WWF

ZA

2018

THE WATER FILES

COMMUNICATING IN A TIME OF WATER CRISIS

WWF editorial team: Christine Colvin, Rodney February, Pedzi Gozo, Kholosa Magudu, Sue Northam-Ras, Eitan Prince, Klaudia Schachtschneider and Andrea Weiss

WWF would also like to thank the various contributors to the weekly *Wednesday Water Files* which were created during January and March 2018. All contributors are listed on the inner back cover.

Sanlam

WWF acknowledges Sanlam for their continued funding and support of WWF's freshwater work.

Text Editor: Marlene Rose

Design and layout: GAPdesign

Front cover photo: Eitan Prince/ WWF

Printed on: FSC-certified Galerie Silk Matt Art

Printed by: Hansa Digital & Litho Printing (Pty)Ltd

Published in July 2018 by WWF - World Wide Fund for Nature (formerly World Wildlife Fund), Cape Town, South Africa.

WWF is one of the world's largest and most experienced independent conservation organisations, with over 5 million supporters and a global Network active in more than 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by: conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

wwf.org.za

CONTENTS

INTRODUCTION

At the height of the summer of January 2018, and after three years of a historic drought, Cape Town was facing the very real prospect of running out of water.

DAY ZERO

THIS IS THE NAME THAT WAS GIVEN TO THE DAY THAT THE TAPS IN CAPE TOWN WERE DUE TO BE SWITCHED OFF

The City warned that if dam levels dropped to below 13,5% it ran the risk of no longer being able to supply water on tap to large parts of the metropolitan area. This scenario became known as Day Zero.

In response to these extraordinary times, WWF South Africa began to put together weekly communications, known as the Wednesday Water Files, which provided guidance and credible advice to citizens. Over the ensuing 10 weeks leading up to World Water Day on 22 March, these Water Files addressed a variety of topics – from household groundwater management to citizen preparedness – and were widely shared in the media and through social networks.

As the summer of 2018 drew to a close, it became clear that through extraordinary water-saving measures the Mother City had narrowly averted the immediate Day Zero crisis. Nevertheless, this scenario remains a strong possibility for Cape Town and many other urban areas in water-stressed South Africa.

What follows is an edited version of the information first published in the Water Files so that this useful information, collated during a time of crisis, will continue to be of value to those who need it most.

LIVING THE 50-LITRE LIFE

Shower for 90 seconds
15 LITRES

General hygiene
3 LITRES

Dishes and laundry
18 LITRES

One flush
9 LITRES

Cooking
2 LITRES

Drinking water
3 LITRES

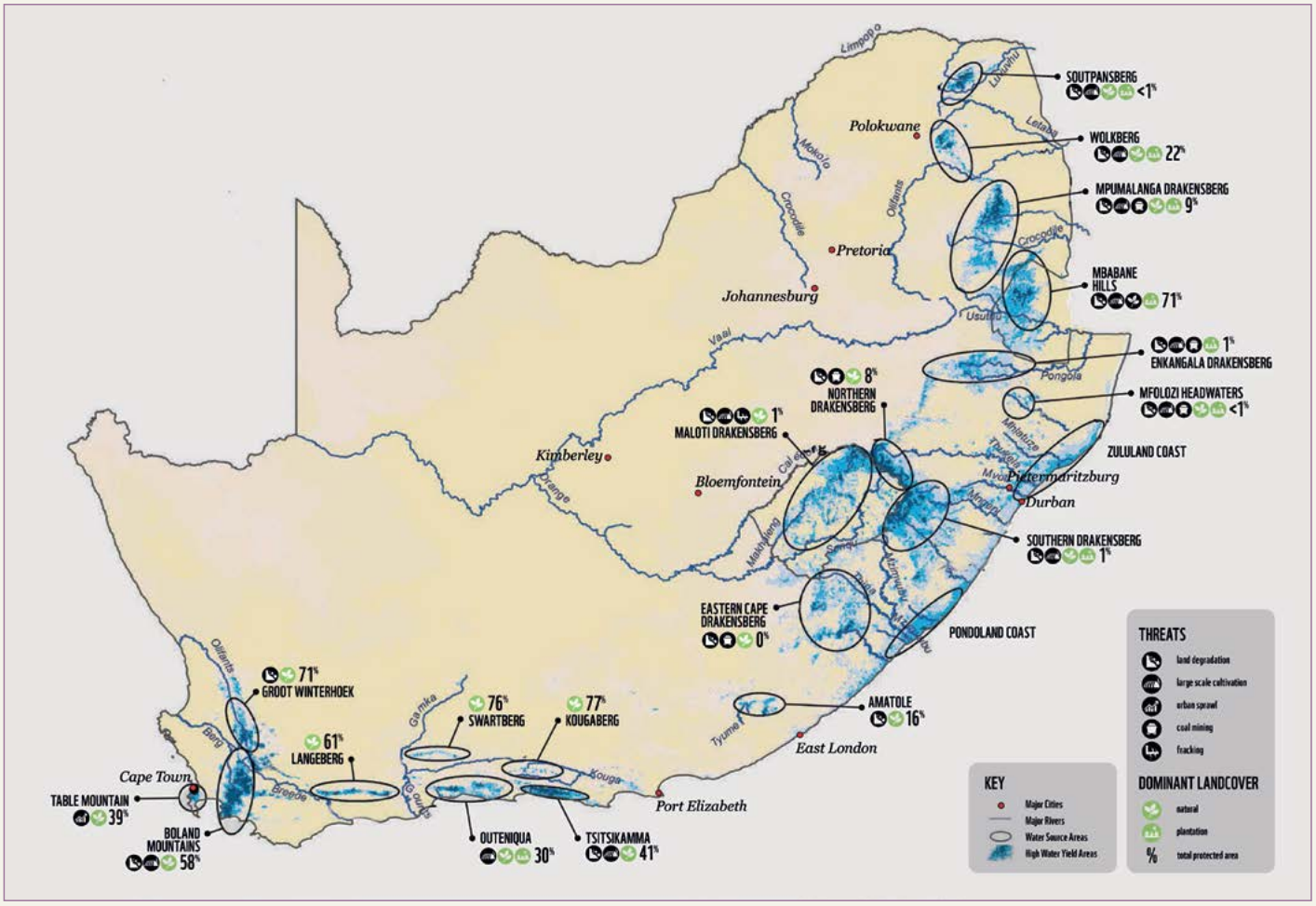
WATER DOESN'T COME FROM A TAP

Until there's a crisis, most of us don't give much thought to where water actually comes from. For those of us living in cities or large towns, our water is often piped in from water source areas and dams far away. It is important to safeguard a healthy natural environment in our catchments. There's a lot we can do to look after these critical areas.

SO WHERE DOES OUR WATER COME FROM?

We may have learnt about the water cycle in school, but many of us depend on taps managed by our local municipality and so take our water supply for granted. South Africa's rainfall is highly seasonal. This means we need to store water to be able to use it all year round. Over the last 100 years, we have built thousands of dams around the country. But even before water gets into dams and engineered infrastructure, it flows through wetlands, rivers and aquifers in the natural environment in our catchments – and this is something we need to focus on.

WATER SOURCE AREAS OF SOUTH AFRICA



WHERE ARE SOUTH AFRICA'S WATER SOURCE AREAS?

Rainfall varies a lot around the country. Our highest rainfall areas are in the high mountainous areas such as the Drakensberg in the Eastern Cape and the mountains of the Western Cape. These mountains are our headwaters, otherwise called water source areas. Collectively they constitute only 10% of South Africa's land area, yet they deliver 50% of our river flow (see map on page 5). For the vast majority of people living in cities, this is the water we depend on.

ONLY 10% OF SA'S LAND AREA DELIVERS 50% OF OUR RIVER FLOW

WHY IS NATURE IMPORTANT FOR PEOPLE IN CITIES?

