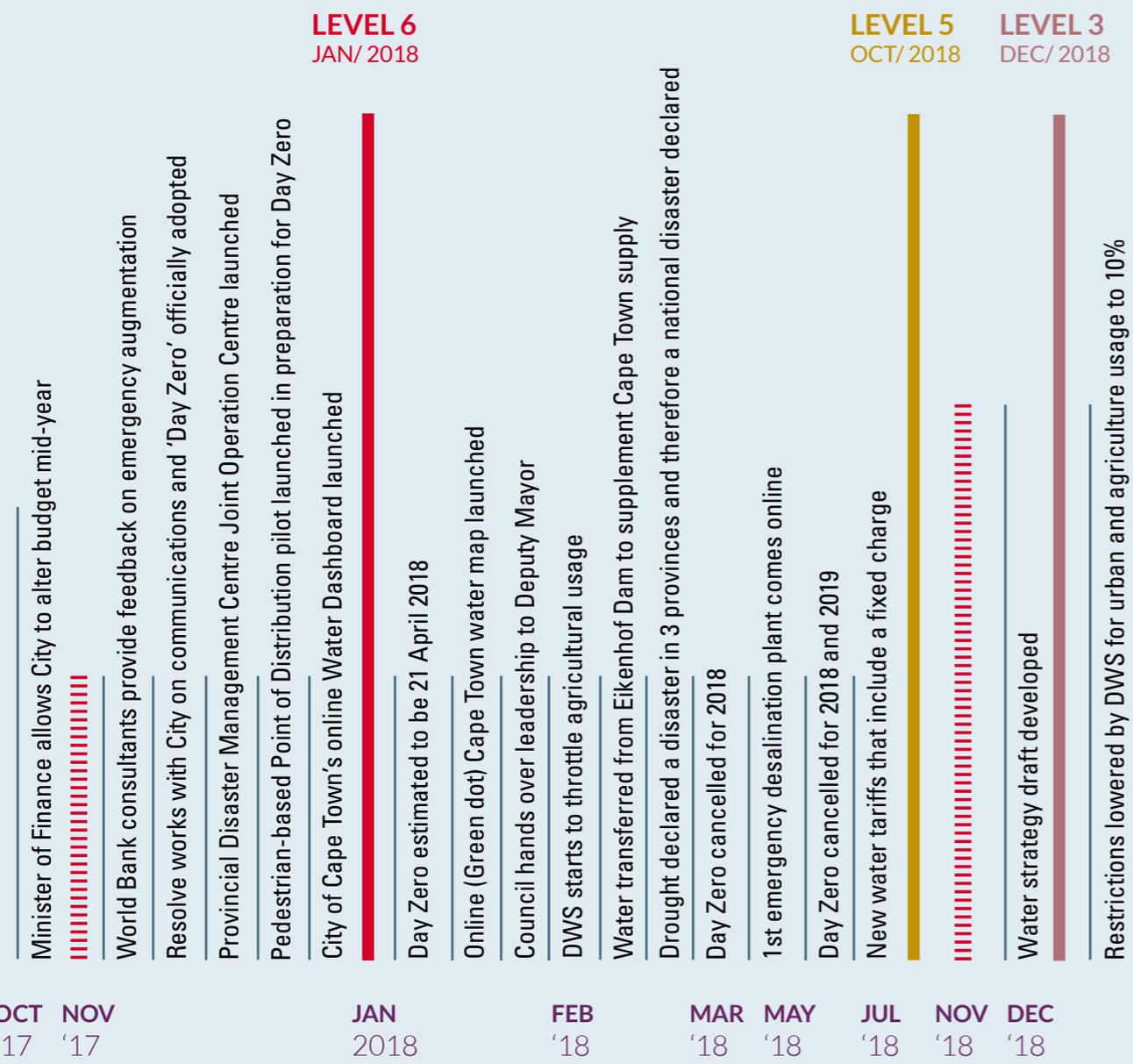


DAY ZERO

ONE CITY'S RESPONSE
TO A RECORD-BREAKING
DROUGHT

LEONIE JOUBERT & GINA ZIERVOGEL

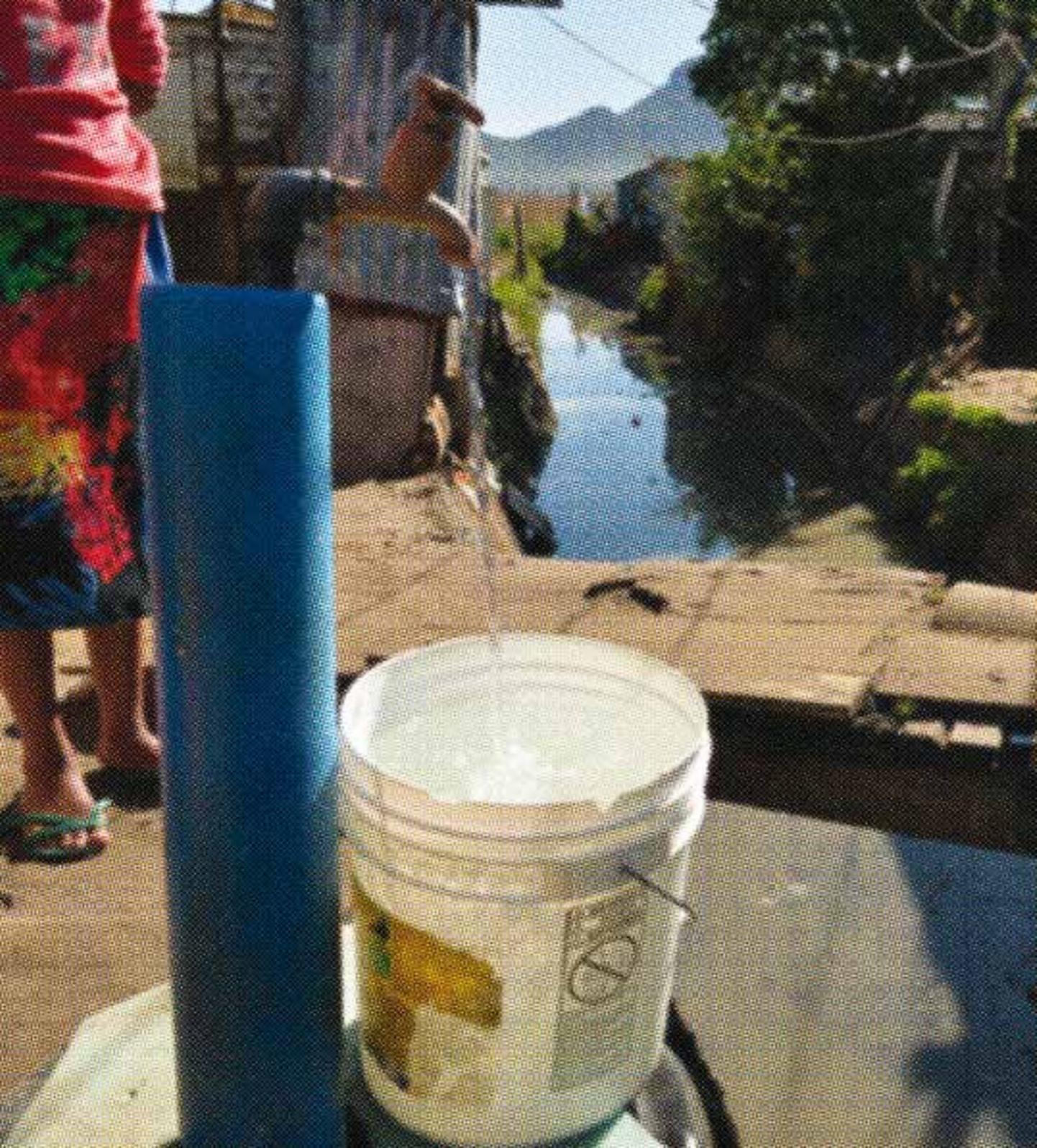


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LEONIE JOUBERT & GINA ZIERVOGEL

JUNE 2019



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CITY OF CAPE TOWN

Many Capetonians live in a perpetual state of Day Zero, collecting water from communal standpipes every day in informal settlements.



Foreword

I grew up in northern Zambia, in Luapula Province, also known as the Lake Region. I saw water everywhere, in lakes, rivers, swamps, marshes, and more rivers. My late mother was a South African, whose ancestry is from the Eastern Cape province. It's no wonder that this childhood exposure to water influenced my career as a water resources management specialist. I had never visited Cape Town as a child. Coming here in the mid-2000s, I was struck by its beauty, but also by how many swimming pools I saw as the flight came in to land. Water – lovely water – I thought.

Other than my rural childhood, I have lived in cities most of my life. Cities across the world, in Europe and Africa alike. Not in my wildest dreams have I ever imagined a tap running dry in any of these.

I have worked on climate change adaptation issues for over 15 years, and it has mostly focused on rural settings rather than urban ones. However, more recently, I have worked on urban resilience, and the ignorance with which many urbanites live their lives in a fast-changing world is surprising. Climate change almost always feels like a distant threat that affects others, not them. Dinner table conversations with friends in Nairobi, Kenya, where I have lived for the past 12 years, always seem to head in the direction of 'have you heard how community such-and-such has been affected by the drought or floods?' Until we were hit by this changing climate. In a city that boasts Africa's largest inner city forest – the Karura Forest – recent heat-waves have shown the relevance and importance of this resource, especially for cooling the city.

The three-year drought, which peaked in January 2018, was the worst in over a century of record-keeping.

Having watched in shock in 2017 as Cape Town and its citizens responded to the news of 'no water', I was struck by how equalising climate change can truly be. This one precious liquid that we all depend on became a scarce resource due to recurring droughts. Living in East Africa where climate variability and droughts are the order of the day, I understood this intellectually. Witnessing it, on the other hand, was a totally different story.

In June 2018 I travelled to Cape Town to speak at the Adaptation Futures Conference, shortly after Day Zero was called off. Landing on the eve of the conference, I was struck by the vivid messaging all over the airport about the water crisis. Before jumping into my taxi I dashed to use the bathroom. My usual instinct was to open the tap to wash my hands, when I realised water wasn't coming out. I pressed several taps with no luck until I read the writing on the wall – literally, no pun intended – informing me that I had to use the hand sanitiser. I wasn't ready for this at all.

The poignancy of this conference was that it brought together many participants from other parts of the world – predominantly city dwellers – as if to witness the kind of imminent crisis that could befall us all, if it hasn't already. I was glad that

the conference wasn't cancelled or moved to another location. For herein lies a lesson and certainly an experience for everyone: climate change will remain a real challenge and threat for all humanity regardless of where they live, rich or poor. Considering that projections have shown that over 70 percent of the world's population will be living in cities by 2030, how we respond to climate change and adapt is indeed a matter of life or death. No two ways about it.

What we learned from how Cape Town dealt with this crisis, which comes through in the pages of *Day Zero*, is that this is the kind of common future all of us face. We need to learn from one another as we gear ourselves up to deal with the twin challenges of existing development stresses, and a more extreme climate.

Dr Musonda Mumba
Chief of the Terrestrial Ecosystems Unit, with the UN Environment, Nairobi, Kenya

ABOUT THE BOOK

What happened in Cape Town is significant globally. This drought was the local expression of the unfolding global climate change emergency. It affected everyone here. The City of Cape Town was one of the most important players in responding to the drought, but running any city is complex, because its administration is made up of many different departments and people. Understanding what happens on a day-to-day operational level within a city administration, or how it does longer-term planning, and the political nature of some of a city's roles, can be opaque to those on the outside of the administration.

During the emergency, the City and its residents responded in different ways. Some of these stories have been told publicly. Some of these were picked up by the media. A few were amplified in the process, and others were distorted. Many stories remained behind the closed doors of City administration processes.

Day Zero is an opportunity to capture some of the perspectives and experiences of the various sectors as the water crisis played out. It explains the different roles, responsibilities, and responses in a way that helps citizens better understand how complex the process of urban water management and climate change adaptation is.

These stories draw together the lessons that Cape Town's managers and citizens learned through the drama of this drought. The book documents these stories, not only so that Cape Town can better prepare itself for future droughts, but that other cities can learn from this experience.

The lessons learned from Cape Town's response to the drought are relevant globally, as other developing world municipalities may face similar water constraints within their fast-growing cities in the future.

Each chapter gives a glimpse into the different areas of the City's water management, the challenges the decision makers faced in the course of the water crisis, and how different people responded. This is from the various perspectives of the water manager, the politicians, and the communications team, and sheds light on the role of external experts, and where researchers fit into the picture.

Day Zero is based on research by social scientists at the University of Cape Town. Associate Professor Gina Ziervogel, one of the authors, was on the Water Resilience Advisory Committee (WRAC), a Section 80 committee set up by the municipality to provide expert support during the drought. Ziervogel works in the field of urban adaptation to climate change, and she was particularly interested in the response to the drought. Being part of the Section 80 committee monthly meetings, she was able to get an intimate insight into how the City was responding to the drought crisis.

The South African National Treasury's Cities Support Programme identified the need to document the Cape Town experience and commissioned Ziervogel to do some broader thinking around what lessons other cities could learn from the way the

city navigated this environmental shock. Once the drought abated, Ziervogel met with senior decision makers who had, in some way, been involved in helping the City deal with the drought. She conducted 21 interviews with people from across different spheres of government – from national, to provincial, to city government – but with a specific focus on the City of Cape Town municipality officials. She also sat in conversation with some non-profit organisations and private expert consulting firms who supported the City through this crisis.

