and dam engineers.

WRC Report no. SP 31/12

Web link: <https://bit.ly/39qSzvR>



Latest version of WRC Career Guide now available

South African water resources are national assets. We need qualified people to look after and manage these resources for the good of the country and its people. To choose the right career, aspirant water sector employees need to find out what they like and

enjoy doing. Then you can decide which careers appeal to you and if your personality matches your career of choice. The third edition of the popular *Water Research Commission Water@Work Career Guide* is now available for download and in hard

copy. The career guide provides a snapshot of careers and work opportunities related to the water sector. More than 60 different career options are described. The guide is divided into five sections:

- **Section 1** provides an overview of the future of skills and work and how it relates to careers in the water sector. The section describes some of the basic skills that are important when working within a fast-changing society as well as the skills you will need to thrive in the future.
- **Section 2** focuses on different careers across the water cycle, providing details about the necessary skills and qualifications needed. This includes those careers responsible for managing water resources, distributing and treating water resources, as well as using water wisely.
- **Section 3** describes in detail the most prominent careers in the water sector. Each career group is colour-coded (for example, orange for engineering-related and purple for science-related careers) to help you find your way in this guide. Each career outlines some areas of specialisation, what people in the career do, related careers, skills and persona qualities, qualifications and training, potential employers, professional bodies, and organisations where more information can be obtained.
- **Section 4** includes useful contact details for learners and students who want to find out more about a particular career or field of study.
- **Section 5** highlights options for sourcing funding for your studies. The publication provides a useful list of organisations and institutions that offer bursaries and scholarships.

Report no. SP 145/20

To download the different sections the new career guide, Visit: <https://bit.ly/3INovAr>. The guide is also available in hard copy.



To watch a video introduction of the career guide, click here <https://vimeo.com/578535139>

To download any of these reports click on the web link provided, Visit: www.wrc.org.za or Email: order@wrc.org.za

NEW PUBLICATION CELEBRATES 50 YEARS OF IMPACT BY WRC

The Water Research Commission (WRC) has launched a new publication in celebration of its fiftieth anniversary.

The publication, *WRC@50 – Celebrating a half-century of excellence* (WRC Report no. SP 148/21), was launched during the WRC's Fifth Symposium, held virtually on 20 – 22 September 2021. The colourful, 340-page publication is the product of months of research lead by project leader Jody Reizenberg under the mentorship of environmental sciences doyen Dr Jenny Day with support from Belinda Day.

The WRC was established in 1971 following a period of intense drought in South Africa. Its mandate, which remains true to this day, was to promote coordination, cooperation and communication in the area of water research and development; establish water research needs and priorities; stimulate and fund water research according to priority; promote effective transfer of information and technology; and enhance knowledge and capacity building within the water sector.

Over the past five decades, the WRC has grown to be South Africa's premier funding agency dedicated to water research. "The Commission is considered a 'glue institution' for the South African water research and innovation community of practice," notes WRC: former CEO, Dhesigen Naidoo in the Foreword.

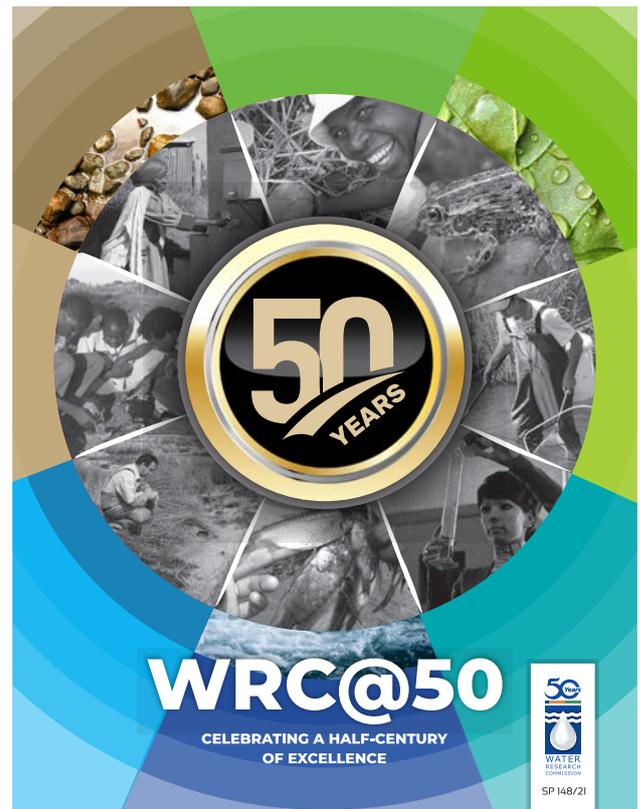
The book's 14 chapters provide a critical overview of the Commission's contribution to various fields of research including hydrology, water and sanitation services, water law, agriculture, water quality, social sciences, environmental sciences, and climate change. The book starts with a chapter on the history of the WRC, outlining the reasons for its existence. It ends with a critique of the Commission, touching on controversial issues and suggesting future paths that will build on what has already been done. A total of 49 authors contributed to the book chapters.

"Putting this book together has been a challenge and an eye-opener. We were unaware of the enormous amount of work that the WRC has funded over the last 50 years, the number of students supported to graduation, and the extent to which this funding has allowed us to grow as scientists and managers of our inland waters," note the project team in the Preface of the book. "No other country has a similar funding mechanism, and we South Africans can count ourselves fortunate to have the financial and logistical support of the WRC as we go about our research."

Emphasis is also placed on the WRC's contribution towards the transformation of the South African water and sanitation sector, particularly in the last 20 years. Says Naidoo: "The Commission has achieved important milestones, such as having the majority of project leaders being from the category of black,

women and youth. The students supported on WRC projects are predominantly black and majority female. This has been achieved with the generous mentor contributions of senior researchers and innovators."

The book describes the WRC as a "key national asset". "To truly appreciate the role that the WRC has played in generating and applying knowledge in the wise use of water resources, we must acknowledge the relatively short period of time over which these advancements have been made. In only five decades, the institution has generated world-leading knowledge, and has become a flagship for change," the authors note in the concluding chapter. "The WRC must remain a critical part of the South African knowledge economy, articulating and re-establishing the value of reliable knowledge, and developing pathways for effective mobilisation of knowledge into policy and practice."



WRC@50 – Celebrating a half-century of excellence is available online at <https://bit.ly/3Cu87LW>

A limited number of hard copies will be made available. To obtain a hard copy of the book, send your details to WRC Knowledge Services Manager, Lani van Vuuren, at laniv@wrc.org.za.

WATER CONSERVATION

Keep on saving – Water demand management in a time of plenty

*A new Water Research Commission report by a CSIR team explores how water conservation and water demand management efforts can be sustained beyond water crises.
Article by Sue Matthews.*



This year's winter has been a wet one in the Western Cape, with rainfall well above the long-term average. By mid-August the dams supplying Cape Town were collectively 98% full, having hit the 100% mark in October 2020 for the first time since 2014 and then dropped back down to 67% after the dry summer months.

Water restrictions, which had already been relaxed considerably since the height of the drought, when a daily personal usage limit of 50 litres was imposed between February and October 2018, were lifted altogether from 1 November 2020, although water-saving regulations under the City of Cape Town's Water Bylaw (2010, amended in 2018) will remain permanently in place. These stipulate, for example, that garden watering may only be done before 9:00 or after 18:00, that swimming pools are kept covered when not in use, and that new or replaced toilet cisterns

may not exceed six litres in capacity.

Theoretically, I could resume my old habit of luxuriating in a bath every few days, but now I generally stick to short showers, although I've stopped standing in a tub to collect water to flush the loo. If I do treat myself to a bath these days, it's only half-full at the most, and instead of pulling the plug afterwards I usually add washing powder and soak some laundry so that the next load in the washing machine can be done on the most water- and energy-efficient setting.

Evidently, many other Capetonians have also continued with such 'behaviour change', as overall water usage for the city has generally remained below 800 million litres per day (MLD) – bar a few peaks in summer – whereas before the drought it was

topping out at 1 200 MLD. This is a testament to the effectiveness of the awareness-raising campaign conducted by the City of Cape Town, although its intensive water pressure control, leak detection and repair programme and rising block tariff system have undoubtedly reduced water usage and losses considerably too.