Very little water in South Africa is recycled and reused, and even less is produced through desalination. This makes natural water resources (aquifers, rivers and wetlands) our primary sources of water, and we get better quality and higher yields of water when these catchments are healthy and unpolluted. Because a disproportionate amount of our water comes from water source areas, the condition of these areas is vitally important to city dwellers.

WHAT IS THE STATE OF OUR NATURAL WATER RESOURCES?

South Africa's natural water resources are polluted, overexploited and there is a lack of active management. Sadly, South Africa is not alone in this. Worldwide, natural wildlife populations are declining at an alarming rate and they are falling fastest in freshwater ecosystems. Wildlife populations living in freshwater have fallen by 81% between 1970 and 2012 (according the Living Planet Report 2016).

WHAT ARE THE MAIN PROBLEMS?

At a neighbourhood level, we have problems with refuse management, litter in our streets, even oil leaking from cars on our roads. This often ends up in the stormwater system and ultimately in our rivers. At a municipal level, underinvestment in sewage or wastewater treatment works means that many of these treatment plants are not able to cope with the levels of waste they receive. The result is that some discharged treated water is still contaminated and should not be going into our rivers. Poor enforcement at mines and factories also means that polluted water ends up in rivers and aquifers underground. Weak land management means that essential nutrient-rich sediments get washed into rivers and dams. Another problem is that water-thirsty alien invasive vegetation is allowed to spread unabated, sucking up water that should be flowing into streams.

FRESHWATER WILDLIFE POPULATIONS WORLDWIDE DECLINED BY 81% BETWEEN 1970 AND 2012

WHO SHOULD BE LOOKING AFTER THESE AREAS?

Under the National Water Act 36 of 1998, catchment areas should be looked after by nine different Catchment Management Agencies around the country. As of 2018, only two of these have been set up and even they are not fully functional. This means there is a gap in how catchments are considered when we make long-term plans for future development and decisions about how to use our land and water resources. Landowners and land managers (such as farmers, foresters and nature conservation agencies) are really important custodians of our catchment areas. The decisions and actions of communal and private landowners, and many government entities (mining, agriculture, environment, local authorities) affect our water source areas. Most of the time water security is not prioritised.

WHAT IS THE GOVERNMENT DOING TO CLEAR INVASIVE WATER-THIRSTY ALIEN VEGETATION?

The Department of Environmental Affairs (DEA) manages the Working for Water programme that clears thousands of hectares of alien vegetation (pines, wattles and gum trees) each year and so helps to prevent these plants from using more water. Since it was started in 1995, Working for Water remains the country's largest publicly funded programme. As well as working towards clearing the vast invasive vegetation problem in South Africa, it has created employment at a local level. But it takes only one area of non-cleared land to create the seeds to repopulate a fast-spreading invasion again. To control this, landowners are obliged by law to keep their land cleared of invasive alien vegetation.

WHAT ABOUT THE EFFECTS OF CLIMATE CHANGE?

Under conditions of climate change, the Western Cape is likely to get drier while more intense storms are predicted for some of the summer rainfall areas in the east of the country and Gauteng. This puts more pressure on our natural landscapes and means that their health is ever more important for our future water security. If we allow alien invasive vegetation to spread in the catchment areas, we run the risk of our rivers running dry. During the drought we have become acutely aware that the estimated 38 million cubic metres soaked up by alien vegetation is water that we can't afford to lose any longer. Clearing these alien plants from our catchments is imperative. By doing this we could deliver more water faster and more cheaply than, for instance, energy-intensive desalination. Similarly in the Drakensberg, ensuring that mountain grazing areas are well managed and not stripped of natural grass is critical to prevent precious topsoil being washed away during heavy downpours. We want to keep healthy soil on our mountain slopes to grow grass for livestock and not have it washed off to silt up and block dams downstream.

WHAT NEEDS TO BE DONE TO MANAGE OUR CATCHMENTS BETTER?

Strong coordination between many government departments, landowners and private companies is needed to protect and restore natural landscapes that give us water. This desperately needs a coordinating agency. Water User Associations, Fire Protection Associations and NGOs are already managing natural resources in these landscapes and have also stepped in to restore wetlands and clear alien vegetation. Money from the Expanded Public Works Programme is being used to create jobs in active restoration and clearing, and the private sector has also used corporate social investment funding for partnerships. But much more needs to be done. Through partnerships, WWF South Africa works with local NGOs, local government and the private sector to improve management of the water source areas.

HOW CAN NATURAL SOLUTIONS PLAY A ROLE IN OUR FUTURE WATER SECURITY?

With a changing climate and increasing demands on natural resources, we need to make wise use of what we have. Healthy, intact landscapes are more resilient to the shocks of climate change. The catchments that feed our dams need specific management and attention to stop their degradation. Decisions about how we use and build on land need to take account of the impacts on water resources. Looking after natural areas in our cities also allows underground aquifers and groundwater to be replenished and slows stormwater flows into our rivers.

DEBUNKING DESALINATION

Water, water everywhere – but not a drop to drink! Desalination can provide an important additional source of water from seawater or reclaimed wastewater as existing freshwater sources become more stressed owing to drought and climate change. But removing salt is no silver bullet. Here's why.

HOW DOES DESALINATION WORK?

Water is desalinated when it is treated to reduce the level of salts in it. Seawater typically has about 35 grams of salt (about 7 teaspoons) dissolved per litre of water. This is a concentration of 35 000 parts per million (ppm). The healthy limit for drinking water is 1 000 ppm and the upper limit is 5 000 ppm, so to make seawater fit to drink we have to remove at least 30 grams (6 teaspoons) of salt from each litre of water. Separating the salt from the water takes energy. If seawater were to be left under a transparent dome with the energy of the sun shining through, about 3 litres would evaporate per day per square metre of water surface. If that water condensed again on the dome roof, you would have a solar still and you could separate small volumes of freshwater from seawater. You need large quantities of energy to make large volumes of freshwater. Depending on which method is used to desalinate (reverse osmosis, vapour compression or membrane distillation), between 2 and 12 kWh of electricity is needed per 1 000 litres.

WHERE IS DESALINATION MOST COMMON?

The International Desalination Association estimates that there are nearly 20 000 desalination plants worldwide producing water for over 300 million people. Most of them are situated in arid countries that have few other options and relatively cheap and subsidised energy. For instance, Kuwait, an oil-rich country in the Arabian Desert, gets all its drinking water from desalination.

WHAT ABOUT DESALINATION IN SOUTH AFRICA?

In South Africa, desalination is used quite widely by mines to clean up polluted mine water and acid mine drainage. Small- to medium-scale desalination has also been used in coastal towns during times of drought. Six municipalities – Mossel Bay, Knysna, Bitou, Ndlambo, Cederberg and Richard's Bay – have small-scale reverse osmosis plants to desalinate water for bulk water supply.

SO WHY AREN'T WE DOING MORE DESALINATION?

For arid and drought-stricken coastal cities, desalination can be an important source of water that is completely independent of local rainfall. However, desalination remains the resource of last resort because it is the most expensive (see page 9 for comparative water costs).

WHAT OTHER CONSTRAINTS ARE THERE?

The availability of electricity is also a potential problem. Concerns have been raised in the USA that electricity supply in local grids is not able to accommodate new desalination plants built in response to the Californian drought. South Africans still remember load-shedding caused by an electricity supply crisis. A further energy crisis at the same time as a water shortage would put desalination plants at risk. Most of our energy is generated by coal-fired power stations, which means our energy generation puts a lot of greenhouse gases into the atmosphere. This is a cause of climate change – which in turn would fuel future droughts.

WHAT IS CLIMATE-NEUTRAL DESALINATION?