These interviews fed into a report called *Unpacking the Cape Town Drought: Lessons Learned*¹ written by Ziervogel for the Cities Support Programme and published by the University of Cape Town's African Centre for Cities. The report is detailed and technical, and geared more towards government officials and administrations. It recommends four key areas of action that could help municipalities in future as they work towards becoming more drought-resilient. *Unpacking the Cape Town Drought* calls for stronger and more 'transversal' governance across City departments, the need for improved data, knowledge and communication, and a better understanding of how the wider water system works, as well as the need to upskill people to be adaptive and competent. This document draws from Ziervogel's work, and builds on it, based on new information and wider research findings.

If a city hopes to be agile and responsive, in spite of climate uncertainty and the growing developmental pressures on an ever-shrinking shared urban water reserve, it needs a big-picture understanding of the system, and the complex factors that shape how a city governs the resource. And its citizens are an important part of this picture.

A city's citizens are some of its main water users, so their behaviour relating to water is a key factor in how it shares this common pool resource. The

residents of any city also need to understand the complexity of managing resources such as water.

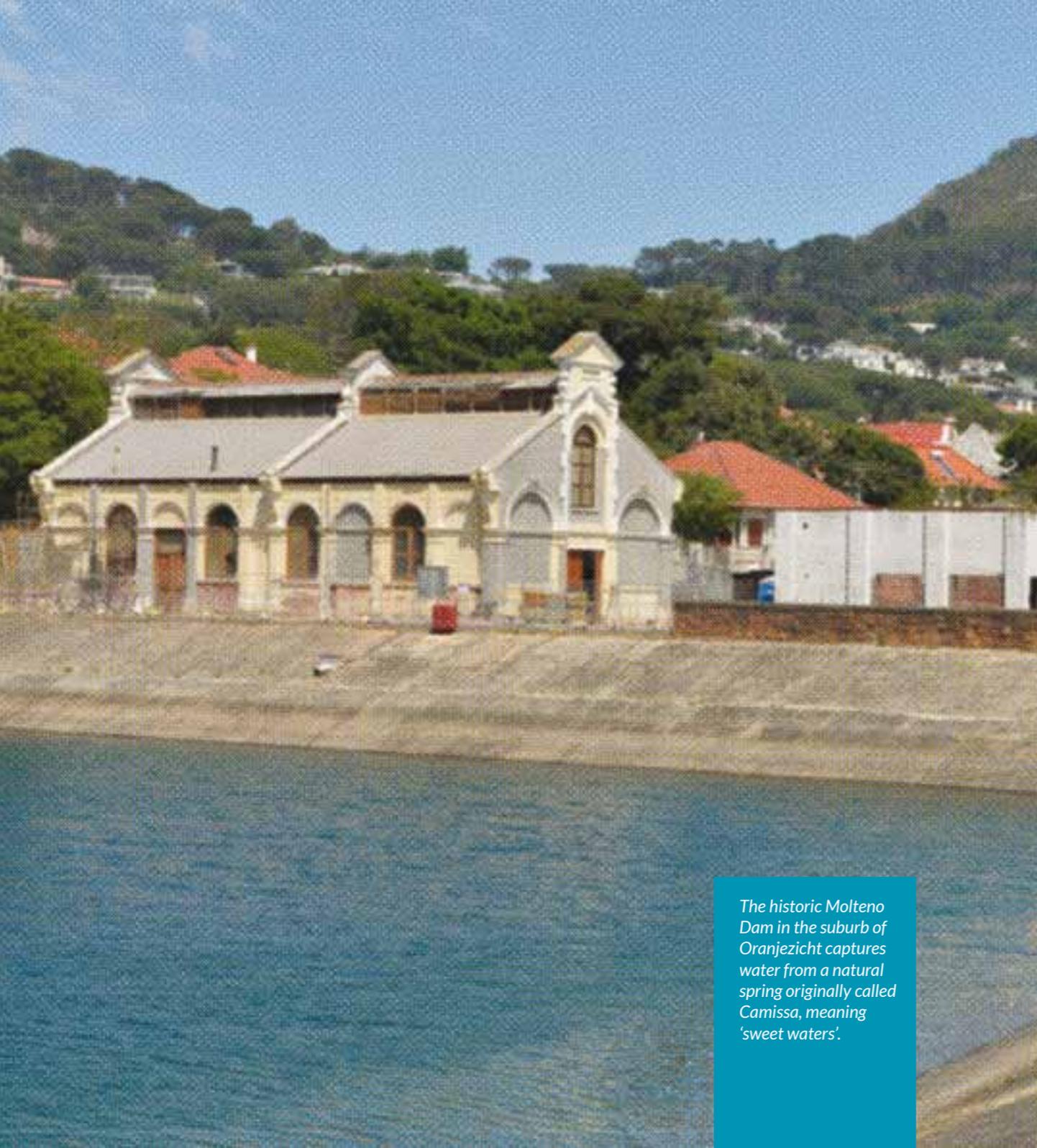
All water users, including residents, need to understand how a city governs and manages water in order to be a part of an engaged citizenry that actively contributes to running this resource.

Day Zero draws on the above report, and lifts out some of the key messages for people living in Cape Town. Ziervogel teamed up with Cape Town-based science writer Leonie Joubert to pull these lessons together. The book hopes to provoke a sense of civic responsibility amongst water users in cities across South Africa.

The residents of any city need to be responsible water users, but also need to be part of an active citizenry that holds their municipality to account.



1 Ziervogel, G. 2019. *Unpacking the Cape Town Drought: Lessons Learned*. African Centre for Cities, University of Cape Town.



The historic Molteno Dam in the suburb of Oranjezicht captures water from a natural spring originally called Camissa, meaning 'sweet waters'.

1/

One City, Five Stories, and a Record-Breaking Drought

At the height of summer in 2018, Cape Town was reeling from an environmental shock, the scale of which no one here had seen in over a century. A three-year drought, which even seasoned climatologists hadn't seen coming, broke records going back more than a hundred years. The drought was counted as a one-in-300-year climate event and newspaper headlines around the world warned that Cape Town might become one of the first cities globally to have its municipal dams run empty.

City² managers started using the term 'Day Zero' to refer to the first phase of the steps it would take, should emergency water rationing kick in. If dam levels ran down to the last 13.5 percent, utility managers would shut off water to homes in the suburbs and to businesses outside of the priority city centre area. Families would have to collect a ration of 25L of water per person, per day, from 200 collection points around the city. The police and military were told that they would need to be on standby to deal with civil unrest.

In the end, Day Zero never arrived. But the imminent threat of such drastic measures showed how politically and economically unstable a city can become if political tensions, bureaucratic management challenges, infrastructure failures and delays, and day-to-day development pressures collide with an environmental or climate shock such as a drought of this magnitude.

Cape Town may have narrowly avoided Day Zero this time around, but its spectre nevertheless remains. Human-caused climate change will increase the likelihood of extreme droughts happening in future, in tandem with a city's growing economy and population putting more pressure on its dwindling water resources.

TELLING THE CAPE TOWN WATER STORY

No one saw this drought coming. It is only with hindsight that weather watchers can pin a start-date to the event: June 2015. Between then and June 2018, the rainfall varied between 50 and 70 percent of the long-term average, according to senior researcher Piotr Wolski of the Climate Systems Analysis Group (CSAG) at the University of Cape Town, with many rainfall figures dropping to the lowest since written records began in the 1880s.

Cape Town draws its water from the Western Cape Water Supply System (WCWSS), almost all of which is stored in a few main reservoirs, including the Theewaterskloof, Steenbras, Berg River, Voëlvlei, and Wemmershoek Dams. Together, they hold about 18 months' supply of water for farming and urban needs – 900 million m³ of water, in all. The City of Cape Town uses the lion's share of

² There are two uses of the word 'city' throughout this book. Where it is capitalised, it refers to the City as a local government municipality; where it is not, it refers to the wider notion of the city's geographic footprint and its residents.

this, about 58 percent. Smaller towns take about 6 percent. Agriculture gets 26 percent of that. About 10 percent goes back up into the air as evaporation or is lost through things like infrastructure failure in the bulk water system, such as leaks.

Cape Town is a city of just over 4 million people, and a breakdown of who uses the most water shows starkly the inequality that still bedevils the service delivery here: those living in formal housing use two-thirds (66 percent) of the city's water allocation, while those living in informal settlements only draw 4 percent of this shared resource. With 14 percent of people living in informal homes, and ever-growing numbers of those setting up homes in backyard makeshift wooden wendy-houses and iron sheet shacks, there is a backlog in terms of the urgent need for water and sanitation services.

On top of that, about a third of the city's residents, 1.5 million people, can't afford to pay for water, and many of them lean heavily on the state's subsidised water services. If a person registers as 'indigent' – crudely, labelling families as poor – they get a free monthly quota, but this is fraught with its own problems. There are also another 180 000 households in informal settlements who don't have running water in their home, and collect free water from public standpipes.

THE UNFOLDING EMERGENCY

In 2014, the city's dams were full. By early summer, in November 2015, water levels were down to 71 percent. A year later, they were down to 60 percent. By the start of the summer of 2017, they were down to just 38 percent.

By January 2018, it looked as though there was only three months' supply of water left. That's when the countdown to Day Zero began.

This announcement sent shockwaves throughout the city. There was panic, finger-pointing, and accusations that politicians were grandstanding to manage their reputations. But this crisis wasn't

just an issue of city-level water management by utility departments and technicians. Many of the responses to the water shortages fell beyond the scope or jurisdiction of the city's water utility management structures.

Who was responsible for the crisis? Was it the national government failing in its constitutional mandate to build and maintain bulk water infrastructure in the province? Was this a way that the ANC government could sabotage the political ambitions of its rival and main opposition, the Democratic Alliance (DA), which held power in the Western Cape Province and in the City of Cape Town? Was the crisis the fault of the City, which critics said had failed to implement tighter water restrictions in time? Was it the fault of a careless or greedy wealthy residential class, who weren't heeding the call to work together as a city towards a common good, by watering their lawns or filling their pools at the possible cost of everyone not having water to flush their toilets or drink? Was it the fault of the City, which had seen the climate change scenarios from scientists who warned that droughts might intensify here, but hadn't planned for it? But who could have foreseen that this particular drought would stretch into its third year and become the worst drought in the city's recorded history?

By pulling into clear focus the divide between the city's 'haves' and 'have-nots', it reminded everyone that many Capetonians live in a perpetual state of Day Zero. Thousands of people need to collect water from standpipes outside of their homes every day, and share often run-down communal toilets and porta-loos.

This divide doesn't only refer to those who are plugged into the water grid and can afford to buy more water than they need, and those who aren't and cannot. It also relates to whose voices are heard, be it in the local media, or through political platforms.

Many wealthier residents panicked at the idea of having to queue at a standpipe for a meagre

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Cape Town may have avoided Day Zero but its spectre remains. Human-caused climate change will increase the likelihood of extreme droughts happening in future, in tandem with a city's growing economy and population putting more pressure on its water resources.

ration of 25L of water per person, per day. But many of these families were also able to insulate themselves from the uncertainty of a collapsing municipal grid by putting in water storage tanks, grey-water systems, or sinking boreholes.

Meanwhile, just 25km from the plush water-irrigated lawns of suburbia, families in informal settlements still wait for the 'luxury' of clean running water in their homes, with no clear end in sight to this state of affairs. Some families in these communities started to worry that they'd now have to compete with middle-class Capetonians who might drive into their neighbourhoods to fill up their water containers.

Would tensions across the city really run so high that people might turn on one another? Would the military and police need to intervene? Or would people pull together, and help each other through it?

THE 'NEW NORMAL'

Everyone talks about the 'new normal' these days, where environmental shocks like this drought are expected to become more common. Cape Town's water planning is based on historic rainfall and water use records, and projections of the likely water use increase as the population and economy swell. But how does a city adapt its planning when rainfall trends change as the region's climate

becomes warmer and possibly drier, and definitely less predictable, because of human-caused global warming?

In the calm that has returned following the arrival of good rains in the winter of 2018, climate scientists at the **Environmental Change Institute** at Oxford University and the **Climate System Analysis Group (CSAG)** from the University of Cape Town have calculated that human-caused climate change tripled the likelihood of this drought. The message from their analysis is clear: this kind of climate change risk is real and all future city planning needs to be done with this kind of heightened uncertainty in mind. The residents of a city need to adjust their water use permanently, too, so that it becomes a way of life.

Capetonians started to look for other sources of water, as household restrictions got tighter. Many started queuing at local springs in the suburbs to fill up water containers.

RODGER BOSCH



2/

The Water Manager

Cities in South Africa have a 'Robin Hood' approach to meeting our historic service delivery backlogs, charging the rich more for their higher water and electricity use, and using this revenue to subsidise poorer households' basic needs. During a resource-crunch like this drought, though, it means a city might not want to encourage water-saving behaviour, because lost water sales means lost income, and lower income means tighter service delivery budgets for the poor.

Meanwhile, the nitty-gritty of storing, cleaning, sharing, delivering, and billing for water falls to technicians and managers in different City departments. Building bridges between these institutional silos, and between departments higher up the government food chain in provincial and national departments, needs a new kind of governance.