Given that South Africa as a whole is facing a projected water deficit of 17% by 2030 unless 'bold action' is taken to reduce demand, according to the National Water and Sanitation Master Plan of October 2018, the WRC funded a project to consolidate the lessons learned from the drought so that they can be mainstreamed into other municipalities. Conducted by a team from the CSIR consisting of Dr Karen Nortje, Ms Ngowenani Nohayi and Ms Benita de Wet, the project's output is the ***Report on sustaining water conservation and water demand management strategies and practices beyond water crises (WRC Report No. 2946/1/20)***.

The project focused on messaging strategies adopted as part of water conservation and water demand management (WCWDM) measures, and rather than being limited only to the City of Cape Town, it included the City of Ekurhuleni in Gauteng as a second case study. Although this metropolitan municipality has not yet been subject to the kind of 'Day Zero' countdown Cape Town experienced, water restrictions were imposed during the 2015–2016 El Niño-induced drought in the region, and heatwaves attributed to climate change seem to be increasing.

The project sought to address the following research questions:

- What are the messages from municipalities during times of crises and beyond?
- What are the strategies that authorities adopt?
- When the crisis is over, how do municipalities then frame their messaging strategy?

The research approach relied on workshops with municipal officials and a focus group discussion in each of the two cities, together with a household survey that the CSIR had conducted in six metropolitan municipalities during 2018–2019 for a larger project funded from a CSIR Parliamentary Grant. During this survey, 225 respondents in Cape Town and 197 in Ekurhuleni – from a range of income groups in both cities – had been interviewed, and the focus group participants had been drawn from those indicating they were willing to be contacted again. The two focus groups represented very different sectors of society, because the Cape Town one was made up of University of Cape Town staff and students who lived in the vicinity of campus, while the Ekurhuleni one consisted entirely of residents of KwaThema, a township near Springs.

The project team point out in the report that while the focus group discussions were clearly not representative of all residents in the two metropolitan municipalities, they did offer valuable insight into the thinking, attitudes and perceptions of residents. The participants were asked to evaluate – via a 'Dotmocracy' exercise of voting with coloured stickers – a selection of print media messages around water-saving, followed by a discussion on the results. The Cape Town participants preferred simple, visual messages with catchy phrases, rather than text-heavy information sheets that they did not have time to read, while the

KwaThema participants indicated that numbers and percentages in the messages meant little to them, but they could identify with the concept that water would run out. They also felt that messages about taking short showers instead of baths were irrelevant to them, given that they did not own a shower and their township did not even have a continuous water supply.

The KwaThema residents may well be exposed to more targeted messages in the future, given that the City of Ekurhuleni only produced its first long-term WCWDM strategy in November 2019. The strategy covers the period 2020 to 2025, and was developed in response to current constraints in water provision from the Integrated Vaal River System. The water is supplied through Rand Water, which has a licence to abstract 1 600 million cubic metres per year from the system, and this will not be changed until Phase 2 of the Lesotho Highlands Water Project (LHWP) comes online. Originally due to be operational by 2020, the Phase 2 completion date has now been pushed back to 2027. In May 2017, Rand Water initiated Project 1600 to encourage the municipalities it supplies to target a zero or negative growth in water demand in the interim, but the licence volume is nevertheless being exceeded.

Although the City of Ekurhuleni had been implementing a water loss reduction programme for the past decade to curtail non-revenue water, projects were rolled out as and when funds were available. The new WCWDM strategy now strives not only to reduce non-revenue water from 33% to 25% by 2025, but also to stay within the target allocation provided by Rand Water and to reduce water demand by 15% over the 10-year period to 2030. The strategy contains 10 interventions to achieve this, and one of these is the implementation of a water conservation education and awareness portfolio. A browse of the City of Ekurhuleni's

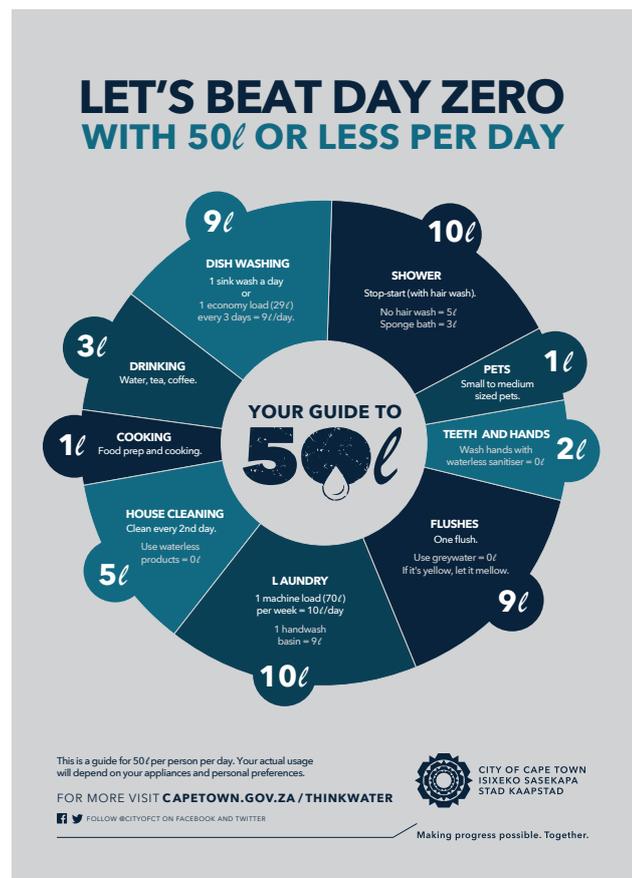


Ashraf Hendricks/Grundup

During the height of the drought in 2018 residents of Cape Town supplemented their water with free supply from the Newlands spring.

website does not yield any easy-to-find information on the topic, but a Google search reveals that the municipality periodically issues press releases about waterwise practices in the home and garden, and regularly posts messages about water saving on Facebook and Twitter. Of course, Rand Water also has a long-running and high-profile WaterWise campaign in the region, with a team of people to facilitate environmental education activities and a comprehensive website with curriculum materials, posters, factsheets, tools, games and quizzes.

The City of Cape Town's awareness-raising around water saving has a long history too, although activities have largely been linked to drought events. Water restrictions were imposed over the summer of 2000–2001, and again in September 2004 following low rainfall in the 2003 and 2004 winters. But as early as 1995, the then Cape Metropolitan Council (CMC) had committed itself to a 10% saving on the historical demand growth of 4% per annum, and in 1998 established a Water Demand Management Section to oversee a 12-point strategy and implementation plan. The following year it launched the Integrated Water Resource Planning Study to investigate water demand initiatives and supply schemes within its jurisdiction, and the results of this study were used to inform the development of a new WCWDM policy and strategy in 2001. By that time, the CMC had merged with neighbouring local municipalities to form the City of Cape Town.



The City of Cape Town's Day Zero campaign, implemented between July 2017 and March 2018, highlighted the risk of Cape Town 'running out of water' if water use was not severely curtailed. A daily personal usage limit of 50 litres was imposed as part of the Level 6B water restrictions from February 2018.

The strategy aimed for a 20% reduction in the projected demand for water by 2010, but funding for WCWDM initiatives was reduced between 2003 and 2006, and the commitments were not maintained. However, the signing in 2003 of the raw water supply agreement between the municipality and the national water department (then DWAF) for the construction of the Berg River Scheme included a condition that WCWDM would be implemented, and this, followed by the 2004–2005 drought, prompted a revival of WCWDM initiatives. By 2007 a more comprehensive WCWDM policy and strategy had been developed, and a unit was established within the municipality's water and sanitation department to implement it. The strategy has been reviewed and updated a number of times over the years and remains in place, although an overarching Water Strategy was also published by the City of Cape Town in February 2020. This includes WCWDM commitments under a chapter on 'wise use', as well as an annexure covering the background history of the municipality's WCWDM initiatives.

Now that the drought is over, the awareness campaign has gone rather quiet again. Perhaps it would create confusion to keep telling people to save water when they are being encouraged to wash their hands frequently to stop the spread of COVID-19, although there is no evidence that such hygiene measures are measurably impacting overall water use, according to Xanthea Limberg, the City's Mayoral committee member for water and waste.