Climate-neutral desalination relies solely on renewable energy, which neither produces greenhouse gases nor contributes to climate change. Solar-powered desalination plants are found in California, for example, but at this point the water generated in this way costs even more than water from conventional desalination.

ARE THERE ANY OTHER ENVIRONMENTAL CONCERNS?

Desalination plants need twice as much seawater as they produce freshwater. Often the seawater intake points suck in small organisms such as fish larvae and plankton which can negatively affect local fish populations. The by-product of the desalination process is highly concentrated brine, which is generally disposed of back into the sea. As well as being very salty (which is toxic, even in a marine environment) this brine contains biocides and antifouling chemicals used in the desalination process, which can also harm marine life.

HOW EXPENSIVE IS DESALINATION COMPARED TO OTHER SOURCES?

Globally, desalination is two to four times as expensive as most other sources of water depending on the relative cost of capital equipment (for instance, how much has to be imported), the cost of energy and the cost of labour to implement other water savings.

WHAT ARE THE LONG-TERM LESSONS HERE?

We have been warned about overinvesting in a source that other wealthier countries have had to mothball because of excessive energy costs. In Australia, the severe drought from the mid-1990s until 2012 prompted the construction of six large-scale seawater desalination plants at a cost of 10 billion Australian dollars. The plants took years to build. Meanwhile, Australia's National Water Initiative implemented water policy reforms and improved efficiency measures that led to cheaper water supply alternatives. By the time the plants were operational, the drought was over and the more cost-effective alternatives made desalinated water prohibitively expensive. Most of these facilities have stood idle or are operated at significantly reduced capacity.

COMPARATIVE WATER COSTS FOR CAPE TOWN (2018)

RAW SURFACE WATER
R1–R4/ KILOLITRE

ALIEN CLEARING TO RELEASE MORE WATER FROM OUR CATCHMENTS
R6–R15/ KILOLITRE

NEW GROUNDWATER
R15/ KILOLITRE

RECLAIMING AND REUSING TREATED WASTEWATER
R10–R20/ KILOLITRE

LARGE-SCALE, PERMANENT DESALINATION
R10–R22/ KILOLITRE

SMALLER, SHORT-TERM DESALINATION
R34–R44/ KILOLITRE

GETTING TO GRIPS WITH GROUNDWATER

Groundwater use came under the spotlight as an off-mains source of water that could help households reduce the demand for bulk water provided by municipalities. But groundwater is not only a hidden resource, it is a national asset that belongs to all South Africans, and needs careful management.

WHERE DO WE FIND GROUNDWATER?

The geology (type of rock) under your property determines whether or not there is likely to be an aquifer (underground water supply). If you are on sand, calcrete or hard-fractured sandstone there is likely to be groundwater. If you live on thick clay or granite, you are unlikely to have enough groundwater to pump.

WHAT'S THE DIFFERENCE BETWEEN A WELLPOINT AND A BOREHOLE?

Wellpoints tap into loose sand aquifers. They are generally shallow, have a narrow diameter pipe and are quick to install. A borehole can vary from a few metres to hundreds of metres deep. A borehole is drilled at a much wider diameter than a wellpoint, into either loose sand or hard rock using a larger drilling rig.

YOU MAY PUMP UP TO 400 m^3 PER HECTARE PER YEAR IN CAPE TOWN

WHO CONTROLS HOW MUCH GROUNDWATER YOU'RE ALLOWED TO USE?

The Department of Water and Sanitation (DWS) controls all aspects of water use. This includes how much groundwater you can take out and what to use it for. Municipalities also have a say in what you are allowed to use this water for under their by-laws and the water restrictions. If you want to insert a wellpoint or drill a borehole, you have to register your borehole or wellpoint once it is drilled. And, unless you have been given a licence by the DWS, you are not allowed to pump more than 400 m^3 per hectare per year – which is about 1 000 litres a day (that is only about 100 litres per day on a 1 000 m^2 stand/erf) in Cape Town. Every area has its own 'General Authorisations' for groundwater use (that is the amount of water you can use before you need a licence). The maximum is 750 m^3 per hectare per year, so about 200 litres per day per erf.

WHAT CAN YOU USE GROUNDWATER FOR?

You are allowed to use groundwater for basic garden and household needs, but you may not use it on a commercial scale or sell it.

GROUNDWATER NEEDS TO BE TESTED FOR SALTS, METALS, NUTRIENTS AND BACTERIA TO BE SAFE TO DRINK

IS IT SAFE TO DRINK GROUNDWATER?

Under normal circumstances, drinking water should only be sourced from treated mains water. It is not safe to drink untreated groundwater without testing it and, in many cases, treating it. In order to find out how to make groundwater safe to drink (potable) you will need do a laboratory test for salts, metals, nutrients and bacteria (preferably the full South African National Standards or SANS 241 test for drinking water). The acidity or pH level of the water also affects what the water can be used for. When you take a sample it's very important that you first purge (pump out) the borehole, use a sterile container and don't touch the inside or lid of the container (this can introduce bacteria, which will show up in the test). Once you know the water quality, you can find out how to treat it and make it safe to drink under emergency conditions. In many cases, this will require very basic treatment.

IS OUR GROUNDWATER ALSO GOING TO RUN OUT?

Like any renewable resource, if we take *out* more than is going *in* over the long term, groundwater will run out. Because groundwater is a large store of water, it takes longer than rivers and dams to be affected by drought. But to ensure that there is a fair share of this hidden resource for everyone for a long time, we need to measure how much we use, monitor the water levels and be sparing. We should make the most of aquifers as an important water store in cities or towns (aquifers are nature's dams!). We can do this by making sure that when the rains come, as much rain and stormwater are able to soak into aquifers underground through drainage basins.

WHAT ABOUT THE NEW RULES ON METERING SET BY THE DWS?

On 12 January 2018, the DWS introduced new rules which said all private boreholes must be metered and that the amount of groundwater abstracted must be recorded on a weekly basis and submitted to the DWS. While it is necessary to monitor what we want to manage, many people are concerned that detailed reporting of this nature is unmanageable. A second new rule also states that we must use this resource sparingly and not for business-as-usual purposes.

WHAT ARE THE DANGERS OF USING TOO MUCH GROUNDWATER?

If a lot of groundwater is abstracted close to the coast, there is a danger of seawater 'intruding' into the aquifer – salt water fills the aquifer and this water can't be used by homeowners or farmers unless it is desalinated back to freshwater. When we pump groundwater, the water table drops. Active boreholes situated close together can bring down the water table even more. In extreme circumstances where lots of groundwater is removed, the aquifer itself can collapse and land subsidence (caving in) occurs. Our current groundwater store has been built up by rainfall over decades if not centuries. We all want to use this store for the long term, so it's critical that we use it within sustainable limits.

HOW TO SECURE SAFE DRINKING WATER

As Day Zero edged closer, people in Cape Town began stockpiling water from shops and springs. The idea of designated collection points was an uncomfortable thought, and many people started to look at alternative emergency sources such as rainwater tanks, pools and boreholes. These sources made sense for toilet flushing and washing, but what about drinking and cooking?

HOW DO I KNOW IF MY BOREHOLE OR RAINWATER IS SAFE TO DRINK?

Untreated water contains various invisible microbes such as bacteria, viruses and protozoans (eg the *Giardia lamblia* and *Cryptosporidium* parasites). These harmful microbes can cause diseases as well as diarrhoea and vomiting. Unlike the pretreated water that comes from our taps, if water has not been treated it's best to assume it is not safe to drink. The only way to know if untreated sources – whether rainwater or groundwater – are safe to drink is to have a water sample tested in a registered laboratory. You can also use hydrogen-sulphide home tests to indicate whether the water contains harmful bacteria.

HAVE YOUR ALTERNATIVE WATER RESOURCE TESTED WITH THE SANS 241 TEST

WHY MUST I TEST MY UNTREATED WATER IF I WANT TO DRINK IT, AND HOW DO I DO THIS?