Anyone walking down the corridor in the arrivals area of Cape Town International Airport during the drought would have been struck by a slick advert, the size of a small tourist bus, broadcasting its message to passengers streaming into the airport.

'Please save water' the clinical blue font pleaded, next to a larger-than-life graphic of Table Mountain drawn in the shape of flowing water. 'We have a water crisis with severe restrictions in place. Thank you for playing your part in protecting this precious commodity.'

The City's choice of wording in this ad campaign shows up one of the fault-lines in the municipality's efforts to meet its service delivery needs across one of the most socially and economically unequal cities in the world: some see water as a 'commodity', a product to be bought and sold by those with the means to trade in it; but many others see it as a basic human right and part of a common good resource, something that we need to share fairly, regardless of who has the means to buy it and who doesn't.

But at the same time, it costs money to build, run, and maintain the system of water treatment plants, pipes and taps that bring this water into people's homes. Someone has to pay for this expensive infrastructure, and its upkeep. Since national government doesn't fund this, it falls to the City to pay its own way.

Like all municipalities across the country, Cape Town has a tiered block-tariff billing system: the cost of the first basic units of water is relatively

Water is a basic human right, but it also costs money to build, run, and maintain the system that brings that water into people's homes.

CITY OF CAPE TOWN

low, but the more a household uses, the steeper the price increase becomes. The income from the higher-priced water subsidises water delivery to lower-paying households, and households registered with the City as 'indigent' who get a free basic quota. This also pays for delivering free water to the standpipes in informal settlements, which service around 180 000 households.

This tariffing system means that City managers see the water that comes down the pipeline when someone opens a tap as a 'product' and a source of income. Higher sales means the City can keep topping up the coffers, and have money to pay for better service delivery to the many parts of the city that still need to get onto the water grid.

Why would a city with this 'revenue model' want to sell less of this 'commodity', or encourage citizens to throttle back on their use? This model for paying for service delivery remains one of the biggest challenges to creating more sustainable usage of resources in South Africa's cities.

The City came under a lot of fire for seeming to delay the use of more aggressive tools to get residents to cut their water use. As water use dropped, the City's accountants started to worry about lost revenue.

The future of designing sustainable, resource-resilient cities depends on finding solutions to this developing city conundrum. Development thinkers have been floating alternative models around for years already. One idea is for cities to shift their focus from making money out of selling the actual resource to the public, and rather charging for providing the grid infrastructure that delivers the water and electricity throughout the city.

After the drought, in June 2018, the City restructured the water tariff so that household water bills now include a fixed charge that depends on the size of the pipe delivering water. The reason for this is that everyone using municipal water, even if it's just a small amount, still contributes to the cost of the water supply and sewage infrastructure.

Another idea to boost lost water sales revenue

was a 'drought levy'. But the City abandoned this before they'd had a chance to roll it out, because of the strong push-back from the public who felt that they were already shouldering their share of responsibility with the tariff hikes brought in during the drought.

STABILISING DAM LEVELS UNTIL THE DROUGHT BROKE

The City needed a two-pronged strategy to stabilise plummeting dam levels and to stretch what water was left until the drought finally broke: boosting supply, and throttling back on demand.

Tackling the supply-side issue involved getting more water into the system: getting temporary desalination plants up and running, and drilling boreholes into some of the bigger groundwater reserves around the catchments. These needed quick planning and budgeting, release of large funds, and the fast-tracking of tendering processes.

Many of these were complicated technical solutions that needed action from many different government departments across all three spheres of government – local, provincial, and national – and some of these efforts took on a distinctly political flavour (see **The Politicians**, page 19).

However, whatever decision-making happened around engineering solutions, it became clear by the height of the drought in the summer of 2017/2018 that few of these would be able to deliver new water into the system before the next winter rains were due to start. They may be good for medium-term planning, and to appease an anxious public, but might not stop the arrival of Day Zero.

But before pulling the trigger on expensive tech solutions, the local office of an international civil society organisation, The Nature Conservancy (TNC), warned the City to make decisions based on reliable economic calculations of the actual cost of the various solutions. In 2017, TNC commissioned a team of local environmental economists to compare the cost of various engineer-

The City needed a two-pronged strategy to stabilise plummeting dam levels and to stretch what water was left until the drought finally broke: boosting supply, and throttling back on demand.



The City prioritised drilling boreholes to bring new sources of water into the system as quickly as possible.

ing solutions with another ‘softer’ supply-side solution: clearing invasive alien trees from the city’s main water catchments (see **The Knowledge Brokers**, page 33).

Their calculations showed that a relatively small investment of R370 million in today’s value over the next 30 years to restore the priority water catchments around the city’s three main dams, would be a better return on investment than the medium-term hard-engineered solutions. They suggested that in the haste of decision-making, the City shouldn’t forget to also prioritise ecosystem restoration as part of its longer-term water management strategy.

The challenge with this approach, though, is that clearing these heavily invaded areas, restoring the catchments, and maintaining their ‘ecosystem services’, calls for planning, coordination, funding, and management that spans three decades or more – a much longer time-horizon than the voting cycle of a politician or even the likely career of a city technocrat.

THROTTLING BACK ON DEMAND

The second thing the City needed to do was to throttle back the amount of water getting drawn off the system: patching up leaks in the water grid, reducing pressure in the pipes, getting the public to voluntarily reduce their water use, and installing devices that shut water off in the homes of people who were exceeding restrictions.

- **Water Management Devices**

Water management devices are a way for a city to micro-manage a household’s water use: the gadget is attached to the water meter, and is set to allow a pre-determined quota of water through each day. Cape Town has been using these in lower income households since 2007, where the device allows 350L of water through per household, per day, beyond which the water cuts off until the next 24-hour cycle starts.

As the drought peaked, the City started putting these into high-water-usage homes where people were breaking restrictions and not responding to fines and tariff hikes.

Water devices have been controversial from the beginning, though, and their use has had political undercurrents.

The rationale for installing them in lower-income neighbourhoods, according to the City, was that poor households tend to have faulty and unmaintained plumbing, which leads to leaks. This reflects in a family’s accounts, and results in high water debt. These devices were a way to protect poorer families from getting into greater debt, the City maintained.

But critics such as the Environmental Monitoring Group (EMG) argued that the policy is punitive. Its position is that families are often pressured into agreeing to the installation; that the leaks often aren’t their fault so they shouldn’t be penalised for them, or made to shoulder the resulting debt; that the 350L per day ration is calculated for a household of only four people, when many poorer households are much larger than that and need more water per day; that the water shuts off early in the day before people have met all their basic sanitation needs; that these devices prevent people from running small businesses and supporting their livelihoods; and it allows richer communities, who might be more politically powerful, to get away with ‘luxury’ water use simply because they can afford it.

By the time the drought peaked, though, the City had a decade’s worth of expertise with these devices, and the institutional processes to install them quickly and efficiently. When it needed a more punitive way of tackling those wealthier users who were flouting water restrictions, they could roll these out quickly, sometimes as fast as 2000 installations a week, in some of the more affluent suburbs, according to a City source. Some saw the move as fair, as it targeted households based on water use rather than income levels.

- **Pressure Management**

The City already had pressure management zones in place before the crisis peaked, so in January 2018 it was easy to dial down the pressure across the piped infrastructure when things became critical. The City contracted private sector operators to help isolate various zones and through a system of manual and automated pressure-reduction valves, were able to cut pressure where needed. In the first three months alone, the City saved about 50 million litres of water per day, because it slowed the rate at which water flowed out of people’s taps or escaped through leaks.

- **Restrictions**

The following table demonstrates how the City used restrictions to tighten up demand-side water use:

NOVEMBER 2016:

LEVEL 3 RESTRICTIONS

Ban on using garden hoses, washing cars, or irrigating gardens using sprinkler systems

1 JUNE 2017:

LEVEL 4 RESTRICTIONS

Limit of 100L of water per person, per day, and no non-essential outdoor water use or filling swimming pools

1 JULY 2017:

LEVEL 4B RESTRICTIONS

Limit of 87L per person, per day; households of 4 people capped at 10kL of water per month

Groundwater, spring water, and river water are all part of the common pool of the country’s water reserves, and our national government is responsible for managing and sharing these fairly, to everyone’s benefit.

1 SEPTEMBER 2017:

LEVEL 5 RESTRICTIONS

A more lenient household cap of 20kL per month is announced for households of 8 or more, typical of lower income communities

1 JANUARY 2018:

LEVEL 6 RESTRICTIONS

Daily use limit remains at 87L per person, per day, and 10kL per household per month

1 FEBRUARY 2018:

LEVEL 6B RESTRICTIONS

Daily use restricted to 50L per person, per day, with a household monthly cap of 6kL of water

A CITY AMIDST NATIONAL-LEVEL INERTIA

Signing off on the various utility-scale supply side projects to boost water supply meant that many different government departments had to work together, quickly, both within the City, but also upward towards provincial and national government (see **The Politicians**, page 19).

The Project Portfolio Management (PPM) unit in the Directorate of the Mayor tried to tackle some of the institutionalised management issues between different City departments by hard-wiring better cooperation into operations and bureaucratic processes.

Our Constitution obliges both national and provincial government to support municipalities in their service delivery functions. The national Department of Water handles bulk water supply across the country. But the department has been failing in many of its functions in recent years. It has not kept up with infrastructure maintenance or new supply; there's been a high turnover of directors-general, which has created instability in the department, according to the legal advocacy group, the Centre for Environmental Rights; and more than half of the waste water treatment works across the country are failing.

Throughout the disaster, several national departments needed to support the City, including the Department of Water and Sanitation (DWS), Department of Environmental Affairs (DEA), the Department of Cooperative Governance and Traditional Affairs (CoGTA), and the National Treasury. The provincial Department of Environment Affairs and Development Planning (DEADP), Department of Economic Development and Tourism (DEDAT), Disaster Management and Fire Rescue Services, Department of Transport and Public Works, and the Office of the Premier also had to step in.

Looking back, it's clear that many City officials felt that the national DWS dropped the ball in terms of its leadership through the disaster. The DWS was

responsible for setting water restrictions and for funding certain infrastructure projects, but stalled on both counts, according to many City officials. Local government was often hamstrung until the national department acted, but the City took the flack for what the public might have read as inaction.

WHOSE WATER IS IT ANYWAY?

At one point during the drought, someone was photographed pumping water from the Liesbeek River, which flows through the southern suburbs of the city, into Jojo tanks on the back of a flatbed truck. Whether or not the driver knew this was illegal is still unclear, but according to our Constitution, river water is the mandate of the national government, which issues permits for extraction. This case highlights people's confusion about who owns what water.

Author Jared Diamond has a good analogy for how we use a common pool resource like groundwater: if two or three people put their straws into a milkshake and take a drink, the level will drop a bit, but if 20 people do the same, it won't take long to empty the glass.

Groundwater, spring water, and river water are all part of the common pool of the country's water reserves, and our national government is responsible for managing and sharing these fairly, to everyone's benefit.

Private borehole drilling took off as the drought worsened. While people didn't need permits from national government to do so, they were asked to register these boreholes with the City, although there wasn't much follow-through on this.

There was a lot of confusion about who could access what alternative water sources. What about spring water, who was entitled to collect this? And what if this public-owned water flowed out on someone's private property? Could people just pump from rivers as they pleased?

Government needed to communicate these issues with the public.

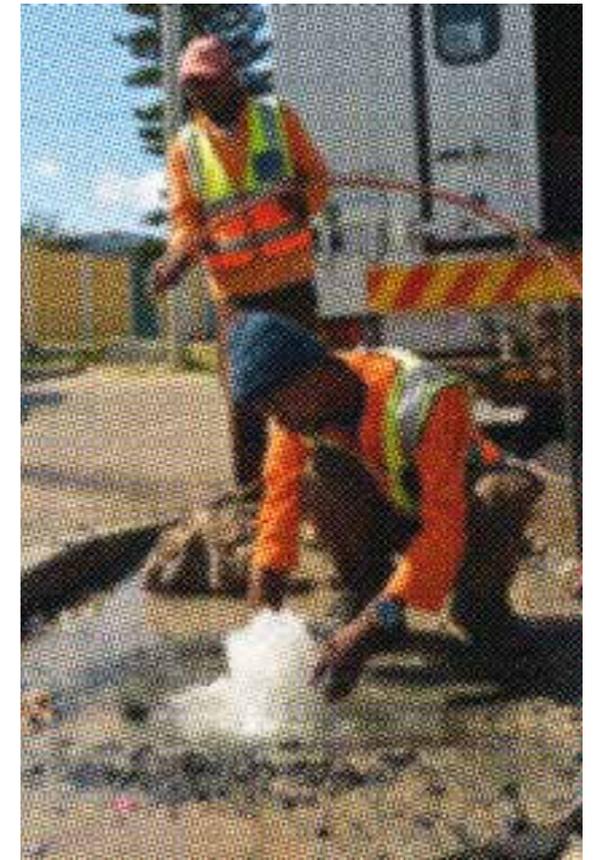
HOW DO WE USE 'ALTERNATIVE WATER'?

As some households and businesses tried to insulate themselves against the uncertainty of a possible municipal grid failure, people started looking for alternative water sources: rainwater storage, borehole and well-water, and grey-water treatment systems. But there was a great deal of uncertainty about the health and environmental risks, about what regulations people should comply with, and about what the best practices should be around how to use them.