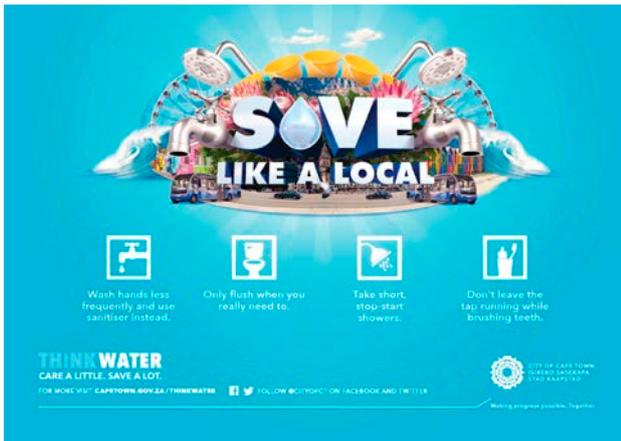
Mainly though, it's a case of shifting priorities – campaigns can be costly and the dams are full, after all. What's more, as the project team point out in the report, "An underlying tension is present here. Municipalities derive income from water sales, and therefore benefit from consumers using more water. At the same time, however, they are required to practice WCWDM in line with the national water legislation. This tension may discourage municipalities from placing as much emphasis on WCWDM as they should, unless they are faced with extreme conditions."

In the final chapter of the report, the project team summarise the key learning points and recommendations from their research under four themes:

- Knowledge, information and education
- The system
- Messaging and communication
- Context, perceptions and the human factor.

Under 'Knowledge, information and education', they stress the need to build a water literate society, using a structured education and awareness approach and incorporating the opportunity to learn and reflect from past experiences, such as Cape Town's water crisis.

Taking a systems approach, they point out, is crucial for taking account of interconnectedness, because while WCWDM interventions may have positive outcomes, they may also have unintended knock-on effects, such as the reduction in revenue from water sales. They also mention the countrywide 'politicisation' of water, which came to the fore during the Cape Town crisis.



The 'Save like a local' campaign was targeted at local and foreign visitors to Cape Town during the drought. The City of Cape Town made print-ready posters, flags, leaflets and door hangers available to the hospitality industry, and many hotels took steps such as closing swimming pools, removing bath plugs and installing timers in shower cubicles.

"Messaging and communication campaigns should go beyond just providing information," note the project team, highlighting the importance of making access to information easy and via a variety of different channels. While social media provides a useful platform to share information, posts about saving water on the two municipalities' feeds inevitably prompt numerous irate or sarcastic comments from members of the public, many of them containing misinformation. "As such, controlling messaging and information is essential through active monitoring, fact-checking and corrective messaging," observe the project team. "This, however, has to happen in a way that does not alienate knowledge consumers and builds trust."

Turning to 'context, perceptions and the human factor', they note that contextual relevance in communication is essential in a developing country like South Africa, where there are vast differences in socio-cultural and economic circumstances. These



The research revealed that residents of both municipalities preferred positive reinforcement in the form of water saving tips. Strategies that involved 'naming and shaming' households who used too much water or ignored water restrictions were not considered by survey respondents to be effective in encouraging them to reduce water use in future.



The City of Ekurhuleni was used as a second case study in the WRC report. Social media has become a valuable tool for sharing information and encouraging water saving, but the research team note that active monitoring, fact-checking and corrective messaging is needed to counter negative sentiments and misinformation posted by members of the public in the comments.

differences will likely affect peoples' perceptions, which are in turn powerful drivers of – and potentially barriers to – behaviour relating to water-saving efforts.

As an example of such perceptions, the project team relate how survey respondents from high-income households in Cape Town frequently remarked that it was people living in low-income areas and townships that needed to learn about saving water because taps were often left running and leaks not fixed there. Yet respondents from low-income areas – particularly in townships where many people relied on communal standpipes for their water supply – felt that the focus should be on high-income areas where people have large gardens and swimming pools.

The success of the 'Day Zero' campaign, which was not universally supported as it was considered by many to perpetuate fear, anger and panic, can be attributed to the fact that it 'levelled the field' and cut across all spheres of inequality, note the project team – zero water for one person meant zero water for all.

WATER AND INDUSTRY

WRC report guides the way to safely irrigating with mine-water

Where there's a will, there's a lawyer. But where there's a WUL expect not so much lawyers as laws and a profusion of red tape. We are referring here, of course, to a Water Use Licence (WUL) and unless you are drawing water from a natural source for something modest and relatively innocuous like domestic use, you will need one. And this comes with a plethora of compliance requirements and plenty of complexity, writes Matthew Hattingh.



Mining is not only one of the largest industrial water users in South Africa but also a significant potential water polluter. Irrigation offers a potential cost-effective reuse option.

What then are the prospects for reusing water impacted by mining activity to irrigate crops? A number of Water Research Commission (WRC) studies over the past two decades in the coalfields of Mpumalanga and the goldfields of the Witwatersrand found that using mine wastewater for agriculture was technically feasible.

We are frequently reminded that South Africa is a water-scarce country. Similarly, we know mines produce a lot of water and dealing with it can be costly. We know too that commercial agriculture is the country's biggest user of water – responsible

for about 60% of water withdrawals – including precious potable resources, unnecessarily good for the job.

Reusing mining-impacted water for agriculture could unlock a host of environmental and economic benefits. It could cut waste treatment costs, offsetting the cost of rehabilitating spent mines. It also holds promise for improving the lives of rural poor, providing work after mines have closed, and contributing to the government's goal of building a more equitable society.

It seems a waste not to put mine-water to good use. Why isn't

it happening then? Partly because it's easier to discharge it as treated effluent, even though this may call for high-quality water to dilute the effluent.

"There is a perception that the use of mine-impacted water for irrigation will not be authorised in a WUL application, which is not the case," say Dr Gina Pocock and Leanne Coetzee, specialist consultants at Waterlab, an analytical chemistry and multidisciplinary water services company.

It comes down to the complexity of the WUL process. Water and other resources must be protected from contamination. This involves a number of government departments, both at national and provincial levels. A number of Acts of parliament come into play too, while shoals of regulations, procedures and policies proliferate.

Navigating these is anything but plain sailing. So, to chart the way, Pocock and Coetzee have written a report, *Guidance for attaining regulatory approval of irrigation as a large-scale, sustainable use of mine-water*. Completed for the Water Research Commission and published earlier this year, the report (**WRC Report No. TT 837/20**) sketches the benefits of putting mine-water to better use and catalogues in detail the rules and procedures that must be followed by mine owners seeking WULs.

Pocock and Coetzee noted that reusing mine-water was not a priority despite it being national economic and agricultural policy to irrigate more fields and pastures.

They cited the second edition of the National Water Resources Strategy, a water policy document drafted by the Department of Water and Sanitation, as well as the Irrigation Strategy of the Department of Agriculture, Land Reform and Rural Development. Among the documents' aims are easing poverty, creating work, developing skills and giving the country's rural poor fairer access to resources.

"Reusing mining-impacted water for agriculture could unlock a host of environmental and economic benefits."

As things stand, if you are a small-scale development farmer, it's unlikely the benefits of irrigation are trickling your way. Of the estimated 1.6 million hectares under irrigation in South Africa, only about 50 000 ha are in the former homelands and allocated to smallholder farmers. The irrigation strategy sets big targets for expanding irrigated areas and revitalising smallholder irrigation

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'Excellent yields' have been obtained in a pilot study, irrigating maize with untreated, mine-affected circumneutral (where the pH is near 7) waters at Mafube Colliery in Mpumalanga.

schemes. The problem is, as the water resource strategy points out, “additional water for an increase in irrigation would be very limited”.

Mine-water to the rescue then? Not so fast.

Before we rush to throw open the sluices and send the contents of tailings and evaporation dams cascading onto freshly ploughed fields, there are rules and regulations to consider. “The legislation and supporting guidelines relating to water reuse in South Africa exist and are readily accessible. However, they tend to be contradictory and confusing in many cases, which may have had the unintended consequence of negatively affecting the consideration of mine-water as an agricultural resource in the past,” say the authors.

The good news is that government is making efforts to improve things. Pocock and Coetzee were encouraged by the draft Mine Water Management Policy, which intended to clarify the responsibilities of officials in the different government departments and to get them to work together better. But they noted that although the policy was gazetted in 2017 it has yet to be promulgated.

Similarly, they welcomed last year’s proclamation by President Cyril Ramaphosa that applications for WULs must be finalised within 90 days – down from the 300 days it had previously taken. The move, they said, “Indicates a strong political will to stimulate the economy and remove unnecessary red tape.” However, turning good intentions into good deeds will take some doing. And the authors noted that limited capacity in the different departments “makes it difficult to adhere to the timelines as legislated for the adjudication and authorisation of applications”.