You do not want any bacteria in your drinking water. Bacteria are the biggest danger and in any emergency situation the water must be treated for bacteria before drinking it. You need to look at the water chemistry to see what the salt, metal or heavy metal content is. The list of elements to check for is long (over 40) and each one has to be considered based on its concentration and health implications. The correct test to use is SANS 241. Water suppliers, like municipalities or disaster-response teams, use this test every day to check our drinking water. So keep in mind that your water quality could change – especially stored rainwater after a heavy storm. Rather be cautious and treat your water.

IS IT STILL SAFE TO DRINK TAP WATER AS WE DRAW WATER FROM THE BOTTOM OF THE DAMS?

Tap water remains a source of safe drinking water as long as it continues to meet the national water standard requirements. The water at the bottom of dams is often of a poorer quality because of particles that become concentrated and settle, therefore it takes extra effort and care to abstract and treat this water – which is the responsibility of your municipality. However, during water outages, pipes will stand empty and there is a risk of dirty water flowing into the pipes at places where there are cracks. So when the taps are turned back on, be careful about drinking the water. Basic treatment, like boiling, is advised in places where the water supply has been interrupted. Your municipality should alert you if there are changes in the water quality and if certain neighbourhoods are experiencing problems.

TESTED BOTTLED WATER SHOULD CARRY THE SANBWA LABEL

WHAT ABOUT BOTTLED AND SPRING WATER?

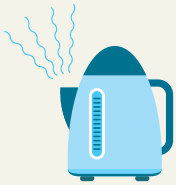
Typically bottled water is one of the safe sources to turn to. To be assured that bottled water has been tested, look for the SANBWA label – the South African National Bottled Water Association. SANBWA tests and confirms that water bottled by its members meet the required health standards. Another popular water source for many residents is spring water, but springs are not part of the municipal water system and are thus not regularly tested by authorities. Interest groups may test the water from time to time and currently many people drink spring water without treating it. You are advised to use your own judgement and be aware that you do this at your own risk.

WHY SHOULDN'T I DRINK WATER STRAIGHT FROM MY RAINWATER TANK?

Although pure rainwater is clean enough to drink, the water collected in rainwater tanks has been recovered from your roof and gutters, which might contain bird, squirrel or rat droppings and leaves, as well as dust that contains chemicals from air pollution. This water should be cleaned and disinfected before drinking.

WHAT'S WRONG WITH DRINKING UNTREATED BOREHOLE WATER?

Groundwater outside cities is often safe to drink, but it is wise to assume that all borehole and wellpoint water in urban areas should be treated before drinking it. Typical problems are high iron and/or salt levels, as well as microbes from overflowing or leaking wastewater systems and from homemade pit latrines, where a hole is dug in the ground. Be aware that a Day Zero situation may result in a breakdown of the sanitation system and you and your neighbours may have to create your own pit latrines. As a result, there may be a growing risk of sewage contamination, so be sure to plan for a sound microbial treatment method when you sink a borehole or wellpoint. Water from streams and wetlands should be treated with equal caution.



BOIL WATER FOR AT LEAST THREE MINUTES TO KILL MICROBES

WHAT IS THE EASIEST WAY TO MAKE WATER SAFE TO DRINK?

The most important step is to make sure that water is free of microbes (bacteria, viruses and protozoa) to prevent outbreaks of diarrhoea. Chemicals dissolved in the water (such as nitrates) are a less acute health threat when you are only drinking this water for a short time. People with compromised immune systems, babies and the sick should use bottled or tap water as far as possible. The simplest and safest way to kill microbes in drinking water is to boil it for at least three minutes. Remember, this treatment is only necessary for water you are going to drink or cook with.

HOW DO I SAFELY STORE MY DRINKING WATER?

It is essential to store your drinking water safely, so that it does not become contaminated again. Clearly label any drinkable water, collected and stored in clean (sterile) plastic/glass/stainless steel containers. You can use a baby-bottle disinfectant (like Milton) to sterilise your containers and keep them in a cool, dark place to prevent any microbial or algal growth. It is also preferable to use food-grade plastic – this is determined by the number within the three-arrow triangle that classifies the type of plastic. Food grade means that no harmful BPA will leach into the water over time. The BPA-free plastics are those with numbers 1, 2, 4 and 5. Make sure that your water container is sealed so that nothing can get in. Also, wash your hands before you handle it and make sure the scoop or funnel you use to transfer the water into and out of your water container is clean.

WHICH OTHER METHODS CAN BE USED TO TREAT DRINKING WATER?

There are many ways to treat water and the effectiveness of the different methods varies greatly. Sometimes a combination of methods is advised for water sources carrying a high risk of both microbial and chemical contamination (such as groundwater, river and wetland water). For more information, see the table below.

WATER TREATMENT METHODS

FACTORS TO CONSIDER	BOILING	FILTRATION			DISINFECTION		ATMOSPHERIC WATER GENERATOR	DISTILLATION
		Activated carbon water purifier	Filters with less than 1 micron absolute pore size	Reverse osmosis	Chlorine (unscented household bleach/iodine)	Chlorine dioxide		
Treatment of microbes (bacteria, viruses, protozoa)	Highly effective	Not effective *	Effective for protozoa, less so for viruses and bacteria	Effective	Effective for bacteria and viruses, less so for protozoa	Effective for bacteria and viruses, moderately effective for protozoa	Highly effective	Highly effective
Treatment of chemical contaminants (such as iron, pesticides, salts)	Not effective	Low effectiveness	Low to moderate effectiveness	Highly effective	Not effective	Not effective	Highly effective	Highly effective
Cost (2018)	Cost of energy to boil	R200–R1 500 + filter replacement	R1 500–R3 000	R1 000–R100 000 depending on volumes to be treated	R30–R300	R300–R800	R18 000 upwards	Homemade: cost of energy to boil; bought: R2 800
Accessibility	Easy but it needs energy	Easy. Ensure regular filter changes	Easy. Ensure regular filter changes	Accessible but needs high-pressure pump to function	Easy. Retailer and online but check instructions	Moderate. Available as tablets online. Check user reviews	Moderate (current demand exceeds supply)	Relatively easy but provides a limited amount of water
Water source	All freshwater sources	Tap, spring, chlorine pool water	Tap, spring, chlorine pool water, rainwater tank	All sources, including sea water	Tap, spring, chlorine pool water, rainwater tank	All freshwater sources	Air	All sources, including sea water
Examples of brands **	Use your own pot and stove	Brita jugs, average undercounter kitchen filters	Ceramic filters like the Silver Streak Water Filtration System, Stefani Water Purifiers	Puritech, ALLofWATER APEC, Home Master	Jik, Milton, Rothco's potable aqua purification tablets	Watermaker, Micropur, Aquamira	Water from air	Household: use your own pot and stove; see watermakers for yachts

** Use another method to treat for microbes FIRST, use carbon filters only as the LAST treatment step to eliminate odours or improve taste.*

*** A wide range of brands is available. Some brands combine treatment methods. WWF mentions brand names to direct readers' research, not to endorse specific brands.*

WHAT TO DO WHEN YOU CAN'T FLUSH THE LOO

When water is cut off, our first concern is for drinking water, but pretty soon we realise that the sudden loss of water to flush toilets poses very serious problems as well. A sanitation and disease crisis can result when there isn't enough water to flush toilets. Here are some alternatives in a worst-case scenario.

IN A DROUGHT SCENARIO, WILL I BE ABLE TO FLUSH WITH RAINWATER OR GREYWATER?

You should be able to flush your toilets with rainwater, greywater or groundwater as long as the sewer systems are still functioning. It would be wise to use as little of your precious daily allocation of drinking water for flushing – so it is worth considering alternative dry options to save water.