The media ran amuck with speculation: don't let grey water stand for more than 24 hours, some said, because pathogens start to build up in it. Don't take grey water captured from bathing or washing machines, and pour it directly into your toilet as an alternative to flushing with clean water from the cistern, because it could aerosolise any pathogens or detergent chemicals in the grey water, and you might breathe them in. How do you clean water collected from a dirty roof? What about the pH in well-water? Can you drink it? Can you retrofit buildings to use non-potable water for flushing loos?

During the drought, the City drew up its *Guidelines for the Installation of Alternative Water Systems* to help communicate more effectively around regulations, best practices, and health and environmental risks for these various alternative sources of water. Although the summary version has been available since 2017, the full guidelines have taken time to be finalised.

Our Constitution obliges national and provincial government to support municipalities in their service delivery. But the national Department of Water has been failing in many of its functions in recent years.



Fixing leaks in the water supply system became a priority as the drought worsened.



3/

The Politicians

When it comes to keeping the taps running, South Africa's law books are clear about which department has to do what to meet their Constitutional promise of getting water to every citizen. Yet it is also crucial to understand how political officials, elected by voters, also play a key role in how decisions are made.

Political considerations can have a direct effect on decision-making, particularly technically complex operational decisions, like those that were encountered during the drought.

Then Mayor Patricia de Lille escalated the crisis from a water department level, to a City level, which allowed for faster decision-making. But tension grew, with some feeling that political interests were eclipsing operational decisions.

October 2017 was crunch-time. Water managers knew they had another long, dry summer ahead of them, and dam levels were precariously low. The person wearing the mayoral chain at the time was the Democratic Alliance's Patricia de Lille. A career politician, activist, and trade unionist, with years of experience in the trenches of state affairs, De Lille had little background in the deeper technicalities of water management.

The symbol of the mayoral chain says a lot about this person's role in the running of a city. In many countries in the world, the mayor's position is mostly ceremonial. Not so in Cape Town. South Africa's Constitution allows a mayor to get stuck into the nitty-gritty of decision-making of how to run a city. The scope of this legal structure gave the mayor significant powers during the crisis, which had a direct impact on how it was managed at a city level.

She had set up the Water Resilience Task Team (WRTT) in May that year, which met weekly and pulled together the technicians and bureaucrats from the different departments across the City, as well as from provincial and national government, so they could draw up a tactical response to the crisis, communicate effectively, and make quick decisions. The task team leadership was housed in the Directorate of the Mayor. By setting up the task team in her office, De Lille raised the issue to a city-scale priority early on, which helped escalate responses in a way that many argue wouldn't have happened if it had been left to the City's

Department of Water and Sanitation (DWS).

From the water management perspective, though, this was a bit contentious: the task team was essentially supported by the City Council. This removed the coordination responsibility from the City's water department, although it was still responsible for implementing water-related projects. The political undercurrents started to create what some saw as competition between departments, rather than cooperation, and created some confusion as to who held responsibility for what level of decision-making.

At crunch-time, at the end of winter that year when it was clear that the dams were dangerously low, some of the senior managers thought it was time to share more detailed technical information with the public, such as the modelling around how much water was available. But De Lille vetoed the decision, wanting to keep the message to the public as simple and clear as possible. Instead, she instructed the communications team to focus on telling the public that the City was now moving to tighter water restrictions, and that everyone had to cut their water use down to 87L of water per person, per day.

Then, in October, as things reached fever pitch, a private consulting firm that specialises in communications and reputation management, Resolve, was brought in to take the helm of the City's drought communications response.

Resolve took over much of the City's communications, in particular handling the announcement of the Critical Water Shortages Disaster Plan, which helped slip into daily language the notion of Day Zero. With hindsight, it's clear that this was a double-edged sword: on one level, it stoked public panic, which drew some criticism as a communications strategy; but at the same time it did drive down daily water use drastically, according to analysis by researchers at the Environmental Policy Research Unit (EPRU) at the University of Cape Town's School of Economics.

De Lille took responsibility away from the water

task team that October, and chaired daily meetings herself. Resolve started sitting in on these meetings at her invitation. Many felt this allowed Resolve to have significant influence, on operational decision-making.

In January 2018 the council took away the mayor's drought leadership powers and in February it passed a motion of no confidence against her. It isn't clear if the DA turning against the mayor in this way had anything to do with the water crisis, or if that was their excuse to create another narrative against her. Regardless, she did help to ramp up the necessary pressure early in May 2017, which turned out to be important.

BUILDING THE BRIDGES

Even though these events highlight how much political interests can influence operational matters, the post-mortem analysis of how different people handled their leadership roles through the crisis, shows that it wasn't all competitive, political, or undermining. And the lessons that emerge from the drought highlight the need for strong collaboration between various departments within a city's governing structures, as well as upward, to the provincial and national departments involved, according to the *Unpacking the Cape Town Drought: Lessons Learned* report.

Just as South Africa's Constitution gives the country's elected mayors more than just a symbolic position, so the law gives specific responsibilities relating to service delivery to different national, provincial, and city-level government departments. National government, for instance, handles bulk water from dams, rivers, and underground sources, and shares it out between municipalities, farmers, and the natural environment. Local government takes care of the last web of pipes, and the water that runs out of the taps into people's homes and businesses.

This could hinder local government's response in a crisis situation. They're subject to how effective other spheres of government are, and to

At the end of winter when it was clear that the dams were dangerously low, some managers thought it was time to share more technical information with the public, such as the modelling around how much water was available. But De Lille vetoed the decision.

Water is a basic human right. Protestors took to the streets, demanding that the City should meet the water needs of poorer people and not try to make a profit out of selling water.



This kind of cooperation – both between city level departments, and between provincial and national departments – is critical for navigating a crisis like this.

circumstances well outside of the City's jurisdiction. As the drought intensified, and with it the finger-pointing and blame-laying, the media ran thick with suggestions that national government – run by the African National Congress (ANC) – had stalled on building more bulk water infrastructure in the Western Cape Province, which is run by its chief political rival, the DA. This, as the rumour mill put it, was a way of undermining the DA's political traction in the province. Although, in the view of many people in the City, it was largely incompetence within the national Department of Water Affairs that made it hard for the City to manage aspects of the drought response.

Whether or not the rumours of deliberate political subversion from the ANC are true or not, the declaration of the Western Cape as a disaster area became a national priority. In May 2017, Cabinet – a national function – declared three provinces as disaster areas as a result of the regional drought. This led to the first national disaster South Africa has ever declared, and a legal process that released funds from national coffers to help pay for disaster relief efforts in the Western Cape.

This kind of cooperation – both between city-level departments, and between provincial and national departments – is critical for navigating a crisis like this.

The Water Resilience Task Team (WRTT), embedded in the Directorate of the Mayor, a bureaucratic arm, helped build bridges between these institutional silos so they could work together more effectively and be more responsive to the daily decision-making needs.

How effectively leadership cooperated between spheres of government, depends on who you ask. One provincial government official reckons there was good collaboration at a province-level from 2015. When politics became involved, cooperation dropped in some ways, and then improved later at the height of the crisis.

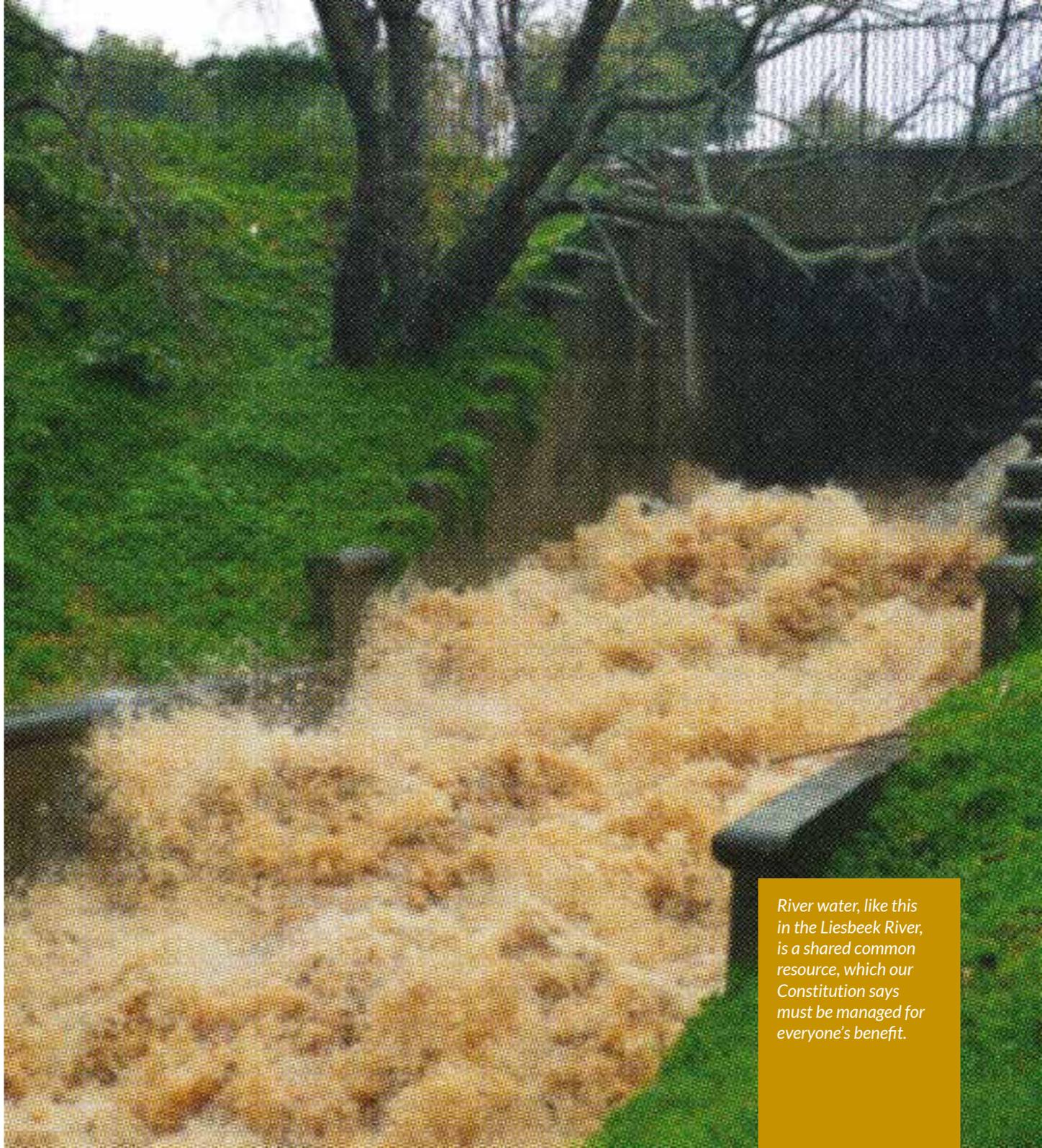
Both local and provincial government ramped up their disaster management response from early on, with senior leadership in the respective departments starting the process of declaring a disaster.

At this point, province kicked into gear quickly, mobilising personnel to be part of regular meetings through the worst of the crisis in 2018 and releasing resources. These meetings brought together technical water specialists, strategic managers, and political representatives. They even set up WhatsApp groups to keep communication channels open.

Even though some thought that, at a city level, political interests seemed to eclipse operational decisions from early on in the drought, some in the City acknowledged that 'when politicians realised that the risk of water scarcity trumps everything, technical needs were then prioritised'.

The take-home message from the post mortem is that people in leadership roles need to drive management that is agile and responsive, and allows officials to learn and adapt as a crisis unfolds. Any effective climate crisis response needs to accommodate this kind of leadership approach, one that allows a city to move from a 'command and control approach' to one that is 'reflective, adaptive and flexible'.

CITY OF CAPE TOWN



River water, like this in the Liesbeek River, is a shared common resource, which our Constitution says must be managed for everyone's benefit.

4/ The Spokesperson

As the possibility of Day Zero drew closer, the public got ever more irate at what many perceived as political and technical mismanagement of the crisis. People wanted to know what was actually being done to avoid this potential disaster. The City's communications team needed to build confidence and stem the growing mood of anger and panic, while not seeming to dress things over with a public relations spin or getting caught up in political grandstanding.

But they also had to deal with the pressure of day-to-day crisis management. City staff were stretched to breaking point with the need to feed technical information through different channels to the wider public. The City's communications policy throttled the flow of information at times, in an increasingly fevered mediascape. All of this muddled the waters of clear information sharing.

The term 'Day Zero' was itself one of the more contentious characters in the unfolding drama of the Cape Town water crisis. In late 2017, as summer set in, electronic billboards along the city's highways broadcast regular messages about how many days were left before the water levels in the city's main dams dropped down to the last 13.5 percent. What little water was still salvageable from the muddy belly of the dams would be divvied up carefully, making sure that emergency services still had access to water.

It was provincial government's disaster risk management boss who first coined the term behind the closed doors of a disaster preparedness meeting. Once the Critical Water Shortages Disaster Plan went public in October 2017, including emergency rationing measures, the Day Zero concept made it into the media and spread like a fever: Cape Town was about to become one of the first big cities globally to run out of water. Day Zero was a shifting line in the sand, a date that moved according to how much water people were using relative to when the dams might refill during winter. As dam levels dropped, the date edged closer and closer. By January 2018, the city had about three months' supply of water left and Day Zero was likely to arrive on 21 April that year.