From a purely rands and cents view, irrigating with mining-impacted water makes sense. Treating it to domestic or even industrial standards before disposal can be expensive, yet previous WRC studies found that when used untreated, or partly treated, for irrigation, big savings were possible for mines. One study put the reduction of capital and running costs at 87% and 78% respectively.

“In addition, and of particular importance in the post-closure period of a mine, the income generated from the sale of the water could be offset against the running costs. Further benefits include job creation and the protection of water resources.” Then there were considerable benefits to agriculture to add to the reckoning. “It was observed that 360 megalitres per day may be generated after closure of the entire Mpumalanga coalfields,” said the authors, citing a 2004 WRC study. Estimates of the total area such a volume of water could bring under irrigation were not given, but a figure of 6 000 ha was quoted for the Olifants River catchment alone.

Other benefits include job creation and improving food security, particularly for neighbouring communities as mining regions diversify their economies away from mining. South African mines tend to be in water scarce areas and bringing in water from afar for farming doesn’t add up. “However, the treatment of mining-impacted water provides a water source on site or nearby, which then allows agriculture on the mine land to become a realistic

opportunity for the surrounding community on a year-round basis,” the authors note, again citing an earlier WRC study.

Pocock and Coetzee took a detailed look at the Constitution, common law and legislation that has a bearing on mine water management, mine closure and irrigation. They reviewed the National Environmental Management Act, Mineral, Petroleum Resources Development Amendment Act, Mine Health and Safety Act, and National Water Act.

“Treatment of mining-impacted water provides a water source on site or nearby, which then allows agriculture on the mine land to become a realistic opportunity for the surrounding community on a year-round basis.”

The National Water Act comes in for particular attention. It includes regulations that specifically deal with mines, compelling owners to: “Collect, confine and take reasonable measures to prevent water resource contamination, as well as ensure that water used in any process at a mine or activity is recycled as far as is practicable.” It spells out duties of care mine personnel must exercise to limit pollution, ensure recycling and look after water resources. And the regulations under the Act detail the obligations that continue even after a mine is closed.

The authors outlined the Department of Water and Sanitation’s revised irrigation water quality guidelines, which are site-specific and risk-based. Water conservation and demand management as it is applied to mines and agriculture got a look-in too.

The report dedicated a chapter to aspects mine owners should consider before even starting down the road to applying for a WUL to irrigate with mine-impacted water. The department’s best practice guidelines are covered too. These set out an order of priority for mine water and waste management. In order of decreasing priority, mine owners must: prevent or minimise pollution or contamination; but if it happens reuse or reclaim it; treat what cannot be reused or reclaimed; reuse treated water; and discharge or dispose of treated water, as a last resort.

When a mine faces closure, the reuse of excess water falls away leaving three options: treatment and discharge; irrigation; and sustainable development projects. “It is in the best interest of the mine, as well as future users of the water, to aim to use water with the minimum amount of treatment required. Reuse of water must be considered carefully to meet health and environmental requirements, and fitness for purpose to ensure sustainability,” say the authors.

They note that it is necessary to determine the suitability of the soil for irrigation and the quality of the water required. Mine-water may contain mineral salts which can be deposited during irrigation. These build up over several seasons making it increasingly difficult for plants to grow. Rainfall can wash away the salts, but only if the soil is well drained.



Irrigation with mine-water could potentially contribute to job creation and improve food security, particularly in communities neighbouring mines.

If a mine plans to irrigate with its excess water it needs to seek approval of the Department of Agriculture, Land Reform and Rural Development and the Department of Forestry, Fisheries and the Environment. This is likely to involve an environmental impact assessment, including a public participation process, as well as specialist studies such as soil, ecological and heritage assessments, and possibly a geohydrological study. The authors made certain recommendations on the order in which these should be done to help smooth the process.

Only once a mine has established that excess water is available and it cannot be reused internally, may it approach the Department of Water and Sanitation for a licence to discharge, including irrigation. A pre-application enquiry meeting is required to look at whether there was enough water, what it would be used for and the risks involved. At this stage officials advise the applicant on the documentation to be submitted, including: designs and plans; the mine's integrated water and wastewater management plan; mine closure and rehabilitation plan; and water quality results of the water to be used.

The authors developed a number of decision trees to assist applicants when weighing options and putting together submissions. These tools cover a variety of considerations, such as the process to develop a water reuse and reclamation plan and to categorise risks; mapping the different routes that may be followed in the application process; and noting the considerations and consequences involved at each stage. In the course of their research the authors interviewed mine-water managers, environmental consultants, environmental law experts, and mining and agriculture stakeholders to properly understand:

- Which laws apply
- The processes that must be followed by WUL applicants
- The roles and responsibilities of the different parties
- The circumstances under which the regulations permit irrigation with mine water and
- What applications need to be made to which government departments

A workshop was held to refine the guidelines set out in the report. Participants, including government officials, consultants and industry representatives from the water, agriculture and mining sectors, made suggestions on how the process might be improved.

Pocock and Coetzee highlight a number of shortcomings in the legislative framework and the application process. They note that mine-water management is not formally defined and there are no specific guidelines for the use of mining-impacted water, only for disposal of treated effluent. They call for the legislation to be rationalised and aligned to "remove ambiguity and address mine water directly".

Licence conditions should require applicants to produce a water reuse and reclamation plan – which is not the case at present. Irrigation with mining impacted water should be identified as a potential water use when planning new mines for inclusion in the integrated water use licence application, and when developing the mine's environmental management programme and closure plans.

WATER SOURCE AREAS

New national park plan to protect mountain water factory

South African National Parks (SANParks) and several partners are hoping to establish a new 30 000-hectare national park near the scenically-spectacular Naudé's Nek pass to protect a natural water factory in the mountains near Lesotho. Article by Tony Carnie.

Peter Brigg



"Grass is like a blanket that protects the land," says Themba Nsibandé.

Not so much to keep it warm, he explains, but because these lush green blankets cover the bare soils and protect them from being ripped away by the massive erosive force of rainwater falling along the mountain borderline between Lesotho and the Eastern Cape province. Safeguarding a threatened high-altitude grassland is one of the primary reasons for the proposed establishment of South Africa's newest national park in a collaboration between SANParks and the conservation group WWF South Africa.

By ensuring better protection and restoration of grasslands, the new park will also help to safeguard the abundant supply

of clean and clear mountain water that feeds local rivers and dams lower down in the catchment. Nsibandé, the WWF project coordinator for the proposed 30 000 ha park, describes it as a "national park with a difference". This is because, unlike traditional parks owned by the state, local landowners will have the opportunity – through a stewardship system – to incorporate their land in the park on a voluntary basis. As such they also stand to benefit from a range of financial incentives for private and communal land that is formally protected.

The heart of the proposed first phase of the national park is located close to the Lesotho border, in the vicinity of Naudé's Nek, Rhodes and Nqanqarhu (formerly Maclear). Naudé's Nek is one of the highest mountain routes in the country, and was originally established by the intrepid Naudé brothers (Stephanus

David Naudé and Gabriel Naudé) in 1896. There is a memorial plaque on the pass which pays tribute to these “*twee stoere boere*”, who trailblazed the winding route on horseback.

Nsibande says the site is among 22 strategic water resource areas in South Africa – areas which make up only 10% of the land area yet provide 50% of our water. However, even though critically important for South Africa’s water security, only 12% of these natural water factories currently enjoy formal protection.

Much of the high-lying land in the north-eastern section the Eastern Cape is also heavily infested with black wattle and other alien vegetation which reduces the flow of water to local river systems. “When we engage the elders of the community the issue of drought and water shortages is something that they can relate to because they have seen streams drying out over their lifetimes,” explains Nsibande.

They include elders from the Batlokoa Traditional Council communal land, spanning more than 10 000 ha and headed by Chief Montoeli Lehana. “He immediately resonated with the project and gave his blessing to approach the traditional council. Under his leadership are 11 administrative areas, each headed by a headman or headwoman, some Sotho and others Xhosa-speaking.

“At the meeting, Chief Lehana discussed the problem of invasive alien species, particularly black wattle, and its impact on water supply. He also discussed the communal adaptive grazing project in the Matatiele region, about 60 km away, where communal farmers have come together in conservation grazing associations aimed at rehabilitating the wetlands and grasslands.”