WHY CAN'T I JUST FLUSH WITH SEAWATER?

Flushing with seawater in the metropolitan area is *not* an option. This will increase salt in the wastewater treatment plants. If the salinity levels get too high, the microbes which treat the sewage can't survive and the treatment plants will stop working. That will create an even bigger problem as the wastewater plants would become inoperable. The same principle applies to septic tank systems that rely on microbes to decompose the sewage.

GOOD SANITATION, COMBINED WITH HAND-WASHING, DRAMATICALLY REDUCES THE RISK OF DISEASE

WHAT IS MORE DANGEROUS: URINE OR FAECES?

Urine (pee) is essentially sterile, which means it is free of bacteria. If you can urinate in your garden onto soil it will be absorbed and not present health problems providing the volumes aren't too high. Spread it around so that it doesn't get concentrated and smell. In contrast, faeces (poo) present a health hazard because they can contain harmful bacteria. That means it is critical that faeces are dealt with safely and do not come into contact with people or animals such as dogs. Open defecation (pooing in the veld or on farms) is a hazard and globally there are many initiatives trying to eradicate this practice to ensure both dignity and health. Our waterborne sanitation system has been designed to safely remove pee and poo and ensure we don't come into contact with it. Good sanitation, combined with hand-washing, dramatically reduces the risk of disease. We need to relook at the best methods to safely provide sanitation while using less water. This challenge is recognised around the world.

A DRY TOILET IS A BUCKET HOUSED IN A BOX WITH A TOILET SEAT AND ORGANIC MATERIAL FOR DIGESTION

SO WHAT IS THE SIMPLEST SOLUTION?

One option is dry sanitation. A dry toilet, as the name suggests, operates without any water to flush away poo or pee. The easiest option is a dry composting toilet. This is a bucket housed in a box to support your weight with a toilet seat of your choice and organic material to cover the poo. The cover material can be sawdust or decomposed compost (which contains lots of good bugs to digest the poo).

If you use a dry composting system, it's really important to keep your face well clear when handling the buckets and use a good pair of kitchen gloves that you can clean and reuse specially for the task.

After the Christchurch earthquake in New Zealand in 2011, an organisation called Relieve coordinated an effort to provide information and support for people who were doing without their usual sewerage systems.

HOW DOES IT WORK?

The ideal is to separate the pee and the poo (urine diversion) as much as possible, because if the mixture is too wet, it will hamper decomposition. The aim is to keep the poo bucket, which poses the highest health risk, from filling up too quickly.

Estimates are that one person produces about 1 to 1½ litres of urine a day that can be disposed of in a green space or in your compost heap. For people in high-rise buildings, the urine can still go in the conventional toilet but the paper should be disposed of separately. There are also products that mask the smell.

Poo has to be carefully managed to avoid diseases and can be converted into 'humanure' (compost) through a full composting process which takes several months. In an emergency situation, ideally this should be managed in a centralised system by the local authority. There are composting toilets that have urine diversion mechanisms incorporated into their design. There are also many websites with more information on how to construct your own composting toilet and how to safely process the waste.

WHAT OTHER ALTERNATIVES ARE THERE?

Pit latrines: Some people will probably be thinking of the old 'long drop' or pit latrine system often found in rural areas – but they can be smelly and difficult to maintain, depending on the geology of the soil. Pit latrines are also problematic in urban areas as they could contaminate the groundwater supply.

Commercial composting toilets: Another option is to invest in a commercial composting toilet system that uses the natural process of decomposition to break down human waste, yet is self-contained. There are a number of commercial self-contained dry toilets available in South Africa but these are not always suitable for small dwellings.

Chemical toilets: Chemical toilets are often used by campers or at outdoor events. However, these toilets also need to be serviced regularly.

ALTERNATIVE SANITATION

TYPE OF SANITATION	HOW MUCH WATER?	DOES IT NEED A GARDEN/OPEN SPACE?	CONSIDERATIONS	COSTS
Minimal flushing of normal toilet	5-litre flushes with grey-/rain- or groundwater	✗	Need to dispose of toilet paper separately	Initial capital costs of alternate water source
Commercial composting toilet	✗	✓	Location, space, substrate	±R10 000
Chemical toilets (including camping toilets)	✗	✓ (for large chemical toilets) ✗ (for camping units)	Generally a rental agreement with service fees included. Managed by a company. Important to consider number of people using the toilet.	Costs can only be calculated once a company has the following: - the number of people using the toilet - distance from the service provider - type of unit required
Bucket composting toilet	✗	✗	Need to dispose of solid waste	Minimal – R200 for bucket and sawdust, but there are people building units with toilet seats
Pit latrine	This should not be considered within the metropolitan area but could be useful in drought-affected rural areas.		Consider the substrate, location relative to water sources, rivers, lakes, groundwater, etc	Labour to construct and basic building materials (R2 000–R10 000)

THE POWER OF PULLING TOGETHER

In a crisis, people soon realise that they need to reach out to others rather than compete in order to cope: strong arms, time, DIY, organising skills and good communication skills are all required to see citizens through a period of extremely limited water supplies.

I'VE SORTED OUT ALL MY WATER NEEDS ALREADY, SO WHY SHOULD I GET INVOLVED?

One of the biggest misconceptions about a water crisis is that by having high walls and stockpiling resources (be it in the form of bottled water, bigger and bigger rain tanks or a borehole) you can somehow shield yourself from the turmoil brought on by water scarcity. These resources alone won't get you through a crisis. Crises are defining moments and will make or break a neighbourhood, community, town or city. As individuals we need to be prepared in our own households and workplaces and support others to cope.

"Everyone in a community has something to offer and can create a shared solution to a crisis."

HOW CAN I HELP?

Think about what you might have to offer in terms of helping yourself and others to cope with less water. Perhaps you are able to fix leaks, solve plumbing/borehole problems or can offer transport to alternate sources of water or distribution points. Maybe you have strong people to help lift water containers when water's no longer available on tap; have time to organise solutions in the home or school; can access communication groups to coordinate quick responses; or have money to donate to people with little or no income who are struggling to fix leaks and save water. Everyone in a community has something to offer and can create a shared solution to a crisis.

WHO IS IN MY COMMUNITY?

If there's a group that you belong to that would benefit from stronger cooperation around water saving and sharing, start the conversation and connect, coordinate and organise yourselves. All of us belong to various communities – from extended families, to your street, school, church, sports club and virtual communities like WhatsApp and Facebook groups.

NEIGHBOURHOOD MEETING

INFORM RESIDENTS ON HOW TO REDUCE WATER USE

↓

HELP THE ELDERLY/ VULNERABLE PEOPLE

↓

ESTABLISH WHERE THE WELLS AND BOREHOLES ARE IN YOUR AREA

↓

ESTABLISH IF THE WATER IS GOOD FOR HUMAN CONSUMPTION

↓

LOOK AT SOME BASIC RULES SURROUNDING WATER POINTS

EVERYONE IS REALLY STRESSED OUT. HOW DO WE STOP THINGS FROM GETTING OUT OF CONTROL?

Everybody has their own world view. Your view may differ from that of family members, friends, neighbours or fellow citizens – and that's okay. The key is to listen to each other rather than withdraw. In that way we may be able to come up with creative, workable solutions we haven't thought of before.

HOW CAN I GO ABOUT CONVENING A WATER MEETING?

If nobody else in your neighbourhood or community has taken the lead yet, consider starting a group yourself. Use existing channels to gauge support from others. If somebody else is thinking along the same lines, then work together rather than competing. The primary purpose of forming a group is to reduce water consumption as much as possible and to prepare for the worst-case scenario.

WHAT QUESTIONS SHOULD WE BE ASKING AT OUR FIRST MEETING?