With hindsight, it turns out that the release of the disaster plan became the single biggest catalyst for change in water users' behaviour. But with it came the use of the term 'Day Zero', which

By the summer of 2017, the City needed to get Capetonians to cut their daily water use drastically, and pushed the message hard through various forms of media.

The release of the disaster plan became the biggest catalyst for change in water users' behaviour. But the use of the term 'Day Zero' was contentious. With it came a swell of alarmism, panic, and distrust, reflected in an ever-more shrill mediascape.

was controversial. There was a swell of alarmism, panic, and distrust, reflected in an ever-more shrill mediascape. Would these water cut-offs result in outbreaks of violence at water distribution points? What would happen if the sewage system shut down? What about outbreaks of diseases, and death? Had the City failed its residents through mismanagement, bad planning, and chasing down unviable new water delivery schemes?³

An angry outburst at a public meeting in Atlantis captures one community's exasperation and expectation. A woman stood up and heatedly addressed City representatives: 'It's your job to bring us water!' she shouted. She didn't want to hear excuses about climate change or that the Western Cape is a naturally water-scarce region.

'You must make a plan!'

'You can't hoodwink us,' another man said, as he left the community meeting.

The conversation between then mayor Patricia de Lille and the public got even more antagonistic. At first, De Lille tried a reassuring tone, driving home the message that the City had things under control and was bringing 'new water' online. But as the weeks progressed, her tone shifted. The sub-text was that the blame for the fast-approaching cut-off day didn't lie with City mismanagement, but rather with selfish consumers.

'It is quite unbelievable,' she said in a press conference in January 2018, 'that a majority of people do not seem to care and are sending all of us headlong towards Day Zero. At this point we must assume that they will not change their behaviour and that the chance of reaching Day Zero on 21 April 2018 is now very likely.'

Looking back at how the public responded during this time, it becomes clear how important it is to have clear, transparent communication during a crisis like this.

SLAMMING ON THE BRAKES: GETTING USERS TO TURN OFF THEIR TAPS

The City's two-pronged strategy to keep disaster at bay (see **The Water Manager**, page 11) – boost supply, reduce demand – needed to be communicated to the wider world.

The first strategy, which involved the longer-term engineered solutions that needed to be put in place to get more water flowing into the city's water supply, are technical and expensive engineering solutions. It normally takes years to get these kinds of projects through tendering processes. During the drought, the City showed agility in that it was able to speed up this process, and get new water online quickly through smaller temporary 'desal' plants.

All these engineering solutions were a way to help the City become more resilient in the longer term. But the public was nervous. It wasn't hearing enough about these efforts, and there was doubt about the timelines involved. These schemes were a way to survive *future* droughts, though. They wouldn't necessarily stop Day Zero happening during *this* drought, particularly if it stretched into a fourth year.

Something drastic needed to happen immediately to stretch what little water remained in the dams until the next rains came.

In November 2017, a visiting World Bank water expert clarified what many had already been saying, that the only way to slam on the brakes was an immediate reduction in daily water use. And that meant communicating the urgency of the situation to the public, and giving practical and realistic information on how citizens could do it. He also recommended prioritising groundwater over temporary desalination, which would bring new water online faster.

³ Booysen, M.J., Visser, M. & Burger, R. 2018. Temporal case study of household behavioural response to Cape Town's 'Day Zero' using smart meter data. *Water Research*. Vol 149: 414-420.

Through the course of the drought, the City used a few carrot-and-stick approaches to get people to be more water-wise: price hikes for the bigger water users, restrictions, installing water shut-off devices in the homes of bigger residential users who were ignoring restrictions, fines, the threat of naming-and-shaming greedy water users, and behavioural 'nudging' messages through the City's utility billing system (see **The Researcher**, page 39).

Only once the emergency had passed, and analysts were able to look back at how people responded to different efforts to educate the public and encourage behaviour change, were they able to see what methods were more effective than others, and what role communication with and between the different sectors played.

Through the course of the drought, behavioural economists at the University of Cape Town's Environmental Policy Research Unit (EPRU) in the School of Economics, tracked the behaviour of 400 000 families living in freestanding homes in different economic brackets across the city. What they found was an interesting trend that seemed to contradict the panic and finger-pointing that was coming through in the media about people being selfish or working against the common good. People were actually pulling their weight, in terms of cutting their water use.

Looking at water use patterns across nearly three years, from before the drought started, Professor Martine Visser and her EPRU colleagues, Johanna Bruhl and Megan McLaren, found that Capetonians cut their water use by half in this time.

This is unprecedented, compared with how some other cities have responded globally, according to Visser. When Melbourne brought in similar water reduction measures during Australia's infamous Millennium Drought between 2000 and 2010, it took the city over a decade to cut their water use by 40 percent. California took 11 years to cut its water use by 63 percent through a mix of manda-

tory water-efficiency technologies, tariff increases, and restrictions.

How did Capetonians do this so quickly? Visser and her team's analysis show that most of the residential cuts came from wealthier communities. These were households who were already using large amounts of water, more than they needed for basic survival, and could trim much more fat from their daily use. Poorer families were already surviving on a lean ration of water and couldn't use much less than they already were.

Many middle and high-income households were also able to buy their way out of the crisis: they could afford to install bulk water containers and grey-water systems, or sink boreholes, which protected them from the uncertainty of the municipal grid collapsing. And while this may have been self-serving behaviour, it took some of the pressure off the common pool of water resources, which meant there would be more water available for everyone for longer.

This quick reduction in water use wasn't just because people were buying their way out of trouble. Many residents of the city really did change their behaviour significantly, and quickly.

With hindsight, when researchers compared all the carrot-and-stick methods used, either by the City to encourage behaviour change, or by the researchers through a 'green nudging' experiment geared towards behaviour change (see **The Researcher**, page 39), it became clear what motivated voluntary water-wise behaviour, and what didn't.

One of the key take-home messages is that if people know their efforts to save water are working, and that their small efforts are contributing toward a greater good, they'll be more likely to do that than to 'free ride' at other people's expense and selfishly use up the resource.

The field of behavioural economics shows that people are more likely to rally around a 'public good', like conserving water, if they feel they're working together towards a common goal, Visser explains. If the media keeps pushing the message



KEN SINCLAIR-SMITH AND KEVIN WINTER (2019) WATER DEMAND MANAGEMENT IN CAPE TOWN: Managing water security in a changing climate. In: Scott, D., Davies, H. and New, M. (Eds). Mainstreaming Climate Change in Urban Development: Lessons from Cape Town. Cape Town: UCT Press, 100 - 133.

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that residents are selfish in their water habits, she warns, it's more likely to trigger panic and selfish hoarding behaviour. If people feel that their small daily efforts are actually making a difference, and are helping to save water to the benefit of their fellow citizens, they're more likely to keep working towards this shared common good.

CREATING A 'WATER LITERATE' CITY:

- **Getting technical, creating trust**

'We don't want to hear the politicians,' one CEO told the communications team during a meeting, 'we want to hear directly from City officials. We don't want spin. We want technical details.'

All Capetonians wanted reassurance that skilled people had their hands on the tiller as the crisis worsened. But from a communications perspective, this became tricky: the people with the kind of knowledge that citizens or businesses needed were stretched to breaking point, trying to do their jobs while fielding the urgent calls for information coming in constantly.

The water demand management team did most of the heavy lifting at the height of the crisis, with many on the team often not taking weekends off for up to nine months. In the midst of trying to do their inspections, they had to field the inundation of requests for technical information, stakeholder engagements, and to be part of public education drives.

When there were vacuums in information, rumour and speculation quickly flooded into the space, spreading like a fever through conventional and social media platforms.

It soon became clear that Capetonians needed different kinds of technical details, as well as reassurance: what longer-term planning was underway to avoid this kind of disaster in future, such as the much-talked-about desalination plants? But they also needed information relating to the more immediate, day-to-day realities as people adopted alternative water harvesting measures: what health considerations or legal guidelines applied to using recycled grey water or capturing storm water or sinking boreholes. Who owns spring water or water in the Liesbeek River? What do the bylaws say about using well-water compared with borehole water? Can you retrofit buildings to have a parallel system of potable water for drinking and cooking, but non-potable water for flushing the toilet?

- **Spreading the word**

Information vacuums often lead to plenty of rumour-mongering or helplessness. But one of the biggest difficulties the City faced throughout the drought was getting technically-complex and accurate information about dam levels and the condition of the water system to the public on a daily basis. It also needed to help citizens with information on how to be more water wise. How

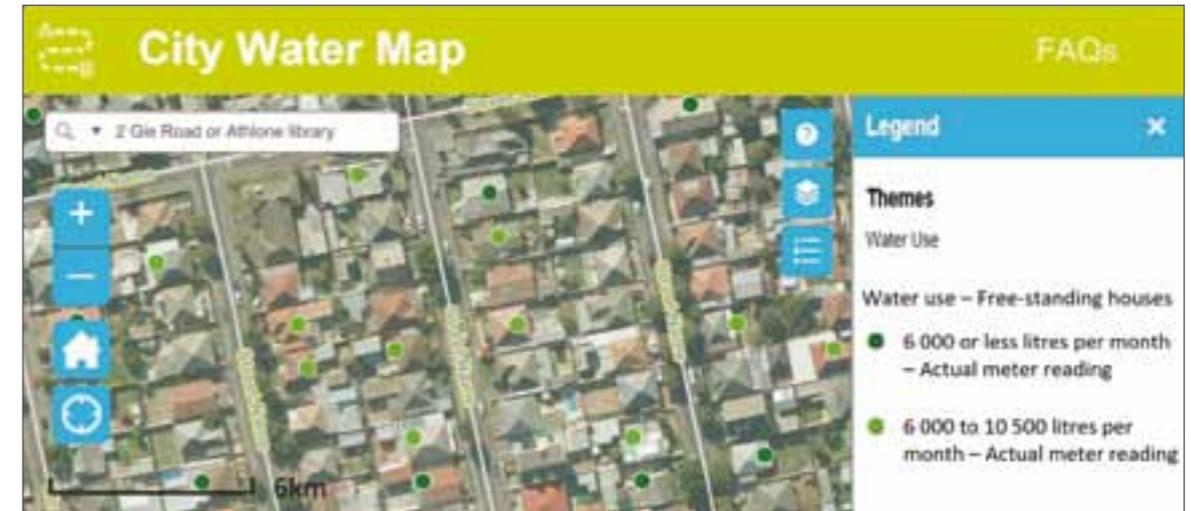
do you manage, for instance, if you only have 87L or 50L of water per day?

In the end, the communications team tried to cover as many bases as possible. It ran public-facing media campaigns using advertising agencies. It used direct mailing lists to target residents and businesses. It sent 'green nudging' suggestions out through the City's utility billing system. City staff ran direct outreach programmes through community meetings.

Some of the most effective platforms for getting information out to the public were digital online tools. The City set up the *Water Dashboard* and the *Think Water* website, which quickly became the go-to places for information on dam levels, explanations about water restrictions, tips on how to save water, and information on a hotline where people could report leaks or people breaking restriction rules.

The City also worked with researchers from EPRU to design the Cape Town Water Map. This was another 'green nudging' tool that was designed to use social recognition as a way to get people to change their behaviour around water use. Freestanding homes whose water use stayed within the City's target levels per household, per month, were flagged with a green dot: a light green dot for households using 6kL of water or less per month, and a dark green dot for those using 10.5kL per month. The map also showed how residents' water use compared with their neighbours', and how one suburb's use compared with another's.

Even though online platforms are more likely to be used by people who are resourced enough to have internet access, local radio stations and newspapers became a vital part of the stream of information, thus including places in the city with low online access.



The Cape Town Water Map was an online tool that used social recognition as a way to nudge people towards being more water wise.



5/ The Knowledge Brokers

The City roped in the expertise of several consultancy firms and not-for-profit and non-government organisations that specialise in urban sustainability and development. Local and international experts became a source of specialist knowledge and evidence-based information. They were able to help with important technical analysis and advise the City on how to navigate bureaucratic and management issues that came up through the drought. But they also warned not to make any rushed decisions that might lock the City into expensive, but potentially unviable, engineering solutions to the problem of securing future water supplies.

The City drew up plans to boost water supply through water desalination, tapping into aquifer water and recycling used water. But many of these engineered solutions wouldn't deliver water fast enough to avoid Day Zero in 2018.

RODGER BOSCH

At the height of summer in early 2018, when Day Zero looked like it was just three months away, the City set its tightest water restrictions yet. Hoping to stretch what water was left in its fast-drying dams, the aim was for the entire city to keep water use down to below 500 million litres per day. But while it was trying to drive these urgent demand-side water savings, it also needed to kick into gear a series of projects that would boost water supplies, even though many of these would only deliver water well after the drought was expected to have ended.

These built on the City's longer-term water strategy, which planners were able to revisit once the winter rains of 2018 started to refill the dams, giving everyone a chance to pause and plan outside of crisis-mode. The new Water Strategy lays out various options for boosting the amount of water coming into the growing city water system. It includes utility-scale boreholes to tap groundwater reserves; a longer-term permanent desalination plant; and improved waste-water recovery. The strategy calculates the volumes of water each option is expected to deliver, the likely timeframes for getting them up and running, and the expected cost.

