GROUNDWATER

Emergency drill – Project counts the risk of indiscriminate groundwater use in times of drought

Groundwater is an increasingly important resource, which is why turning to it at times of crisis brings its own troubles. A new Water Research Commission report delves deeper. Matthew Hattingh reports.

Nomthandazo Gumede put the crisis confronting Walmer High School in stark terms: "If there isn't water, we find with our learners, we cannot go on with the teaching." The school's deputy principal, Gumede was speaking to journalists on Nelson Mandela Day last year. It was at the official opening of a borehole, sunk in the ground of the school, a beacon of hope and excellence in the oldest township in Gqeberha (formerly Port Elizabeth).

"Now things are going to change. School is going to be normal… toilets… everything. For us this is life," Gumede told ***TimesLive*** while water from the new well gushed, almost at her feet. At the time, it was the thirteenth borehole opened in the Nelson Mandela Bay Metropolitan Municipality (which includes Gqeberha) by Gift of the Givers, the humanitarian relief agency.

More than seven years of below-average rainfall in the Eastern Cape, crumbling infrastructure, and, according to not a few critics, governance failures, had brought matters to a head. Schools, hospitals, old age homes and thousands of residents across the metro were running dry. Even the police K9 unit wasn't sure where to find water for their dogs. Gift of the Givers were rightly praised for their swift action. But while the boreholes they sank (or in some cases, reopened) helped stave off disaster, tapping subterranean water can potentially have unintended consequences. Unless done right, drilling risks over-depleting the resource, pollution and other ills.

These concerns were at the heart of a new Water Research Commission (WRC) report, which warns that, "Exploiting groundwater during crisis as an urgent and reactive measure, gives rise to poorly coordinated regulation of increasing users and usage, and fragmented management of aquifers." The report, ***Governing groundwater in city regions: water metabolism and actor networks in the cases of Cape Town and Nelson Mandela Bay*** (**WRC Report No. 3066/1/23**), takes a detailed look at how – and by whom – groundwater is used and managed in the two metros.

We've already touched on Nelson Mandela Bay, Cape Town, of course, emerged from its own crisis in 2018. Day. The three-year 'Day Zero' drought, shocked the Mother City into action, refocusing attention on how it manages water, including groundwater. And not a moment too soon.

The report's authors, Drs Anna Taylor, Ffion Atkins and Christopher Jack, of the University of Cape Town, argue the old ways no longer cut ice. "Traditional forms of governing by command and control are proving ineffective," they write, and quote an earlier WRC report (**WRC Report No. 2741/1/19**) which found the Department of Water and Sanitation has "neither capacity nor the cooperative governance mechanisms" to carry out the country's various national strategies and tactical plans. Similarly, even implementing their water bylaws exceeded the means of the two metros.

The authors called for a consultative and cooperative approach which recognised cities as "system(s) of interdependent actors and flows of water" and which sought to bring together organisations and entities so that groundwater might be better understood, used and protected. They hoped this would influence how water was used, enhancing "stormwater infiltration and increasing the reuse of treated wastewater for non-potable uses and managed aquifer recharge".

To this end, and as part of a WRC-backed capacity-building project (the subject of their report), the authors did interviews, reviewed official documents and organised a series of "learning laboratories". Lab participants included academics, sustainability and groundwater fundis, hydrologists, national, provincial and local government officials and consultants from a number of disciplines. Together, they worked to map the "network of organisations involved in groundwater-related decisions in cities".

To help the participants better grasp how groundwater links to other water flows, the labs sought to quantify the main components of "urban water metabolism". They also considered a number of scenarios that might play out over the next 20 to 40 years as climate change was expected to hit home and as more farmlands in the metros were paved-over – increasing runoff that would previously have soaked into the groundwater.

We will look at a few of the findings and return to the metabolism concept shortly, but first it's worth asking: What's so special about groundwater anyway? Here the report traversed familiar terrain: Water, it noted, was increasingly scarce in South Africa. Looming changes to rainfall levels and patterns were likely to make matters worse, even as the thirst for water grows from competing quarters. Delays dogged the roll-out of new infrastructure, while vital maintenance to the pipes, pumps, transfer canals and treatment plants was more honoured in the breach than the observance.

This is why we are increasingly pinning our hopes on groundwater to plug a growing gap between supply and demand. The trouble is, as the report observed, groundwater is a "distributed resource". This means "widespread mechanisms, capacities and incentives" are needed to monitor it, yet "governance of groundwater remains weak with insufficient monitoring, reporting and enforcement of regulations".

It's not working; what's to be done? Groundwater needs to be managed as part of a wider and inter-connected urban water cycle if it's to serve future generations. We must intervene and innovate, said the authors. But this required us to build a "shared understanding and strengthen capacity for participation in decision-making".

Back to the learning labs. Two were held in each of the metros, from November 2021 to December 2022. A fifth lab was convened online in June this year, bringing together participants from both metros, to mull over what they'd learnt. Taylor shared a slide with the meeting that contrasted the metros by size, population and budgets. She spoke too about the extent to which water systems were integrated (much less so in Nelson Mandela Bay) and how politics differed, with consequences for water management.

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"One of the things that comes through strongly is the stability in some regards of Cape Town's political leadership and what that has allowed in terms of bedding down of plans. Whereas in Nelson Mandela Bay there has been transition and strong contestation between the two dominant parties."