Depending on the nature of your group, there will be a range of issues you may need to look at. If it's a neighbourhood meeting, you might choose to inform residents on how to reduce water use, figure out a plan to help the elderly or other vulnerable people, establish where the wells and boreholes are in your area, how you can treat this water so that you can use it for cooking, and how neighbours can access boreholes in the most convenient way possible. You might also need to look at some basic rules such as the fact that you can't sell water, but it might be fair to offer to share electricity costs for pumps, for example.

In a work environment you might look at continuity plans for employees, assist with access to water containers, and communicate information and advice on how to save water at work. Body corporates should also be looking at how to save water and be putting emergency plans in place for issues such as sanitation.

SHOULD WE STILL BE TALKING TO THE MUNICIPALITY OR SHOULD WE GO IT ALONE?

It is essential that the lines of communication stay open. There are some areas you will have no control over and only the municipality and its officials will have the answers. This is where ward councillors and ward committees should also be stepping up as the liaison between the municipality and your community. Some groups, such as neighbourhood watches, already have strong relationships with the municipality and the South African Police Service, so it makes sense to task them with keeping these lines of communication open.

KEEPING THE DOORS OF WORK OPEN

Businesses should have plans in place to reduce water demand, diversify water sources, and also prepare for the impact on direct operations with staff, neighbouring businesses and suppliers in the event of prolonged water cuts.

HOW COULD AN ONGOING DROUGHT IMPACT ON MY WORKPLACE?

Your work life is likely to be affected in a variety of ways. If water is an essential part of the business you are in, you will probably be doing things differently in order to adhere to water restrictions. If you are in an office job, you should change the bathroom etiquette to allow reduced flushing ('if it's yellow, let it mellow') and the use of hand sanitiser instead of running water. But a water shutdown scenario would affect many workplaces more gravely. There might be radical changes in operations, such as shorter shifts, flexitime or work-from-home arrangements. There might also be complete shutdowns and possible retrenchments. It will depend on your industry and the level of continuity planning your workplace has been able to achieve.

ASK IF YOUR WORKPLACE HAS A BUSINESS CONTINUITY PLAN AND INCIDENT RESPONSE PLAN TO DEAL WITH THE DROUGHT

WHAT QUESTIONS SHOULD I BE ASKING MY EMPLOYER?

Ask management to show you evidence of how much water your company was using before the drought, and how much you are using now. Ask if your workplace has a business continuity plan and incident response plan to deal with the drought. If so, ask them to circulate or communicate once it is ready, so you can see what your employers have done in terms of risk assessment, drought preparation and contingency plans. Ask for clarity around issues such as reduced working hours, shifts, flexitime or work-from-home arrangements. Who has to be at work no matter what (essential services)? Are the circumstances of individual staff members, such as parents with young children whose crèche might close, factored into such a scenario? How will the time needed to queue at distribution points for water be managed?

IS THERE A RISK OF BUSINESS SHUTDOWN AND PEOPLE LOSING THEIR JOBS?

Retrenchments are a realistic and worst-case possibility for employees in industries that are completely dependent on water, for example laundries, textile manufacturers, printers, food-and-beverage manufacturers, gardening services, pharmacies, gyms, plant nurseries, farms, hairdressers, bottle-washing factories or pool companies. Domestic workers and gardeners might face a similar risk. Some areas may have water pressure drops already, making it difficult to operate the business as normal. If you are faced with the risk of retrenchment, or are worried about it, it is important for you to get clarity about the decisions your employers have made about the drought. The usual formal procedures regarding retrenchment should apply during a water crisis. Staff should be consulted, given sound reasons and given the option of representation. The employer should explore alternative options and follow the correct administrative procedures.

TEMPLATES FOR BUSINESS CONTINUITY PLANS ARE FREELY AVAILABLE ON THE WEB

WWW

fedhasa.co.za/wp-content/uploads/2018/02/JAMMS-Business-Continuity-Plan-Template.pdf

HOW CAN AN EMPLOYER PUT TOGETHER A BUSINESS CONTINUITY AND INCIDENT RESPONSE PLAN?

The purpose of a business continuity plan is to help you ensure that your business can continue during and following any critical incident that disrupts your normal operations. Many businesses drew up such plans during the energy crises in South Africa in 2008 and 2013/14, and now these need to be reworked for water. What are your risks, how are you preparing and how will things continue? An incident response plan would form part of the business continuity plan. Templates for plans of this nature are freely available on the web although they are unlikely to be tailored for a Day Zero scenario.

WHAT ABOUT THE WATER RISKS THAT SUPPLIERS FACE?

No business works in isolation. There is always a supply chain and your suppliers' water woes, whether in or out of their control, might in turn affect you and your workplace. Examples are: hotels and laundry services, food manufacturers and farmers. It is important to engage with people in the supply chain in order to understand how a water crisis affects their operations – and in turn, your own.

" It would be a real win if we could turn our crisis-saving steps today into our collective water stewardship for tomorrow. Water is everybody's business."

CAN THE CONCEPT OF NEIGHBOURLINESS APPLY IN BUSINESS?

Yes, it can. Reaching out to your supply chain, your direct business neighbours and your staff can all be acts of neighbourliness or growing community support. Neighbouring businesses could initiate a discussion and seek joint solutions, like sharing the costs for sourcing an alternative water supply or joint security planning. Businesses can play a valuable role in informing staff about drought issues, or by offering support to staff at home, if needed. Examples could be the payment of a plumber to staff households that struggle with leaks; sponsoring retrofitting devices; the offer of a workplace crèche, and the distribution of information to all staff. The more drought-resilient the staff, the less work disruption there is likely to be.

IF THERE IS NO WATER SHUTDOWN, WILL ALL THIS EFFORT AND EXPENSE IN THE WORKPLACE BE FOR NOTHING?

Some areas will not get out of severe water restrictions in the next year or two, while others may start to experience severe drought. It is worthwhile making long-term adaptations in the workplace. Office use – and the resulting water bill – will be greatly reduced in the long term if you budget now to invest in retrofitting devices such as low-flush toilets, tap and shower restrictors and waterless urinals. It would be a real win if we could turn our crisis-saving steps today into our collective water stewardship for tomorrow. Water is everybody's business.

LIVING THE WATER-LESS LIFE

Throughout the water crisis, ordinary citizens internalised the water-saving message and were keen to share their tips and experiences.

HOW DO I STAY CLEAN WITHOUT USING TOO MUCH WATER?

90-SECOND SHOWERS

New bathing and washing habits are required to adapt to the 'new normal'. It's inspiring to see how efficient and innovative people in drought-stricken areas have become within a short space of time. To keep our bodies clean, we should continue to take occasional on/off 90-second showers and alternate these with having a sponge or splash bath. You can also use a squeezy bottle or spray for a 'spritz shower' to make an extreme water saving. Alternatively, you could share the same bathwater with family members. Each family member can take turns choosing their preferred bathing order. Make it a family affair! You can prepare a combo spray of shower gel and water to lather your body before even switching on the shower to rinse. You can do the same for hand-washing, especially if your skin is sensitive to the waterless hand-cleansing products available.

HOW DO I KEEP MY CLOTHES FRESH?

Staying nifty with minimal effort is totally possible. 'Refresh and rewear' is the new wash and wear. Air-drying clothes after wearing them reduces laundry loads and saves water. Hanging clothes directly after wearing also avoids crumples and creases, which also means less ironing. Less frequent washing and ironing also help to preserve the quality of school uniforms, delicate fabrics and your favourite items. One way to freshen clothes is to use baking soda, which is available at any supermarket: put your dirty clothes into a bag with half a cup of baking soda, shake it around a bit and then leave for 10 minutes before dusting off your clothes and voilà! your clothes will smell fresh again. There are many other cheap ways and substitutes for baking soda – such as lemon juice and vinegar – that can be used to deodorise and spray clothes.