A number of external experts, including development and environmental consultants, helped to shape the thinking that went into these plans. One of those was international civil society organisation, The Nature Conservancy (TNC).

'The City calculated that demand for water will

outstrip supply by 2028. To avoid this, it would need to get an additional 350 million litres of water into the system per day by then,' explains TNC's South African director Louise Stafford. 'This target would need a capital expenditure of up to R8 billion, based on current estimates, a cost that is likely to climb in future.'

Many of the big engineering solutions being offered in the water augmentation plans grabbed the newspaper headlines during the drought. Although details were sometimes hard to find, this planning signalled that the City was making plans to avoid a Day Zero scenario during the drought or at some point in future. But while this planning was going on, TNC briefed a team of resource economists to do its own bit of number-crunching around another critical threat to the city's water: the invasive alien trees growing in the main water catchments for the province.

Clearing these wouldn't cost much in the longer-term, they found, and doing so would release as much as two months' supply of water back into the system.

The City was under enormous pressure to 'pull the trigger' on many of the engineering solutions being recommended by the tech advisers, but the resource economists urged caution. Don't rush into any costly projects in future without a sober and rational review of the numbers and where the best return on investment would be, they said.

The resulting analysis from these economists will prove important in shaping how the state and its various partner institutions manage the Western Cape's water system over the next three decades. This kind of external support by knowledge brokers proved to be critical throughout the drought.

WHERE'S THE BEST BANG FOR BUCK?

TNC's brief for this analysis was to look at the impact of invasive alien trees growing either 'wild' in the Western Cape's main water catchments, having escaped from forestry operations over many decades, or farmed in commercial plantations.

These trees, mostly pine, eucalyptus, and wattle, drink as much as 20 percent more water than the indigenous fynbos vegetation, according to TNC. At the height of the water restrictions, when the target was for a city-wide daily limit of under 500 million litres per day, these trees were using the equivalent of almost two months' worth of Cape Town's water. According to Stafford, this figure will double by 2045 if they aren't cleared.

Resource economist Dr Jane Turpie, from Anchor Environmental Consultants, headed the team that took on the analysis. They looked at what it would cost to clear alien trees from around the main dams, restore the 'ecological infrastructure' in those water catchments, and keep them alien-free for the next three decades. What would the return on investment be, compared with the engineering solutions the City was suggesting for future water augmentation?

In a nutshell, the conclusion of this study was that a relatively small investment of R370 million in today's value over the next 30 years would restore the priority water catchments around the city's three main dams. This, they concluded, would produce a significantly better return on investment than the engineered solutions. Though the total yield of water would amount to a third of the total combined yield from the engineering projects, it would be at significantly lower cost, according to Stafford, and should be prioritised alongside the other recommended engineering solutions⁴.

Alien invasive trees in the catchments drink as much as 20 percent more water than the indigenous fynbos. Clearing these trees from the main water catchments wouldn't cost much in the longer-term, and it would release as much as two months' supply of water back into the system.

⁴ Stafford, L. 15 January 2019. Clearing thirsty alien vegetation set to bring cheapest solution to Cape Town's water crisis. *Daily Maverick*. Available: <https://www.dailymaverick.co.za/article/2019-01-15-clearing-thirsty-alien-vegetation-set-to-bring-cheapest-solution-to-cape-towns-water-crisis>.

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Zooming in on the farmed pine plantations that surround the Steenbras and Wemmershoek Dams, which cover 420ha and are owned by the City of Cape Town (meaning it is the City's legal responsibility to manage the plantations), Turpie and team showed that the cost of clearing these, and making sure the area then stayed alien-free, would be almost half the cost per litre of sinking boreholes into the Steenbras aquifers⁵.

The call to arms from Turpie, who also works with the Environmental Policy Research Unit (EPRU) at the University of Cape Town's School of Economics, was that the City needs to prioritise invasive alien clearing in its longer-term water management strategy. While the City does have an alien-clearing plan, for many reasons the work isn't being done at a scale close to meeting the ongoing spread of these trees.

TNC added another layer of analysis to the discussion, where it showed how extremely complex it can be to manage these kinds of long-term projects, in terms of institutional cooperation, funding, and year-on-year implementation. This job will involve pulling together funding and operational decision-making from national and provincial departments, state bodies such as SANParks and CapeNature,

private contractors, and various municipalities responsible for the catchment areas in question⁶.

By the end of 2018, once the drought broke, TNC had set up a 'water fund'. This is an internationally-used model aimed at helping cities pull together the many partners that might need to be involved in coordinating and managing funds associated with projects that are geared towards restoring or improving ecological infrastructure relating to water⁷.

BRINGING IN THE EXTERNAL EXPERTS

This piece of the story shows how necessary it is for a city to draw on the knowledge and analysis of skilled experts – academics, researchers, development practitioners, civil society organisations, and even retired technical experts who previously had worked for local government – in order to make informed, evidence-based decisions in the short- and long-term, even within the urgency of day-to-day decision-making.

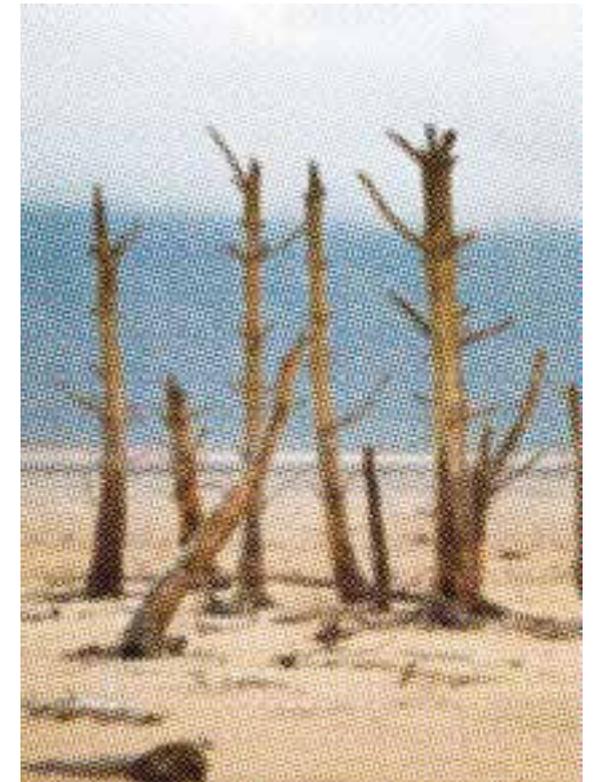
Many technical personnel in the City admit that they didn't have strong networks that they could draw on to find the type of information they

needed, often urgently. Some said they turned to the Internet to find examples of other cities' best practices relating to crisis water management. One water manager said he had two tourists come to his office one day, who turned out to be urban water management experts. They had taken it upon themselves to give up some of their holiday to offer some advice, which the manager was grateful to receive.

But as the analysis of the alien-clearing programme showed, managing projects like this calls for coordination across multiple government and non-government interests, funding from many varied sources, and planning that spans decades. A City management team will be just a small cog in a much bigger project, but one whose success ultimately determines how vulnerable the wider province's water system is. This kind of complexity is true for so many of the other water system interventions that the City, province, and national governments need to spearhead in future.

Once the winter rains finally started topping up dam levels again in 2018, TNC's Louise Stafford, writing in the *Daily Maverick*⁸, urged the City not to become complacent or lift water restrictions too soon. This was a chance, she wrote, 'to pause and use the best scientific evidence to support the decisions we make as a region and community to manage the shared water resources upon which our lives, health, and economy depend'.

8 Stafford, L. 15 January 2019. Clearing thirsty alien vegetation set to bring cheapest solution to Cape Town's water crisis. *Daily Maverick*.



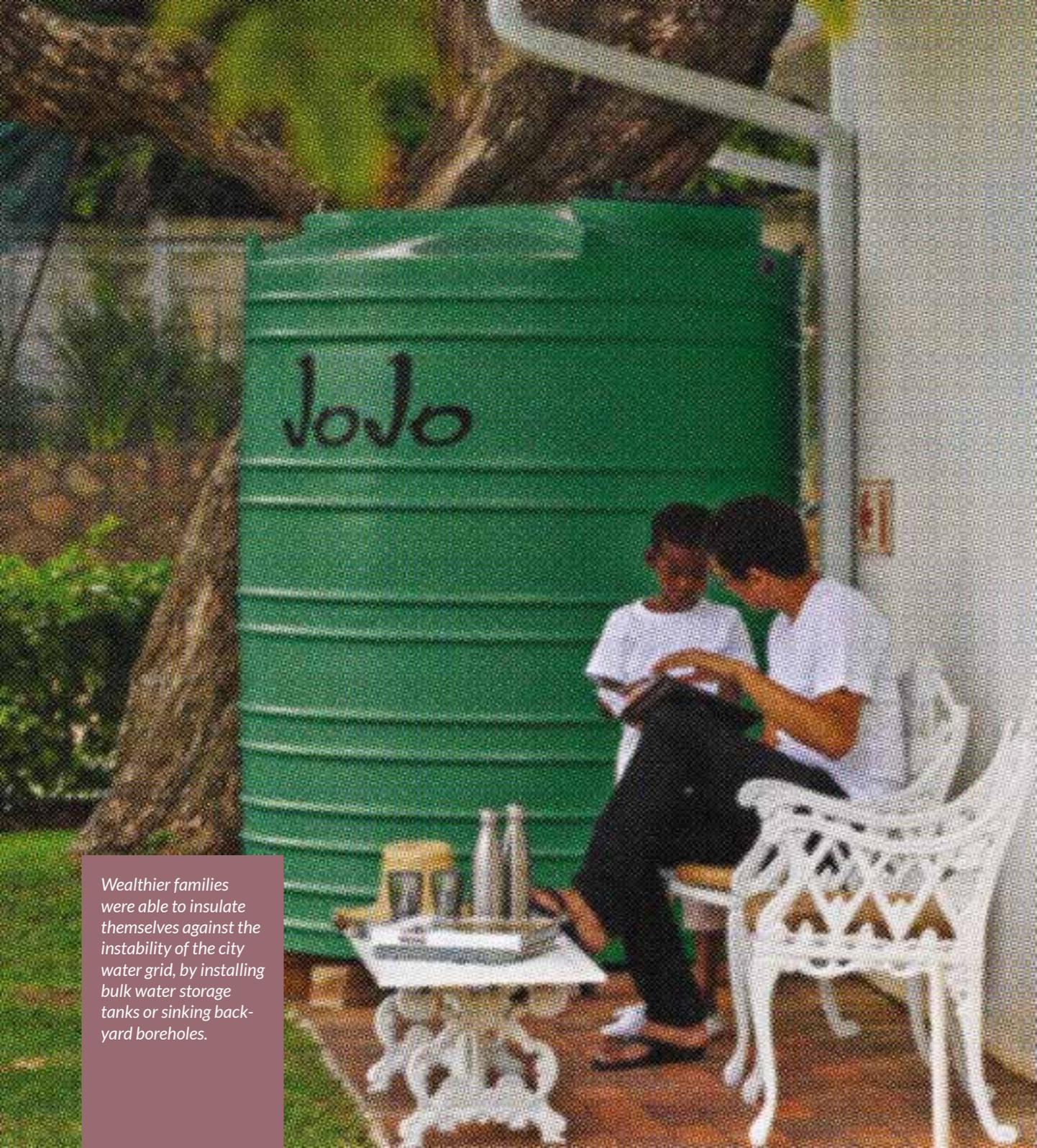
RODGER BOSCH

Environmental scientists calculated that alien trees growing wild or farmed in the city's main catchments were drinking the equivalent of two months' supply of water at the height of the drought.

5 Joubert, L. 5 November 2018. Restoring catchment areas the cheap water solution for Cape Town. *Business Day*. Available: <https://www.businesslive.co.za/bd/life/2018-11-05-restoring-catchment-areas-the-cheap-water-solution-for-cape-town>.

6 Joubert, L. 5 November 2018. Many hurdles hamper protection of water catchment areas. *Business Day*. Available: <https://www.businesslive.co.za/bd/life/2018-11-05-many-hurdles-hamper-protection-of-water-catchment-areas>.

7 The Nature Conservancy. 2018. Greater Cape Town Water Fund Business Case – Summary of Findings. Available: <https://www.nature.org/content/dam/tnc/nature/en/documents/GCTWF-summary-11.14.18.pdf>.



Wealthier families were able to insulate themselves against the instability of the city water grid, by installing bulk water storage tanks or sinking backyard boreholes.

6/ The Researcher

What are the best ways for a city to work with its residents to encourage more water-wise behaviour? Is it through education campaigns, punishing tariff increases and fines, threatening to name-and-shame wasteful users, or recognising people for good behaviour? Before committing any time, staff, or money into rolling out these kinds of behaviour-change campaigns, it's useful to test which methods work best, by running controlled 'field experiments'.

This is where academics and researchers can step in, to help a city design policies and behaviour-change initiatives that are evidence-based, scientifically rigorous, and most likely to have wide reach. Field tests like this, done by local behavioural economists, have become central to helping Cape Town respond to the latest water crisis.

The concept of 'Day Zero' slipped into everyday language in October 2017 when the City released its Critical Water Shortages Disaster Plan, which spelled out clearly what the emergency rationing measures would be if the dams ran down to that critical threshold of 13.5 percent of usable water. This disaster plan turned out to be the single most effective intervention to bring about behaviour change from water users, as dam levels ran perilously low. Spelling out the urgency of the drought, and how imminent the emergency really was, seemed to send a shockwave through communities, and people were compelled to change how they used water.