Nsibande notes that improved grasslands also improve the condition of the cattle, which then fetch higher prices at auction. “We are not saying that people should not graze or utilise the land, but these activities should be done in a more sustainable manner by resting the land and practicing rotational grazing.”

When Nsibande was appointed as the park project coordinator in April 2019, he started meeting the local community, especially

the traditional leaders and communal and commercial farmers and landowners, as well as citizens, municipalities, non-governmental organisations and business groups. “I was received with a mixture of enthusiasm and suspicion by some landowners, as they were naturally concerned about what we wanted to do with their land. I went to great lengths to explain that this is about partnering; it is absolutely not about fencing off the area and moving people off the land.

“It is about collaborating in an agricultural working landscape where all the farmers continue to graze their livestock sustainably in these mountains, as they have done for centuries. Our goal is to establish formal biodiversity stewardship agreements with all stakeholders in the park area to retain and restore the rich biodiversity here, and work together in implementing conservation grazing programmes.

“Well-managed livestock, especially cattle, are essential to maintaining the health and vigour of the grasslands, which become moribund in the absence of grazing. Healthy grasslands and wetlands are essential to a healthy water supply as they slow down the flow of water from the catchment area, mitigate erosion, and act as a sponge, releasing water throughout the year,” Nsibande notes further.

He also met several private landowners and commercial farmers in the Nqanqarhu and Rhodes areas and several have shown their willingness to participate in the project through partnership agreements. “If farmers in the park area are willing to sell their farms to us, we will certainly consider this, but the main objective is for them to be biodiversity stewards on their farms.”

Regarding access for future park visitors, some landowners do not want strangers coming on to their land, whereas several others are keen to attract tourists and to benefit from accommodation revenues. Welcoming the initiative, SANParks Acting CEO, Dr Luthando Dziba, says the ultimate objective is to consolidate an ecologically, economically and socially sustainable protected area, primarily by working with private and communal landowners: “The establishment of this national park will mark a new and innovative approach to protected area expansion as it will be located within a working agricultural landscape.”

On the economic front, Dziba says the project aims to raise significant government funding for the restoration and maintenance of the landscape for water security, bringing much needed employment opportunities to the area (through alien plant clearing and wetland restoration).

“Because of its rugged, unspoilt landscape, the area has rich potential for adventure and cultural tourism which could help to build an all-year-round tourism industry, further unlocking potential jobs. The declaration of a national park will also be a motivation for the inclusion of this area into the adjacent Drakensberg World Heritage Site.”

Dr Morné du Plessis, CEO of WWF South Africa, adds: “The beauty of this model is that biodiversity conservation and ecological management will be done in partnership with those who live and work in this area – while allowing them to continue deriving benefits from their land through sustainable agriculture and

Courtesy E. Muchapondwa



The Naudé’s Nek mountain route was pioneered by two brothers, Stephanus David Naudé and Gabriel Naudé, in 1896. According to the plaque at the monument to them, erected by their descendants in 1967, these twee stoere boere trailblazed the winding route on horseback. It was marked out and constructed using picks, spades and scotch carts, and completed in 1911.

Themba Nsibande



Themba Nsibande is the WWF project coordinator of the proposed mountain grasslands national park.

other compatible land uses. Ultimately this is a win-win – for nature and for people. We can't wait to see this project coming to fruition."

Nsibande notes that before any land can be included in the national park, an assessment must be done of the biodiversity value on their land. The declaration of the national park status on private and communal land is voluntary, involving willing landowners and SANParks. The landowners retain ownership and the rights to their land and SANParks and its partners will work with the landowners to protect the biodiversity on the land.

There are also benefits for landowners who wish to have their land declared as part of the national park, including those in terms of the Income Tax Act; the Property Rates Act; efforts to provide innovative conservation finance; extension support and ecological advice.

"Most importantly though, a landowner can establish legal protection for the biodiversity that has existed on the land over the years and create a legacy that ensures the natural, historic and cultural heritage of the landscape is protected for current and future generations."

Two legal agreements are prepared. The first is a written agreement between SANParks and the landowner, which records the landowner's consent to have their property included in the national park, the terms of which are endorsed on the title

deeds of the property. The second is a management agreement, which refers to the management plan and the commitments the parties have made towards the protection of biodiversity on the land.

For more information, contact project coordinator Thembanani Nsibande (WWF-SA) at email: tnsibande@wwf.org.za



Angus Burns

SANParks general manager Kristal Maze says the proposed new national park is one of South Africa's key strategic water source areas (the Eastern Cape Drakensberg).

POLLUTION AND THE ENVIRONMENT

Not so fantastic plastic – What the latest research says about plastic pollution in SA environment

Speakers at a recent Water Research Commission webinar shared some gloomy statistics about how plastic pollution and, in particular, microplastics, is affecting the South African environment. Matthew Hattingh reports.



Film lovers of a certain age will remember the funny-sad *The Graduate* for its awkward hero (a young Dustin Hoffman in the title role), the older woman (Anne Bancroft) who seduces him, and its Simon & Garfunkel soundtrack, which includes the hauntingly beautiful, *The Sounds of Silence*.

Less celebrated, but rich in comedy value, is a scene from the film where a family friend corners Hoffman's character at his graduation party to share some career advice. "I want to say one word to you, just one word," says friend to hero, "are you listening: Plastics. There is a great future in plastics. Think about it, will ya."

Already, back then (the film first screened in 1967) plastic had become a byword for much that was wrong with society... sterile, mass produced and ugly. A generation later, it's safe to say

that many of us, like Hoffman's character, have grown disaffected with the polymer products that crowd our lives.

But the thing is, plastics are just so *bliksems* useful – a fact Carina Verster reminded guests of at a July webinar hosted by the Water Research Commission (WRC) and entitled 'Microplastics as environmental stressors: Risk communications and community engagements'.

Plastics are durable; lightweight (therefore cheap to transport); inert; made from readily available fossil fuels; and have a low melting point, making it easy to shape. Plastics help food stay fresh longer, improving food security. And it has assisted advances in medical technology, according to Verster. But the very things that have made it so useful are also among the

reasons it is so tough to deal with as waste. Take durability: "A bottle that's supposed shelf-life is, say, max a year, could end up in the ocean and stay there for a thousand years," said Verster, of North-West University's unit for environmental sciences and management.

And because it is easy to shape and made from cheap raw materials, there's a lot of it about. This has eroded prices paid for recycled plastic, discouraging collectors who must gather ever-larger volumes of the lightweight stuff to turn a profit. Plastic has bred a consumer mentality. "It's cheap, we can discard it," Verster explained.

What are microplastics? It includes plastic fragments ranging in size from 1 micron (one-thousandth of a millimetre) to 5 mm; nurdles (beads used in plastic production); fibres from textiles and clothing; and microbeads from cosmetics and personal care products. Fragments are frequently broken or scuffed off larger items, such as bottles that have been weakened by sunlight, knocked about by the elements and left to heat and cool repeatedly. Bacteria and fungi play a role too in degrading plastics, releasing chemical compounds, including monomers and additives.

Microplastics were widespread, said Verster, citing a 2018 WRC scoping study that found it in all ground, surface and drinking water samples taken. In the Vaal and Orange river systems, up to 40 particles a litre were recorded, comparable to polluted European rivers like the Rhine and Seine.

"It was concluded at Rand Water that microplastics were not of a high risk factor in our treatment works or distribution systems and the water that was being supplied was regarded as safe to be consumed."

IUCN



A PET plastic bottle floating in Durban harbour. About 13 000 tons of these bottles leak into the South African environment every year.

Plastic pollution is a growing problem in Africa. China, the world's largest producer of plastics (31%), view the continent as its biggest export target. Africa's population is expanding at a brisk 3.5% a year, fuelling consumption, while waste management remains overwhelmingly (88.5%) poor. "That creates a really gloomy picture for waste and plastic management entering the environment in Africa," noted Verster.

South Africa generates more plastic waste per capita than the global average (an estimated 41 kg per capita a year versus 29 kg) and plastic makes up a "fairly high" share of the country's waste stream, according to Peter Manyara, co-ordinator of the International Union for Conservation of Nature's marine plastics and coastal communities programme for Eastern and Southern Africa.

While many of South Africa's landfills are doing well to contain plastic, this must be viewed against high overall use. The country generates more than 2.3 million tons of plastic a year (based on 2018 data). Of this, some 70% is collected and of the collected waste about 40% is disposed of in sanitary landfills or incinerators. A further 40% goes to unsanitary landfills and dumpsites while the balance is recycled (352 000 tons).