WHEN BUYING NEW CLOTHES CHOOSE EASY-CARE FABRICS AND COLOURS LESS LIKELY TO SHOW DIRT

HOW CAN I CUT BACK ON THE AMOUNT OF LAUNDRY WE HAVE?

With washing machines using between 50 and 150 litres per load, we need to reconsider and reduce our laundry loads. For example, your favourite denim items don't need to be washed every week. Once your personal washing needs are reduced, combine the things that need washing with friends or family to create a combined wash so that you run a full machine less frequently. Hanging bed linen outside once a week also helps to freshen it up and shake out accumulated dust, hair and skin cells without adding to the washing load. Wash just your pillow cases and air-dry the rest.

If you have a washing machine or use a laundromat service, also take time to get to know your options, such as finding the cycle that uses the least water (it might not always be the eco-cycle in some models) and know how to control the functions. For example, you can skip the default rinse cycle after every wash and shoot straight to the spin cycle to save water. For heavily soiled items such as children's clothes, consider soaking in a premix of soap powder and water before adding to the washing machine. When buying new items, choose easy-care fabrics and colours less likely to show up dirt.

SCRAPE AND WIPE OFF PLATES BEFORE WASHING

WHAT ABOUT THE WASHING UP IN THE KITCHEN?

With the washing of dishes taking up to nine litres of our precious daily allocation of drinking water, we need a change in our dishwashing culture. Let's start with scraping and wiping off plates before washing. A small amount of boiling water can be used to loosen and soften food stuck on plates, and this water can be reused and repoured onto other dishes that also need to soak. Keep moving this water between dishes that need to soak, and be sure to transfer it to a bucket to use for future loo flushing. Do the same with any sink and rinsing water. You can also create a dishwashing soap and water mixture to spray and wipe dishes instead of washing and rinsing them separately. We also need to group our dishes together to aim for one sink wash per day or one dishwasher load a day (on eco-cycle).

HOW CAN I USE LESS WATER WHEN COOKING?

Home-cooked meals are the way to go because they are healthier, cheaper and consume less water than eating out. The best water-saving methods with home cooking are to make one-pot or open-pan meals rather than cooking in multiple pots at a time. In this way you still get your 'buffet-style' dinners but with using less water and fewer cooking utensils, resulting in less washing up afterwards. Cooking in bulk and freezing the food is also worth considering. Braais are always the perfect excuse to bring everyone together but, for quieter days, grills and slow cookers make nutritious meals with less water.

HOW DO I ENSURE THE BEST TOILET HYGIENE?

REUSE GREYWATER TO MOP FLOORS, WATER PLANTS, CLEAN CARS AND FLUSH LOOS

The biggest realisation from a drought is that we can no longer afford to flush away perfectly good drinking water with every pee. However, with more efficient water saving in our daily lives, greywater also becomes less available for reusing to flush. We need to realise that we can save and reuse every drop of water that we use elsewhere. So shower water can be used to mop, then to flush. Dish-washing water can be used to wash, then to flush. We should also catch the water from rinsing our pasta and rice, and any veggie cooking water too. You can invest in microbial flushing products (such as Wee Pong or Poo-Pourri) to reduce the number of flushes and odour. These products are relatively easy to find with a range of prices to suit your needs.

CAN YOU SUGGEST ANYTHING FOR KEEPING MY CAR CLEAN?

You can still keep your car clean without making a splash. Use reliable waterless car-care products or greywater to wash your car at home.

HOW CAN I REUSE MY GREYWATER?

No water should leave our homes after a single use, and we can often give our greywater a second or third life. We need to change our relationship with greywater if we haven't already. Greywater can be used to mop floors, water plants, clean cars and flush loos.

PREPARING FOR A WATER SHUTDOWN

There are many things which can be researched and assessed in advance so that we are aware of the options and prepared for a worst-case water scenario.

DRINKING WATER

- If water cuts are looming, ensure that you have enough clean storage containers for drinkable water – and store them in a cool, dark place.
- If you are likely to use an alternate source of drinking water (rainwater or groundwater) make sure you have a sample of that water tested at a registered laboratory (SANS 241).
- Start thinking now about the treatment method that is best suited to you (refer to page 14), water sources and your needs, and make sure you have everything you would need to treat and safeguard your drinking water. Find out more about treatment of drinking water:

WWW The World Health Organisation (WHO) provides many documents describing the household treatment of drinking water on their **website**: who.int/water_sanitation_health/water-quality/household/household-publications/en

WWW Drinking-water quality guidelines can be **found here**: who.int/water_sanitation_health/water-quality/guidelines/en

WWW Treatment of water following emergencies and disasters are explained on **these pages**: who.int/water_sanitation_health/publications/hwts-following-emergencies-and-disasters/en

WWW The Centers for Disease Control and Prevention, or CDC, provides fact sheets on **'Making Water Safe'**: cdc.gov/healthywater/emergency/drinking/making-water-safe.html

GROUNDWATER

- Find out how much groundwater you are allowed to use and for what, according to your local by-laws and the 'General Authorisations' set by the DWS.
- If you have a borehole or wellpoint you need to rely on during water cuts: Make sure your pump is in good working order. When was the pump last serviced? Do you have the necessary spare parts? Now is the time to think ahead, get it serviced and make sure you can rely on it.
- If you haven't done a water quality test within the last six months, test your water at a SANAS-registered laboratory. As a minimum you need to know the levels of total dissolved solids (TDS), pH, nitrate, iron, *E. coli* and coliform bacteria. A full drinking-water test is the SANS 241 test.
- If you don't have a borehole but your neighbours do, start talking to them about sharing emergency access to their groundwater if needs be.

ALTERNATIVE SANITATION

- Work out what is going to be the best option for you depending on your circumstances. Do you have a garden? Do you have alternative water sources that can be used to flush your toilets? How many people live in your household? What can you afford?
- Do some research on your preferred method – there is a lot of information on the Internet.

WWW
- facebook.com/groups/drysanitation
- facebook.com/CompostLoo
- diyhousebuilding.com/bucket-toilets.html
- composttoilets.co.nz

- Think about doing a 'dry run' and testing your method (if it's something simple like a bucket) so you know what you need.

COMMUNITY

- Find out who is already active in areas of your life most directly linked to water (street, school, work) and join forces with them if you can.
- Talk to your neighbours to find out what they are doing about the water crisis and to establish your collective resources: who is a handyman/plumber; who has access to groundwater or rainwater; who is physically strong and can help the less able with lifting water containers; who has time to assist others?
- If nobody has taken the initiative yet, convene a meeting to talk about water – but be sure to have a clear agenda and to keep it civil.

BUSINESS CONTINUITY

- As an employee, initiate a water-related conversation at work, asking your management about a business continuity plan and how much water the company has already saved in its direct operations and supply chain.
- As a trade union member, ask your labour representative if your union has a stance about water and drought crises.
- As a manager, ensure that 'water saving and adaptation' becomes a prominent budget line for the new financial year. You should also clearly determine roles and responsibilities in your organisation.
- As a manager or business owner, share your plan with your staff. Information sharing builds the relationships that will see us through this together.

WE ARE NOT ALONE

The World Economic Forum listed water crises among its chief concerns in its Global Risks Report 2018. Many cities are now struggling to make the transition to climate-resilient water budgets that reduce demand and increase levels of reuse and recycling.

SAO PAULO CAME TO WITHIN 20 DAYS OF RUNNING OUT OF WATER

SÃO PAULO, BRAZIL (21 MILLION*)

The largest city in Brazil went through a major water crisis from 2014 to 2016 when about two-thirds of São Paulo's population experienced a water shortage. At the end of 2014, the Cantareira reservoir sank to its lowest levels (dropping below 5%) and the city came to within 20 days of running out of water.