Some considered the use of this term through media platforms as an irresponsible 'fear-mongering' tactic that led to panic. And yet, according to local behavioural economist Professor Martine Visser, the threat of extreme rationing measures worked well to change people's behaviour.

Although in hindsight, Visser argues that a more moderate and transparent communication drive, started earlier on in the drought, might have been less costly for businesses and citizens, and would have built more trust.

Theories from the field of economics, about what drives behaviour, supports the idea that if people have clear information about how serious a threat is, but still have a sense of agency in terms of knowing what they can do to help tackle the problem, they're more likely to act.

Visser is Director of the Environmental Policy Research Unit (EPRU) at the University of Cape

Theories support the idea that if people have clear information about how serious a threat is, but still have a sense of agency in terms of knowing what they can do to help tackle the problem, they're more likely to act.

Town's School of Economics. When the drought peaked in late 2017, she and her team had already been tracking Capetonians' water use behaviour from before the drought began and before anyone had an inkling of what was to come.

Early in the summer of 2015, the EPRU researchers were about to start a behavioural nudging experiment to see how people would respond to certain interventions that were geared towards encouraging water-wise behaviour (see **'Nudging' down water use through positive messaging**, below). They began monitoring water use behaviour from the start of the experiment, which they ran through that summer. But once the experiment was done, they continued tracking people's behaviour. As the drought worsened into 2017 and 2018, and as the City rolled out various other campaigns that were aimed at getting people to cut their water use, they could track how people responded.

Looking back over the course of the drought, the researchers could see what sort of interventions worked best to encourage behaviour change, and what didn't.

The combination of interventions included the researchers' behavioural nudging experiment, and the City's various approaches to encouraging water use cuts, amounting to a series of carrot-and-stick approaches.

Some of these involved economic instruments like the 'inclining block tariff'. This is a pricing system that charges low rates for the initial water

that a household uses, but then increases the rate significantly after that, per block increase, so that higher water users pay much more per unit of water for their non-essential water needs.

Other interventions included water restrictions, such as a ban on hosepipes for cleaning cars or watering gardens, or setting limits per household, per month, or per person, per day. These were enforced through higher tariffs or fines. There were also threats of naming-and-shaming high water users who flouted restrictions, as well as the possibility of having water shut-off devices installed in their homes.

Once the drought was over, the researchers could compare how effective these different approaches were. The lessons they've learned, they say, can apply to more than just public behaviour around water use during a time of drought crisis – they can also be useful to drive positive and sustainable household behaviour relating to energy use, or reducing household waste, or recycling.

'NUDGING' DOWN WATER USE THROUGH POSITIVE MESSAGING⁹

In the summer of 2015/16, Visser and the EPRU team ran a behavioural or 'green nudging' experiment to see if positive messaging could be a way to get Capetonians to be more water-wise. How well would this kind of messaging work, compared with the City's other efforts to cut water use, such as the price hikes, water restrictions, fining, and so forth?



When behavioural economists studied how Capetonians responded to the water crisis, they saw how important it was that people understood the urgency of the crisis, and also had useful information about what they needed to do to cut their water use.



⁹ Brick, K., Demartino, S. & Visser, M. 2018. Behavioural Nudges for Water Conservation: Experimental Evidence from Cape Town, South Africa, Draft Working Paper. DOI: 10.13140/RG.2.2.25430.75848 on Research Gate and Academia.

The economists drew up nine individual messages, each one framed in a different way. Each was generally affirming, subtle, and positive. Targeting 400 000 households, they slipped these messages into people's utility bills that went out through the City's mailing system over the course of the six summer months when water use generally goes up across the city. They targeted households through a random selection process. These were all free-standing homes, across different income brackets.

Some messages involved tips on how to cut water use at home. Others used graphics to better explain the block tariff pricing system, and then either showed people how much money they could save if they cut their water use, or how much it would cost them if they didn't. Some messages tried to bring out the competitive streak in people, by showing in the bill how a family's water use compared with others' in their neighbourhood. Other messages used a value-systems approach to rally people around the idea of a 'common good', hoping to appeal to the idea that people are more likely to work cooperatively when they know it's for the good of the wider community. One message appealed to being socially recognised: it promised people that they would be praised publicly for their water-wise behaviour, through having their names published on the City's website.

The EPRU team tracked how the different groups responded to these messages, and compared these responses to those of a control group, another group of households that didn't receive any messaging in their monthly bills.

WRITTEN IN THE DATA: WHAT DRIVES BEHAVIOUR CHANGE

Visser and her team were already tracking water use behaviour before the drought started, and before anyone had even conceived of a Day Zero-type scenario. They started their behavioural nudging experiment in the summer of 2015, and then continued monitoring people's water use behaviour

once the experiment had run its course and as the drought tightened its hold into 2017 and 2018.

By the time the drought finally broke with the first rains of winter 2018, the EPRU crew had nearly three years' worth of observations and data. They were able to look at the data from the City's utility records, and see how households' behaviour responded to the various interventions: the 'green nudging' experiment methods, the price hikes, water restrictions, fines, the public honouring, or the name-and-shame threats used by the City. In the end, they could also see how these methods compared with behaviour change that corresponded with the heightened sense of panic that came with the knowledge that Day Zero might actually happen.

What they found was a surprisingly positive trend from Capetonians: in just two and a half years, people reduced their water consumption by half, far faster than other cities that have faced similar crises in recent decades (see **Slamming on the Brakes: getting users to turn off their taps**, page 27).

This is the kind of evidence-based research that Visser says needs to inform city-level policies around water and energy use, not only in a crisis situation, or in Cape Town, but for other cities in the country and the Global South.

Looking back, these are some of the take-home messages about how people responded:

- **'Give us a gold star'**
People want to be recognised for being water-wise. Those households who opened their monthly utility bills and found a message from the City saying that they would have their names published on the municipality's website if they cut their water use, were more likely to do so.
- **'Hitting us in our wallets doesn't work'**
Middle and higher-income households didn't respond significantly to tariff increases, and the nudges that focussed on the high cost of excessive use didn't have much impact on their behaviour, either. Basically, rich people don't feel

the pinch of the block tariffs; poorer households are usually low water users already, and can't afford to pay for more than they currently use and so are unlikely to respond to this sort of messaging (see **Slamming on the Brakes: getting users to turn off their taps**, page 27).

- **'Bring on the bans'**
Water restrictions worked well: banning hosepipe use, only allowing people to water their gardens or wash cars using buckets, insisting that private swimming pools be covered – these all brought on fairly significant responses from the public.
- **'Give us easy-to-use info tools'**
The City set up a few online tools that helped plug the information gaps (see **Creating a 'water literate' city**, page 30). The *Water Dashboard* and the *Think Water* website gave daily updates about dam levels, and were a key source of information on how the public could save water.
The Cape Town Water Map, which the City developed with EPRU as another 'green nudging' tool, was also designed around the idea that drawing on social comparisons and social recognition may be good ways to encourage behaviour change. The online map flagged households that stayed within the City's target water levels per household, per month, by awarding them a green dot.¹⁰
The EPRU team wasn't able to track how this map impacted on behaviour within households, as they had with the other nudging experiments, but their survey of people's engagement with the map through conventional and social media

suggests that it got plenty of attention. The *Unpacking the Cape Town Drought: Lessons Learned* analysis also shows how important the *Water Dashboard* and *Think Water* websites were, in terms of getting technically complex content out to an information-hungry public.

- **'Name-and-shame'**
As the drought worsened in 2017, the City released the names of the streets where the top 100 most wasteful household water users were, across the suburbs, threatening to name-and-shame those who ignored the restrictions. Next, the mayor sent out letters to individual households that were using more than 50kL of water per month, reprimanding them and asking them to lower their usage and behave in a more pro-social way. The letters also threatened them with the installation of water-restricting devices (see **Water Management Devices**, page 14). EPRU found that people responded quite positively to these letters, cutting their water use for up to seven months after receiving the letters.¹¹
- **'It's time to panic': fear works, but with instructions on how to respond'**
When the City released the Critical Water Shortages Disaster Plan in October 2017, and with it the notion of Day Zero, Capetonians jumped into action: domestic water use dropped drastically.¹² This was the single biggest reduction across the two-and-a-half year drought period. The take-home message: sharing clear, salient information with citizens during times

10 Sinclair-Smith, K., Mosdell, S., Kaiser, G., Lalla, Z., September, L., Mubadiro, C., Rushmere, S., Roderick, K., Bruhl, J., McClaren, M. & Visser, M. 2018. City of Cape Town's Water Map. American Water Works Association. Vol 110 (9): p62-66. Available: <https://awwa.onlinelibrary.wiley.com/toc/15518833/2018/110/9>.

11 Brick, K. & Visser, M. 2018. Green Nudges in the DSM toolkit: Evidence from Drought-Stricken Cape Town, Draft Working Paper, School of Economics, University of Cape Town. DOI: 10.13140/RG.2.2.16413.00489 on Research Gate and Academia

12 Visser, M. & Bruhl, J. 2019. The Cape Town Drought - Lessons learned about the impact of policy instruments in curbing water demand in a time of crisis. Draft Working Paper, University of Cape Town.

Rich people don't feel the pinch of the block tariffs; poorer households are usually low water users already, and can't afford to pay for more than they currently use and so are unlikely to respond to this sort of messaging.

of crisis is crucial in driving behavioural change, particularly if it also gives people a sense of what they can do to help fix the problem.¹³

THE TAKE-HOME MESSAGE FOR CITIES IN THE GLOBAL SOUTH

'Cities around the world face resource scarcity like this, not just in times of crisis. Most have limited funds to roll out campaigns that encourage people to use less water or electricity, or change their behaviour around household waste,' Visser explains. Many cities have tried different models to drive behaviour change, but without real evidence on what causes these changes, it's hard to attribute change to any specific drivers. What works in one city, can't necessarily be copied directly into another city context. It may not work, may be a costly waste of time, or it may bring about unexpected negative consequences.

'Using randomised controlled trials to test different models for behavioural change in the beginning of the drought allowed us to show which approaches worked amongst a diverse population of Capetonians,' Visser says. 'Now these can be used to target larger groups, and used in other cities.'

The take-home message about how to design these kinds of strategies is also clear: for any kind of behaviour change instrument or model or approach to be effective, a city needs to be transparent about what it's going to do to deal with the crisis, it needs to show its data and models, and it needs to be clear in its message to the public. People want real information.

'If a municipality wants people to change their behaviour, they have to give the public credible and trustworthy information,' says Visser.

RESEARCHERS WORKING WITH THE CITY: EASIER SAID THAN DONE

The process of working with the City in order to do this kind of research highlighted various institutional, legal, and relationship challenges, which researchers now say are worth capturing so that others can learn from these lessons if they want to try similar collaborations elsewhere in the country or the world.

Departmental 'silos'

One of the most difficult parts of getting an experiment like the behavioural nudges one up and running, is that it involves a small team of academics at a local university working with a number of large municipal departments, where each one works in its own jurisdiction and is often bound by its own institutional rules and responsibilities.

'We had to work with the City's utility directorate, the legal department, the billing department, and the revenue department,' says Visser, reflecting on the process. 'We also needed to get permission to access confidential household data, and we had to guarantee the City that this information would be kept safe.'

It was difficult liaising between so many different municipal 'silos', and figuring out exactly who in each department should be the 'go-to' person. Since the start of the experiment, the City has now set up a designated research unit, which can help smooth over these sorts of practical rumble-strips. But during the crisis, many of the people who needed to be involved with the research had other priorities.

¹³ Booysen, M.J., Visser, M. & R. Burger. 2018. Temporal case study of household behavioural response to Cape Town's 'Day Zero' using smart meter data. *Water Research*. Vol 149: 414-420.

MONEY DOESN'T MATTER: LESSONS FROM AN ENERGY-SAVING EXPERIMENT

Having a 'champion' for a cause within a community is more likely to get people to voluntarily change their behaviour relating to water or energy use, particularly if people aren't paying for the resource and therefore wouldn't have an economic incentive to cut their use.

This is the finding from another of the EPRU team's behavioural nudging experiments¹⁴, and gives a further glimpse into how to encourage wiser resource use during times of electricity load shedding or a water crunch.

From June 2015 to October 2016, the EPRU economists ran a behaviour-change experiment in a 24-storey office block in the centre of town where people were employed by the provincial government.

From a researcher's perspective, trying to tweak people's behaviour in an office block context like this is a tough nut to crack: compared with experiments involving households, where you're generally only dealing with four or so people, an office block context could have between 50 and 200 people taking part, per floor. And because office workers aren't footing the bill for their water or electricity, researchers can't use money as a motivator to drive behaviour change. In this experiment, researchers divided up the staff in the building by floor into three groups, and used smart meters to track energy use per floor.

Group 1: The 'control'

The first group of seven randomly-selected floors was the 'control' group, and were left to carry on as normal, without any 'intervention' targeted at them.

Group 2: Tips and competitions

The staff from another seven floors were targeted with energy-saving tips, sent by email, with reminders to turn off the lights, or tips on how to cut energy use in the office kitchen. Researchers also stoked the staffs' competitive flame, by setting up competitions between different floors.