An estimated 107 000 tons of plastic leaks into the country's waterways and the ocean each year, the lion's share in the form of bigger pieces, known as macro leakage. Microplastic leakage figures stand at about 6 500 tons, or 6% of all leakage. Manyara viewed this percentage as high compared with Mozambique, Tanzania and Kenya. Tyre dust, he noted, accounted for most of this (5 800 tons).

Manyara singled out LDPE, PP, and PET bottles as the most significant in absolute leakage terms. PET bottles were the biggest contributor of absolute leakage (13,000 tons), although its leakage rate was low (5%), the likely consequence of high recovery and recycling, he said.

Disposable nappies, polystyrene food containers, PET food trays, and cigarette filters, also earned special mention. Manyara noted that about 2 500 tons of nappies, or about 11% of those produced, end up in the environment. Somewhat less than 1 000 tons of cigarette filters leak into the environment. No butts about it, a staggering figure if you consider a single filter weighs under 3.5g.

Plastic pollution by sector is revealing too. Packaging dwarfs all other sectors, with more than 60 000 tons entering rivers and oceans, followed by tyres and construction. The fishing and medical sectors were insignificant in absolute terms, but leakage rates were a high 14% and 12% respectively, said Manyara. An estimated 15 000 to 40 000 tons of South Africa's plastic reach the oceans each year. The figure was lower than previous estimates, Verster said, noting that most plastic stayed near its source rather than flowing far downstream. River sediment may be a major sink for plastics, she added.

Up to two-fifths of the country's wastewater is untreated, and this partly explains the high volumes of microplastics in rivers. Verster shared a photograph of Gauteng's Klip River, near Germiston, with webinar guests. "Basically, it looks like plastic



Microplastic pollution levels in South Africa's main rivers, the Orange and the Vaal, have been compared to those of the Rhine and Seine.

soup," she said, "that is raw wastewater, sewage water." Similar examples were "unfortunately the case in so many places in South Africa".

Are microplastics in the water bad for you? The short answer: scientists aren't certain.

Yvonne Liew, a senior water quality adviser with Rand Water, told the webinar that most research focused on marine animals and found that plastics indeed blocked digestive systems, affecting feeding and enzyme production and doing other harm. She felt microplastics might potentially affect human health, but noted a World Health Organisation report that concluded the effects were not known and more research was needed. The UN-mandated health body said microplastics could enter the body as fragments or chemicals. There was, however, limited evidence of it harming humans.

"It is important that communication of risk should not be sensational. It must be based on credible evidence, and it needs to be transparent about how the data was generated."

Liew said that Rand Water, which supplied about 14 million Gauteng citizens, investigated the prevalence of microplastics

in its source surface water and in water before and after it was treated for drinking. North-West University did the analysis work, sampling for six different plastic monomers and additives and counting and identifying microplastic fibres and fragments. Samples were filtered and examined using stereo microscopy and fourier-transform infrared spectroscopy.

The researchers found "negligible amounts" of microplastics in fragments or fibre form from the different sites, said Liew. Neither did they find it leached into treated water from the pipes and reservoirs that carried and contained it. By the same token, no evidence emerged that treatment works in the study reduced the amount of microplastics in drinking water.

None of the monomers or additives analysed for could be detected in water from 10 sampling sites. And lower concentrations of microplastics were found in the samples than in studies done in the US, Europe and China. "It was concluded at Rand Water that microplastics were not of a high risk factor in our treatment works or distribution systems and the water that was being supplied was regarded as safe to be consumed," noted Liew. She said a monitoring programme was in place to analyse microplastics levels at least twice a year.

It came down to concentration levels. There is certainly plenty of microplastic pollution in the environment, but it might be spread too thinly in most places to pose much risk. Indeed, this was the topic of another talk at the webinar, entitled 'Are microplastics toxic at environmentally realistic concentrations?'. Ntombekhaya Mgaba, of Rhodes University's Unilever Centre for Environmental Water Quality – Institute for Water Research, shared a few of the



A member of the Youth Employment Services programme team recovers a plastic bag from Durban harbour as part of a project supported by the International Union for Conservation of Nature and run by WildOceans.

results of her WRC-funded study on microplastics as physical and chemical stressors.

First a look at the chemical stressors. Mgaba investigated the effects of three common plasticizers (used to give plastics elasticity) in different concentrations and over different durations on four freshwater species: red-rimmed melania snails (*Melanoides tuberculata*); zebrafish (*Danio rerio*); shrimps (*Caridina nilotica*) and banded tilapia (*Tilapia sparrmanii*). She monitored how the plasticizers affected the growth of the four. For the tilapia and shrimps, she also monitored reproduction.

Fish egg hatchings were measured against concentrations of the plastic raw material bisphenol A, but the “dose response curves were not found to be statistically significant”. Dibutyl phthalate, another plasticiser, appeared not to affect snail growth, although reproduction of this species had a clear response to bisphenol A. Increased concentration of plastic additive calcium stearate did not appear to affect fish growth. However, fish egg hatching did appear to be affected by dibutyl phthalate and calcium stearate. Mgaba concluded most of her tests did not produce clear responses to plasticisers at environmentally relevant concentrations.

For the physical stressors, she sought to measure the effects of microplastic particles on the four species. For the fish, she measured growth and number of particles excreted in faecal

matter. Snails were watched for reproduction and size. And shrimp growth was monitored. No significant toxicological response was found in the concentrations considered. However, particles of polypropylene (a widely used plastic) affected fish growth, but only in higher concentrations, said Mgaba.

Apart from more research, what should be done? According to Manyara, South Africa already recycles an impressive 352 000 tons or about 14% of its plastic waste a year. Although few people separate waste and recyclables at home, the country has as many as 90 000 informal waste-pickers. “They do a very good



An estimated 1 000 tons of cigarette filters end up in the environment.

job in promoting segregation of recyclables from other types of waste."

There was also much informal recycling by small-scale initiatives. The country's recycling capacity was "quite high" and growing, with a "lot of innovation", but Manyara questioned whether the region perhaps overemphasised recycling at the expense of other approaches, including reduction and substitution. Other ways must be found to stem the plastic tide if the marine pollution battle was to be won, he said, mentioning efforts to better manage unofficial dumpsites.

Like Vester, he was against bans and felt preventative measures at source would be cheaper than dealing with plastic waste at the end of its life in the long term. "It is very important to avoid producing and importing plastics objects that do not benefit from recycling solutions in the country." A drive was needed to reduce demand for single-use plastic. Subsidies should be developed to encourage affordable ways to deal with plastic waste. And consumers and producers needed to be made better aware of plastic's environmental cost.

Nelson Odume, of Rhodes University's Unilever Centre for Environmental Water Quality – Institute for Water Research, said the risks plastics posed needed to be communicated to the public, decision-makers and industry in a forthright fashion. "It is important that communication of risk should not be sensational.

It must be based on credible evidence, and it needs to be transparent about how the data was generated."

If this was done. If people talked. If they worked together. And if waste was viewed as a resource for development rather than an evil, then in time, progress was possible. "A vision softly creeping," to quote Simon & Garfunkel. Yes, plastics can certainly be sterile, mass produced and even ugly, but now was not the time for the sounds of silence.



Some of the plastic recovered from Durban harbour.

WATER PERSONALITY



Prof Sue Walker – A career in agrometeorology



Although the renowned South African agrometeorologist, Prof Sue Walker, officially retired at the end of June 2021 after a more than 40-year career, she claims not to know the meaning of the word 'retire'! Far from slowing down, she is still going at full pace to share her knowledge and experience with researchers, students and farmers, not only on projects she is still running but also wherever she travels.

Highlights from Prof Walker's extraordinary career include obtaining her PhD from the University of California, Davis in the USA in 1988 for a thesis titled 'Spatial pattern of leaf growth of sorghum as affected by water stress and implications for canopy development'. She has published 103 peer-reviewed scientific articles and 27 chapters in books and was the supervisor or co-supervisor of 20 doctoral graduates.

Prof Walker's interest in climate and the environment started at a young age when she observed her father measuring the rainfall after every event in a copper rain-gauge. She learned about gardening and wildlife from her mother. In high school, her Geography teachers further stimulated her interest. Even as a child growing up in Gillitts, KwaZulu-Natal, she sought answers to weather-related questions such as why was it misty when she

left home and walked to the bus but when she arrived at school in the next valley the sun was shining? Those things fascinated her.