Taylor was referring to the fractious coalition politics that have emerged since 2016, with neither the African National Congress (ANC) nor the Democratic Alliance (DA) able to command a majority, and how unstable government had hobbled operations in the Eastern Cape metro. She paid tribute, however, to municipal officials for what they had managed to do despite "headwinds".

She noted groundwater played a small part in the overall supply mix – roughly 1% in both metros. But this was changing, with plans in both cities to increase this figure to about 9% over the next decade. The "big unknown", and one of the motivators for the study, said Taylor, was the uncertainty about the private sector, which made it hard to estimate total groundwater abstraction. "Basically, we have very little handle on how many private boreholes exist," she said, explaining that official databases and registers greatly under-represented the reality on the ground.

Anna Taylor

Participants at the first of the Nelson Mandela Bay learning labs use coloured markers and concentric rings to plot the various actors involved in protecting or conserving aquifers or their recharge. The rings indicate level of influence – from high to none.

Anna Taylor

The group at the second Cape Town learning lab deliberate on the strength of ties between actors using or managing groundwater in the Cape Flats aquifer on a scale of 0 to 3, from no interaction to frequent interaction, defined as more regularly than once a month.

She added that the labs sought to chart who was making decisions about groundwater use and protection with the bigger aim of figuring out the degree to which decision-making was collective and coordinated. "Because we know joined-up decision-making is essential to systems resilience."

"Resilience", an oft-recurring theme (along with "sustainability" and "integration") in the urban planning and environmental disciplines, was about building the capacity of systems and cities to withstand and recover from shocks. Here, climate change is very much in mind.

Taylor's co-author, Atkins, spoke about how urban water management was evolving internationally, with a move to a systems approach. This shifted focus from worrying about securing supply or dealing with drought or floods, to bringing together a variety of problems and solutions and building resilience. She said the study used the "urban water metabolism" conceptual framework to analyse natural and manmade water flows into and out of a city and to link this to decision-making processes. Natural flows from precipitation included run-off, groundwater and evapotranspiration.

Evapotranspiration is a combination of evaporation and transpiration – water lost through photosynthesis – and is markedly higher in Nelson Mandela Bay. Man-made flows included those in the wastewater and potable systems, dams and desalination plants.

Data was collected or estimated for the flows in the two metros. These were collated and used to produce a mass balance, essentially a table of all inputs and outputs. "It helps us understand how well the city is doing against what it says it's going to be doing – its management objectives. Is it water-use efficient? Have we reduced our outputs and external inputs?" said Atkins.

The authors explored different scenarios in the two cities, including decreases to rainfall and increases to evapotranspiration and land-cover. It let them and the labs study the effects of shifts in policy and interventions, such as changes to the water supply mix, recycling and managed aquifer recharging schemes.

How useful was this? Atkins conceded some lab participants saw little value in it for their day-to-day work and criticised it as too academic or for failing to address "social aspects". On the other hand, the metabolism framework helped people from diverse fields share a common understanding and discuss water management. "Its greatest value was seen in the strategic and scenario planning level," she said.

Returning to governance, Taylor said the report divided groundwater decision-making into four broad functions: understanding; operating; regulating; and capacitating. Operating included installing and maintaining infrastructure, groundwater treatment, schemes to recharge aquifers, and the links between these and how surface water was managed.

As an aside, Taylor touched on unregulated sand-mining, which was increasing, especially in Nelson Mandela Bay. "We need to know more about the implications for sustainably managing groundwater."

On the regulating function, she said bylaws in both metros were being updated to include lessons from the droughts, but enforcement remained a weakness. This was also true of water use licensing, which was the responsibility of the Department of Water and Sanitation. Borehole registration and monitoring weren't "happening comprehensively" and needed "a lot more work".

Taylor noted the quality of groundwater was an area of growing interest, with both metros turning to spatial planning to protect sources from pollution risks.

The labs worked to map the state, private, civic and non-government organisations or actors operating in the four functional areas. This included establishing which actors had a formal mandate to make decisions or provide oversight, and which of these, in fact, had the capacity to carry out their mandates. "I would say we are far from having complete

answers," Taylor said, explaining it was difficult to get robust data on arrangements in flux. She felt the lab findings were useful for providing relative assessments of capacity rather than for establishing any absolute benchmarks.

She spoke about the innovative approaches to governance being pioneered by some of the aquifer monitoring committees keeping tabs on Cape Town's new wellfields and wondered if other similar groups and partnerships might be used to: "Bring multiple groundwater users together to report on their usage and collectively monitor the state of the aquifers and then start to develop more collective rules to manage usage in relation to changes in supply and demand."

"We need much more nimble institutional arrangements… the question is how do we build this," said Taylor.

Yazeed van Wyk, WRC research manager for groundwater hydrology, agreed that there was a pressing need for collaboration in the face of an unprecedented demand for water, compounded by a host of difficulties, including drought and climate change. He mentioned too, the recent fatal cholera outbreak in Hammanskraal where the polluted groundwater has been found unfit for human consumption.

Van Wyk, who was the WRC's project manager for the study and who made the closing remarks at the June lab, wondered how organisations with vested interests might be encouraged to adapt and transform – to move to more sustainable ways of managing water. "How do we get old dogs to perform new tricks?" he asked, suggesting the work of Taylor and her colleagues helped point the way. "Perhaps to use this new approach, as a tool to apply in arrears where implementation should ideally be taking place."

There appears to be little handle on how many private boreholes exist.