Group 3: Tips, competitions, and a 'champion'

The staff from another seven floors got the same treatment as above, but then also had someone on their floor appointed as the energy-saving 'champion' to help rally colleagues around this common good.

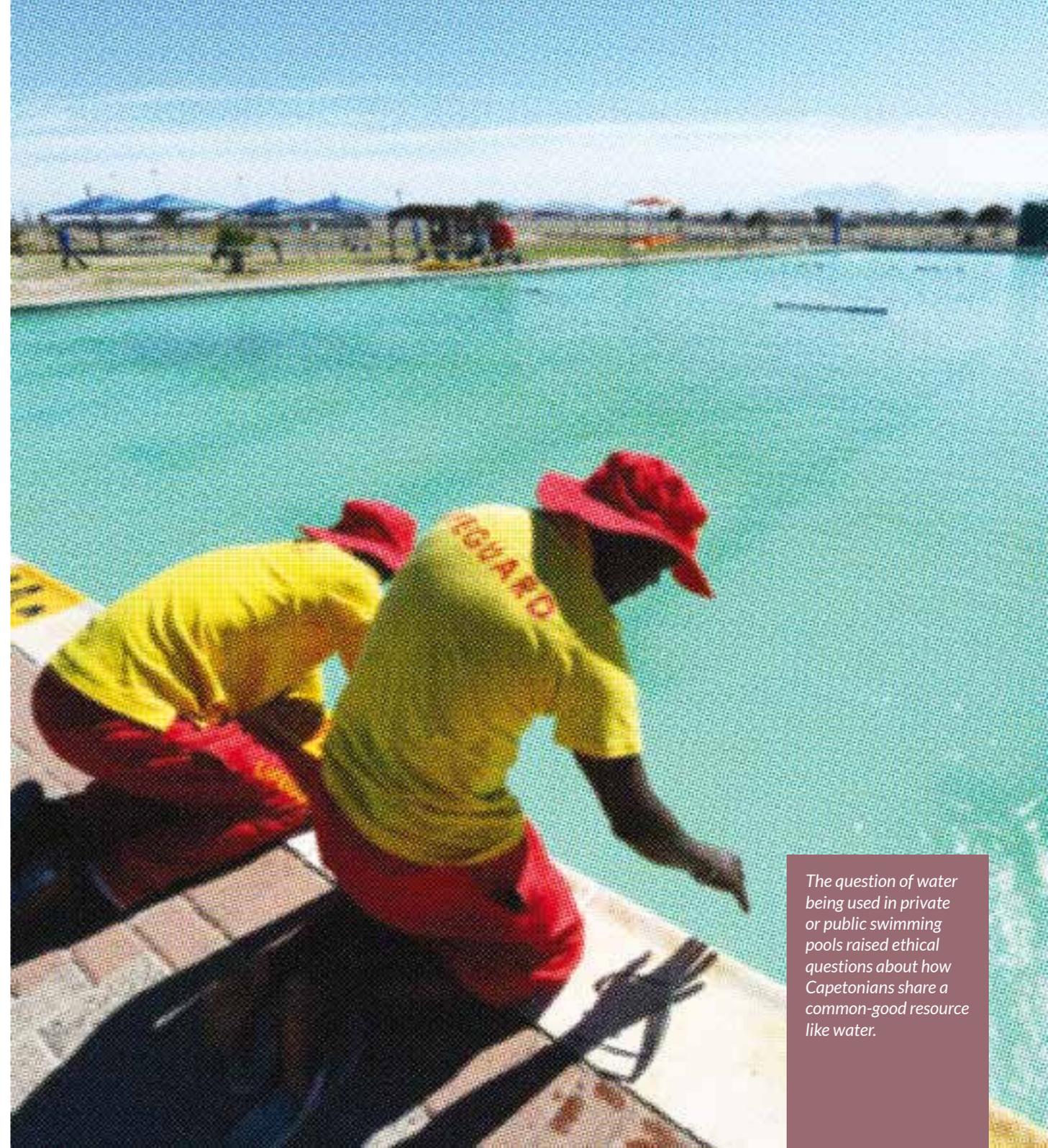
Championing a cause

The staff who only received emailed information and competed against other floors, reduced their energy use by 9 percent, says Visser. But the appointment of a 'champion' seemed to raise enthusiasm levels even more – these floors reduced their energy use by 14 percent.

'This is a surprising find,' say the EPRU researchers, 'and it turns on its head the conventional wisdom that people won't respond to energy or water-saving efforts if they're not paying for the resources themselves.'

The EPRU team ran a similar kind of experiment targeting water use during the height of the drought. Working with researchers from Stellenbosch University, they ran another series of 'green nudging' interventions in a selection of schools in the city, and monitored water use with smart water meters that they'd installed in the schools' water systems. Again they found that giving information to people, creating accountability in the community, and getting people to compete with each other in water-saving efforts was very effective in lowering water consumption.

14 Klege, RA., Visser, M., Datta, S. & Darling, M. 2018. The Power of Nudging: Using Feedback, Competition, and Responsibility Assignment to Save Electricity in a Non-Residential Setting. Discussion Paper Series. Environment for Development. Vol18-19.



The question of water being used in private or public swimming pools raised ethical questions about how Capetonians share a common-good resource like water.



7/

A City in Recovery: the New Normal

The short film *Field of Vision – Scenes from a Dry City* splices together a few vignettes that capture something of the difficulty that a city like Cape Town faces as it grapples with spreading the shared pool of water fairly across one of the most unequal cities in the world¹⁵.

How does a city deliver something that's a basic human right, where there's potentially less of it to share around in future, where it costs money to deliver that water into everyone's homes, and yet where not everyone has the means to pay for that service?

Early in the film, the camera catches the scene of a young man, an entrepreneur in his own right, being chased down by metro police on the streets between single-room state-built houses and tin shacks on the Cape Flats. The charge: breaking water restrictions by running an informal car wash. What other options does a man like this have without this livelihood, the officer reflects after the showdown? Later in the film, another scene captures the moment when a drilling team strikes water in the front yard of a suburban woman's home, someone who can afford to sink a borehole so that she can keep her hobby garden alive.

Day Zero may have been avoided in 2018, but a drought shock like this one will happen again as the climate warms and rainfall patterns are less predictable.

RODGER BOSCH

Swimming pools and irrigated lawns on one side of town; people, without toilets in their homes, left to collect water in buckets from public standpipes in informal settlements, on the other side, just 25km away.

'You cannot make a profit out of water,' one community leader cajoles a crowd through a loudhailer during a protest march, captured on film. 'Water is a necessity for life! It doesn't mean that if you don't have money you can't have water. We must provide water for everybody, and it must be free!'

Cape Town caught the attention of the international media as the threat of Day Zero drew closer in 2018. In many ways, this event, in this city, was the local expression of what happens when a climate shock like this hits a city that already has the everyday development challenges of service delivery backlogs, high unemployment, contentious political rivalries, and generations of systemic inequality. It showed how politically and economically unstable a city can become, very quickly, if a 'natural' disaster of this scale hits.

But it also shows how quickly a city and its citizens can respond. Cape Town became a living laboratory for testing how to navigate a crisis like this, and other cities can draw from these lessons, too.

From the perspective of Capetonians – the residents living in this city – the take-home message from this drought is that we're all part of the col-

15 <https://feldofvision.org/scenes-from-a-dry-city>

This drought was the expression of what happens when a climate shock hits a city that has development challenges of service delivery backlogs, high unemployment, political challenges, and generations of systemic inequality.

lective project of managing and using this shared resource in a way that's fair and for the common good. As citizens, we need to adjust our attitude towards water, and use it wisely and sparingly so that there's enough to go around. This means understanding that for some, keeping a private swimming pool topped up with water might come at the cost of another person's access to basic water for drinking, cooking, and cleaning. At the same time, the water bill for that swimming pool might help pay to get running water into the kitchens and bathrooms of those 180 000 households in informal settlements who still have to collect water from standpipes every day. When dams are full, this approach to managing a city's water system makes sense; when dams are empty, it doesn't.

Cape Town's population is growing, along with its economy, and even without the spectre of extreme drought, rising temperatures, heatwaves, and less predictable rain, demand is expected to outstrip supply soon. Added to that, climate modellers at the University of Cape Town's African Climate Development Initiative (ACDI) are starting to work out how much more likely these kinds of droughts are to occur in future, if global warming trends carry on as they are¹⁶.

The same ACDI analysis, however, also has a

message of hope: it shows that the City has managed to stabilise the growth in water demand at two percent per year, because of its demand management practices. And as the post-drought analysis in the *Unpacking the Cape Town Drought: Lessons Learned* report shows, when a City government and its residents mobilise around a climate shock like this, they can make steps towards being more water- and climate-resilient in the longer term.

The Day Zero story shows how complex it is to deliver water across such a wide geographical scale, in a region of the country that is naturally water scarce and will likely become more so as climate change heats the place up and makes rainfall less predictable, and droughts more likely.

Being part of this collective project of creating resilient cities means being an engaged citizen, holding our elected officials accountable as employees of the public in terms of how they manage the water system today, and build a more resilient one for the future. A critically-engaged citizenry needs to appreciate the technical, legal and institutional challenges of delivering water across such high levels of inequality, where many different government departments have different Constitutional responsibilities and have to work within rigid legal parameters. In many cases, these responsibilities

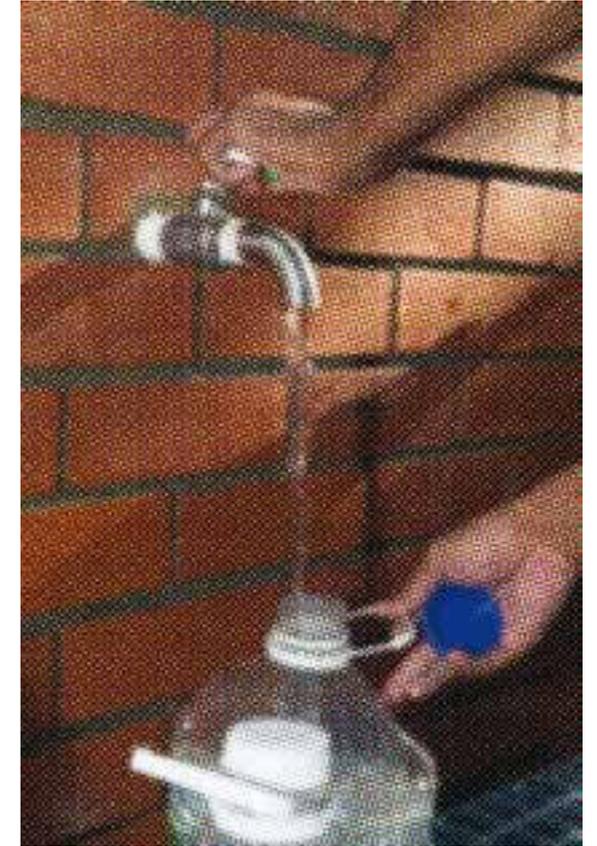
may fall on the shoulders of departments that are under-staffed, under-skilled, and sometimes stretched to breaking point during a crisis like this.

Meeting the existing development challenges of the city, in a context where water will be more scarce in future, means understanding, not just in terms of its day-to-day water delivery, but how it is planning for the future – planning that needs to encompass decades, not just the next five-year electoral cycle.

The post-mortem of the city-wide response to the drought, put together in the *Unpacking the Cape Town Drought: Lessons Learned* report, fleshes out the most important lessons that any city can draw from Cape Town's experience. It looks at the need for stronger governance between City departments and with national government, the need for better data, knowledge and communication, the need to understand how the wider water system works, and the need to skill people up to be adaptive and competent. This is a technical and meaty analysis. Some of these ideas come through in this *Day Zero* title, in order to help prime the residents of a city to understand their own role in this complex and challenging city-scale water system.

When the winter rains finally arrived in 2018, Day Zero was 'called off', at least until the end of 2019. This meant that it looked as though the dams were recovering well enough to guarantee enough water to keep the city going for the next 18 months. By the end of winter, dam levels were back to 75 percent.

But that doesn't mean that the threat of such extreme rationing measures won't be needed in the future, whether it's called Day Zero or not. Hopefully next time – because there is likely to be a next time – the City and the people living in it will be better prepared.



CITY OF CAPE TOWN

Water users in any city have an important role to play in the management and governance of their water system.

¹⁶ Otto, FEL., Wolski, P., Lehner, F., Tebaldi, C., Jan van Oldenborgh, G., Hogesteegeer, S., Singh, R., Holden, P., Fučkar, NS. & Odoulami, RC. 2018. Anthropogenic influence on the drivers of the Western Cape drought 2015–2017. *Environmental Research Letters*, Vol 13 (12).

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Day Zero is not a product of the City of Cape Town. These stories were compiled as part of an independent research and analysis process, which draws from and interprets interviews conducted with a wide range of people employed by the City of Cape Town, and many other stakeholders. It does not reflect the views of the City of Cape Town itself.

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RODGER BOSCH

The drought was a great leveller, showing Capetonians from all walks of life that they were in this crisis together.

The three-year drought that hit Cape Town was the local expression of the global climate change emergency. It shows what happens when the normal demands of running a city, with its many development challenges, collide with a climate 'shock' like this one. The lessons learned from how the City and its residents responded are relevant globally, as major cities around the world face growing populations and ever-shrinking resources in the face of a changing climate.

www.dayzero.org.za