During her long career Prof Walker travelled to more than 70 countries and became a bridge across different cultures – greatly enjoying such interactions. She has guided scientists and students from many countries on how to relate weather and climate to agricultural production. Her PhD graduates comprise 6 from South Africa, 12 from other African countries and 2 from Asia (including 3 female graduates). She has also served on international committees, representing South Africa at the World Meteorological Organisation and the International Commission for Irrigation and Drainage.



With villagers in Mujika, in north-western Zambia.

Perhaps one of the most important things that guided Prof Walker in her research and that she taught her students is “If you don’t ask the right question, you won’t get the right answer”. She says that this works in most situations and helps you to think logically about a problem. Another pearl of wisdom is that “Failure is the backdoor to success”. In other words, you must use your experience of perceived failure to push yourself to the next level and build your perseverance and determination to succeed.

For Prof Walker it is important to make science useful to farmers and extension practitioners – to find out what is important to them, what they are currently doing and what their dreams are. She shares her expertise on the interactions between crops, livestock and the environment and helps them to identify the stresses and limiting factors in their farming systems. She uses her vast knowledge together with information from databases and maps to develop possible scenarios and look at alternative crops that show potential in that area. She then uses this information to develop Agromet Advisories or Climate Services tailored for those specific groups of farmers.

Prof Walker’s experiences in various countries as a devoted Christian made her realise that it was God who sent her to those communities, not only to bring practical agrometeorological advice but also to encourage and inspire the women there. For example, after a long day visiting the farmer field trials at Mujika, Monze in Zambia, her two students informed her that the ladies from the village wanted to talk to her. She went and sat on the ground to listen to them. Their God-given wisdom was “*If I only have seed – then it is better to eat it. But if I have compost or fertilizer – then I should plant the seed so it can multiply and feed my family for the whole year*”. Just like Jesus taught in the parable of the talents – we should use them and they will multiply.

Another more recent opportunity was working alongside two anthropologists from the Universitas Indonesia with Science Field Shops in the Indrumyu Regency. She often walked with farmers in their rice fields, where she especially enjoyed seeing each one with their own rain gauge. She interacted with them in the rainfall observer clubs, helping them to understand about the El Niño-Southern Oscillation (ENSO) and the effect of dry spells on their own cropping patterns and farm management decisions. She taught them how to determine the clay content of their own soils by playing with the mud. She gave them the opportunity to share their own ‘new knowledge’ with others during the ‘train the trainers’ workshops. Eventually she realised that the farmers no longer needed her continued input as an agrometeorologist as they had learnt about these things themselves.

Back home in South Africa, on her return to Hoxane Irrigation Scheme in Tulashe, Mpumalanga after about 25 years, Prof Walker met the extension officers who reminded her of their past interactions. They would walk in the fields and do farm and home visits to farmers on Tuesdays, then meet the extension officers on Wednesdays and hold the monthly Farmers’ Days on Thursdays. All benefited from the inputs from researchers and interaction with other farmers, thereby obtaining updated information and knowledge. This was where she first learnt in practice, through using participatory methods, that the farmer is the most important person!

Until other new opportunities come up, Prof Sue will continue working on a part-time retiree contract at the Agricultural Research Council in Pretoria. Her current projects include one funded by the Water Research Commission on the Water-Energy-Food Nexus in the Inkomati-Usuthu Catchment in Mpumalanga,

Water personality

which highlights the co-development of a decision-making model to capture the tradeoffs and synergies between the three sectors with stakeholder engagements. Another ongoing project is Climate-Smart Agricultural Training for Extension Practitioners in three provinces (funded by GIZ) where she is leading and guiding the development of manuals, week-long training courses and a toolbox about the possible adaptation and mitigation interventions to optimise agricultural practices under a changing climate.

Clearly Prof Sue Walker has no intention of hanging up her rain gauge and relaxing just yet!

Thanks to the Agricultural Research Council for this contribution



At a community meeting on crop modelling at Monze and Sinazongwe, Zambia.



Meeting WMO Commission for Agricultural Meteorology Vice President, Dr Federica Rossi, in Turkey.



During her career, Prof Sue Walker has travelled to more than 70 countries where she has enjoyed interacting with people from many different cultures.

THE WATER WHEEL

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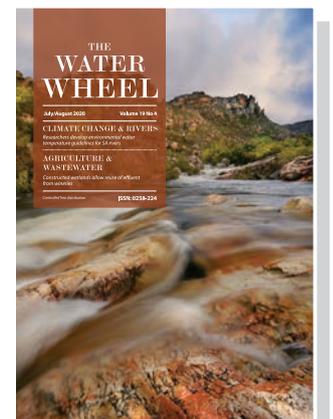
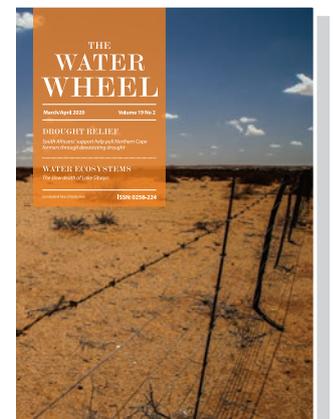
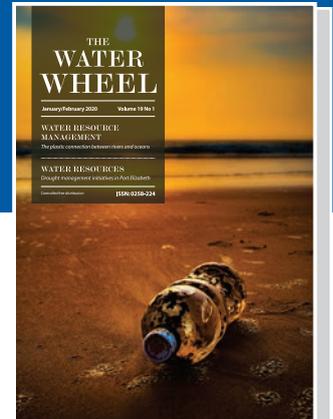
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OPINION

Subsurface water banking for water security and climate resilience

'Banking' South Africa's water in subsurface areas could go a long way towards enhancing the country's water security, writes Dr Shafick Adams of the Water Research Commission.



On 9 August, the Intergovernmental Panel on Climate Change sounded the alarm that the challenges created by climate change is 'code red for humanity'. Water security is intricately linked to climate change. We need to find ways to build climate resilience into our water systems. As our climate continues to change and our weather variability continues to swing between the extremes, we need to continue to develop mitigation and adaptation measures. Even when the precipitation amount does not decrease, we observe that the rainy season downpours are compressed into a few weeks and even days, resulting in localised flash flooding and overwhelming the stormwater infrastructure.

Humans have developed techniques to keep some of this water for as long as possible in the landscape to ensure that they can meet their water needs. Some water infiltrates and percolates into the subsurface to aquifers, some are stored in depressions, dam walls keep some back. This provides a means for domestic, food and energy security. In these environments, the water evaporates from open surfaces or are transpired by vegetation. In dry and hot environments, potential evaporation is significantly higher than precipitation – a significant amount of water is returned to the atmosphere.

Annual evapotranspiration depends on rainfall and potential evapotranspiration and can be over 50% of annual precipitation. It is not practical to cover all our open surfaces to reduce evaporation, but there is one place where we can store our water and that is right under our feet in suitable aquifers where the water is protected from open evaporation. Aquifers are subsurface formations that can store and transmit water in spaces found in unconsolidated material (pores) and hard rock (pores, joints, cracks, faults). Water security can be greatly enhanced by capturing and storing water that would otherwise return to the atmosphere.

In the arena of water security enhancement, one such measure is directing excess surface water, that would otherwise evaporate or flow into the sea, into the subsurface to be stored in suitable aquifers. The stored or banked water can later be abstracted via boreholes for when there is demand or to buffer drought episodes. Redirecting and storing excess surface water is called artificial recharge or Managed Aquifer Recharge (MAR) – I prefer water banking.

“It is time that we invest in proper groundwater development and management to ensure water security at all scales.”

Research by the Water Research Commission and implementation by the Department of Water and Sanitation as well as a few municipalities have shown that the technology works. Many of these schemes are operated across the globe. There are only 52 readily identifiable MAR schemes in Africa, with South Africa having 11 operational schemes, using a variety of approaches with surface spreading infiltration, open well and direct borehole injection being the most favoured. In southern Africa, we have excellent case studies but limited uptake of this proven technology.

In the Western Cape, the Atlantis scheme was developed in 1979 and receives treated domestic wastewater and stormwater that is directed to the subsurface via stormwater detention ponds. Windhoek is one of the driest countries in the region, and it receives an average of 360 mm of rainfall per year and average evaporation of 2170 mm per year. In 1997/98, Windhoek conceptualised banking water in its surrounding aquifers as an alternative to importing water from the far-away Okavango River. Injection into the fractured aquifers started in 2006 and in 2012 the recharge area could not receive, and more water and the second phase went into the planning phase.

Today, Windhoek operates a world-class water scheme and even more impressive is the coupling with their world-class wastewater reuse scheme. Their direct wastewater reuse scheme has been running for over 50 years and is the gold standard of how to do this. South Africa again helped to develop the technology. In addition, this has been done on the back of public-private partnerships and accessing know-how from elsewhere. For those that are still sceptical at this stage – the scheme ensured Windhoek remained water-secure during the

2015/16 drought. The investment yielded a healthy dividend for the city.

On the African continent, South Africa is indeed the trendsetter with several schemes, and it also has an Artificial Recharge Strategy (ARS) that was developed back in 2007. The ARS has as its vision statement “To use natural sub-surface storage as part of Integrated Water Resources Management wherever technologically, economically, environmentally and socially feasible.”

South Africa currently has 37 schemes at various stages of development (5 at desktop assessment; 15 at active investigation report stage; 4 at planning stage; 2 at active pilot injections; and 11 fully implemented schemes). We indeed have a wonderful story to tell. South African experts were central to the development of the Windhoek scheme, and other neighbouring countries are importing our skills to help develop MAR systems. Many astute planners are developing their infrastructure (for future use) to redirect excess surface water into their aquifers.

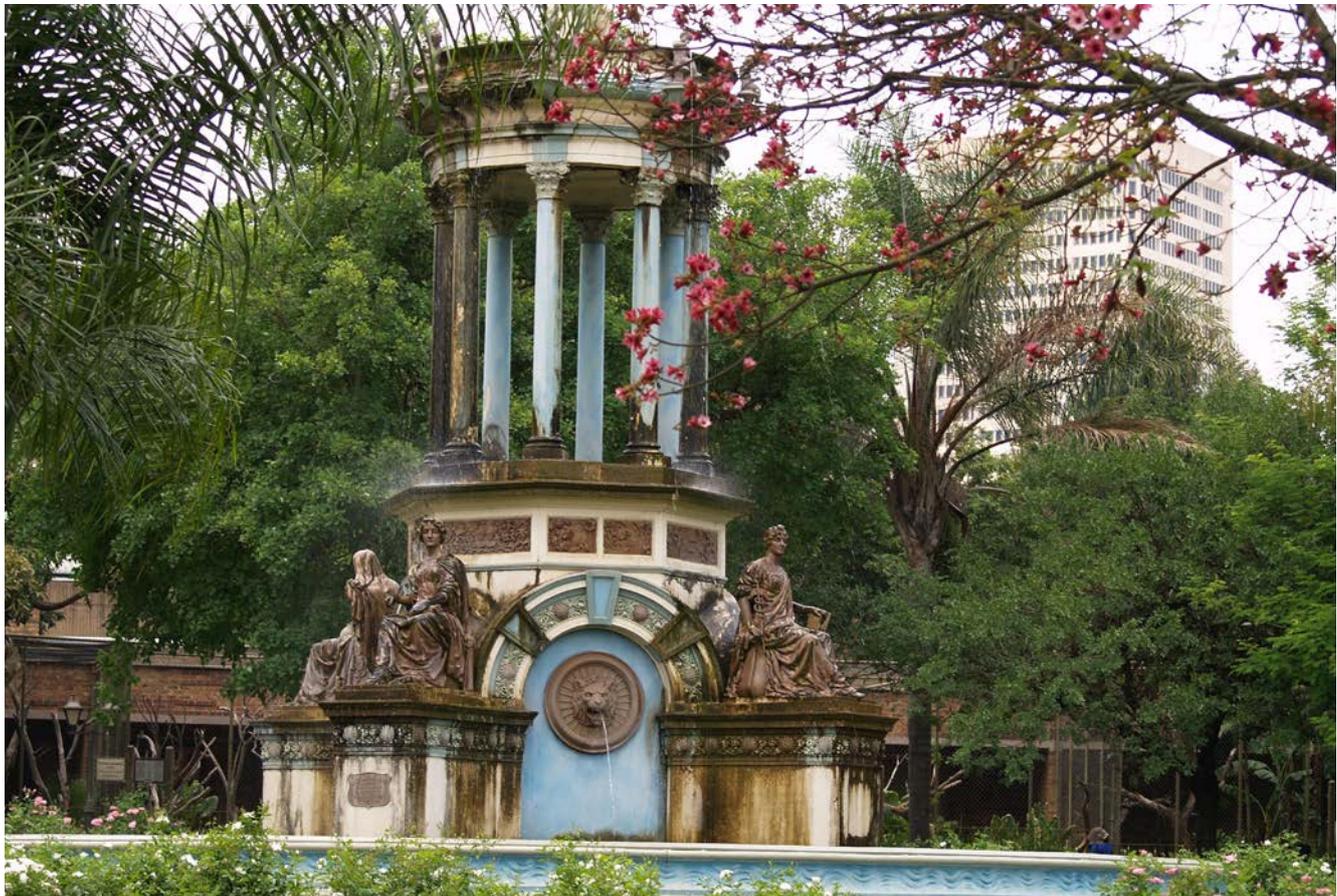
So why if we have the policy and strategy, the skills and know-how as well as ticking all the why, what, and how boxes are we still relatively slow in taking up this technology that is a sure-fire way to improved water security? Institutionally, we like bulk schemes with high capital costs. This can be exemplified by a seaside town – that between two options (MAR and desalination) selected a desalination plant that was 6 times more expensive than a MAR scheme offering similar yields. The operation and maintenance of smaller and decentralised schemes are difficult and poorly managed due to the absence of hydrogeological expertise at the municipal level. We would find it ridiculous not to have electrical expertise available in municipalities, but municipalities that rely on groundwater for water security rarely have any hydrogeological expertise.

It is rarely the case that groundwater as a resource fails, instead the failure is often in the day-to-day management of the resource and associated infrastructure. The technical skills often reside in private and academic institutions. The notion of low capacity often cannot be substantiated, it is more an issue of accessing these skills and know-how.

It is time that we invest in proper groundwater development and management to ensure water security at all scales, as well as using our aquifers to store excess water for use during peak demand and droughts. The water security and climate resilience rewards from compounding yields, through better choices and changes in our institutional behaviours, will benefit our socio-economic aspirations.

The more we implement the technology, through iterative experiences with time, the more robust and cost-effective it will become and downgrade the code red alarm.

SAMMY MARKS FOUNTAIN – REMNANT FROM A BYGONE ERA



Today, the Sammy Marks fountain stands near the bird cages of the Pretoria Zoo.

Few visitors to the Pretoria Zoological Gardens ponder the origins of the Sammy Marks Fountain, a remnant of the capital city's rich water history.

The cast iron fountain was donated to the city by Lithuanian-born mining magnate, Sammy Marks. He imported the fountain – cast at Saracen Foundry, Scotland, featuring pre-casted items selected from the company's catalogue – at the end of the second South African War. It was one of at least four drinking fountains from the Glasgow foundry to find its way to South Africa in the late 19th century – the others were all erected in KwaZulu-Natal.

The fountain replaced a statue of ZAR Republic President, President Paul Kruger, in Pretoria's Church Square. Marks first wanted to donate the statue to the city but was prevented from doing so by the British authorities who won the war. The Paul Kruger statue did eventually find its way to the square, in 1956. For a few years the fountain diverted water from the Pretoria fountains (the city's main water supply at that point) and discharged it back into the Apies River. After only four years the fountain was moved to the Pretoria Zoo. It was refurbished in 1970, followed by an extensive renovation in 1989. It still stands at the zoo today.



Wikipedia

The Sammy Marks fountain stood in Pretoria's Church Square for only four years before being moved to the Pretoria Zoological Gardens

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The Water Research Commission not only endeavours to ensure that its commissioned research remains real and relevant to the country's water scene, but that the knowledge generated from this research contributes positively to uplifting South African communities, reducing inequality and growing our economy while safeguarding our natural resources. The WRC supports sustainable development through research funding, knowledge creation and dissemination.

The knowledge generated by the WRC generates new products and services for economic development, it informs policy and decision making, it provides sustainable development solutions, it contributes to transformation and redress, it empowers communities and it leads various dialogues in the water and science sectors.

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