Since human water supply is a priority under law, industries and farmers from across the state were heavily affected by cutbacks, which exacerbated the financial crisis that these sectors were already facing. Multiple factors were at play, among them a lack of long-term planning, limited incentives for consumers and industries to reduce their water usage, degradation of forests and springs around São Paulo, and even increasing deforestation in the Amazon.

Most of the responses were short-term, such as a financial reward for households that reduced water use and improved water-saving infrastructure. The lack of long-term commitments, including a permanent incentive to entrench new water-saving habits as well as investment in forest restoration or water treatment, means that the city will in all likelihood face another water supply crisis in the future.

32% OF RESIDENTS DO NOT GET ENOUGH WATER TO COVER THEIR BASIC NEEDS

MEXICO CITY, MEXICO (21 MILLION)

Mexico City faces enormous challenges in terms of drinking water supply and the operation of drainage infrastructure that prevents flooding. Currently, 18% of residents do not receive water every day and 32% do not get enough water to cover their basic needs – so they have to buy water at great expense. Meanwhile, 45 neighbourhoods regularly face a high risk of flooding in the rainy season and subsidence owing to the over-abstraction of groundwater.

Residents know that their city is at risk of a medium-term water collapse, and that the water supply for future generations is also at risk. In particular, it is critical to establish a public body that can respond quickly to cope with the growing water needs of the city's vast and ever-expanding population. The new Water Sustainability Law of Mexico City represents a significant step forward as it should lead to a change in public administration and better governance of water resources.

**All population figures, barring Seville, are from 'The World Cities in 2016' published by the United Nations' Department of Economic and Social Affairs. Figures have been rounded up.*

KARACHI HAS A DAILY SHORTFALL OF MORE THAN 380 MILLION LITRES

KARACHI, PAKISTAN (17 MILLION)

One of 20 megacities in the world and the most populous in Pakistan, Karachi faces severe water risks with a growing gap between water supply and demand. This is partly because the city's population growth has always outstripped projections and partly because of a delay in the execution of mega water supply projects.

To meet their needs, Karachi households and industries depend on limited water supply from the Karachi Water and Sewerage Board (KWSB) and on groundwater and tankers. A 'tanker mafia', which gets 25% of its water through the KWSB supply line, much of it illegally, dominates this water supply.

An additional problem is the contamination of freshwater sources. Over 450 million litres of wastewater containing hazardous chemicals – produced by 2 000 legal industrial facilities and a similar number of illegal ones – are discharged directly into the sea without proper treatment every day. This harms freshwater and marine ecosystems and contributes to Karachi's daily shortfall of more than 380 million litres.

DURING THE HEIGHT OF THE DROUGHT, 89% OF WATER WAS IMPORTED FROM MORE THAN 300 km AWAY

LOS ANGELES, CALIFORNIA, USA (12 MILLION)

California is the seventh-largest economy in the world and Los Angeles is its largest city. Since 2011, California has experienced a multi-year drought, followed by a record-breaking winter storm season and then its worst fire season ever.

During the height of the drought, Los Angeles imported 89% of its water from more than 300 km away – a very energy-intensive process. In the midst of water restrictions, some of the lowest levels of water use were just over 132 litres per person per day – still almost triple Cape Town's 50 litres a day in 2018!

After a year-long reprieve, southern California is again under severe water scarcity conditions following low annual rainfall last year. A new study from the University of California Los Angeles suggests that the region should reduce its dependence on imported water by reducing demand while also transforming its infrastructure to maximise recycled water, groundwater and stormwater capture.

WATER DEFICIT OF 200 MILLION LITRES OF WATER PER DAY

DEMAND FOR WATER SURPASSES SUPPLY BY 600%

NAIROBI, KENYA (4 MILLION)

Kenya's capital faces a water deficit of 200 million litres of water a day, with some saying that demand for water now surpasses supply by 600%. Owing to a prolonged drought since 2014 and the degradation of critical catchment areas, most of the dams that supply water to the city are well below capacity. In early 2018, Thika Dam, which supplies 84% of the city's water, was only half full.

The Nairobi City Water and Sewerage Company has been forced to ration water to ensure that every domestic customer gets an equitable amount of water, especially in the informal settlements, to avoid the outbreak of water-borne diseases such as cholera and typhoid. They also supply companies in the central business district, all hospitals, airports and major security installations. They've established a hotline to ensure a prompt response when areas experience long periods without water.

However, it is clear that Nairobi will continue to experience water shortages unless policies to secure key catchments and construct the necessary infrastructure are developed to cope with the demands of the city's ever-increasing population.

WATER USE WAS
330 LITRES/PERSON

WENT DOWN TO
140 LITRES/PERSON

STABILISED AT
200 LITRES/PERSON

BRISBANE, AUSTRALIA (2,2 MILLION)

Australia's 'Millennium Drought' hit rural and urban water supplies extremely hard. Most major cities, including Brisbane, were affected by low rainfall between 1997 and 2009. With dam levels dropping below 20%, stringent measures were taken to avoid water running out, namely:

- major investments to fix leaking infrastructure – one of the most cost-effective measures to improve water supplies
- a demand management programme, which included strict new legal requirements on business and domestic water use, coupled with a major education campaign
- a diversification of water supplies, so if one source failed others could be drawn on, for example dams, desalination, recycled water, rainwater tanks, groundwater and stormwater harvesting
- a water grid, which linked up major regional water supplies so water could be moved to where it was needed.

The lack of preplanning meant that billions had to be spent to avert a water crisis. Expensive infrastructure, including water recycling and desalination plants, now sit idle, although these may play an important role during future droughts. However, there have been some positive legacies. Although water use has increased since, it has stayed well below pre-drought levels. Water use was 330 litres per person per day, went down to below 140 litres during the drought and has stabilised at around 200 litres per person per day. This proves that managing demand and improving water efficiency are the cheapest and most sustainable ways to address water challenges.

DURING A THREE YEAR DROUGHT RESERVOIRS DROPPED TO 9,5%

SEVILLE, SPAIN (>1 MILLION)

During the drought of 1992 to 1995, reservoirs in the Guadalquivir river basin – which supplies the city of Seville – dropped to 9,5%. The consequence was severe water restrictions, including cutting the water supply to just 10 hours a day, reducing water pressure and imposing a ban on watering gardens. The objective was to reach water savings of around 30%.

Even with these restrictions, the city had to draw water from alternative sources, such as the Guadalquivir River, but the poor water quality meant that the authorities had to invest in expensive emergency treatment plants. Once the drought was over, construction started on the Meloneras reservoir, but it was mainly thanks to water awareness and other measures implemented by the local water company (including new water tariffs that encouraged better use of water) that demand for water fell significantly in the ensuing years, making the investment something of a white elephant.

TOP 20 CITIES AT RISK

WWW

* waterriskfilter.panda.org

In 2018, Cape Town topped WWF's list of cities most at risk of water shortages. The other 19 cities come from countries as far apart as Chile and China. The list was compiled using data from the Water Risk Filter* on average conditions (supply versus demand), recent droughts (past three years), future projections (to 2050) and Urban Blueprint Data from The Nature Conservancy.

This list is not a prediction but definitely a wake-up call. These cities urgently need to think about water resilience under conditions of climate change, and address water risks by reducing demand, considering water allocations, strengthening water governance and financing green and grey infrastructure. Critically, all cities need to address water access as an issue of social justice to ensure that everybody has access to water. And, as an environmental issue, to ensure that enough water is left for nature to thrive.

TOP 20 CITIES BY AVERAGE DEPLETION, DROUGHT AND PROJECTED FUTURE WATER DISCHARGE

1. Cape Town, South Africa
2. Tel Aviv, Israel
3. Valparaíso, Chile
4. Amman, Jordan
5. Havana, Cuba
6. Oxnard, USA
7. Santa Barbara, USA
8. Agadir, Morocco
9. Casablanca, Morocco
10. Tunis, Tunisia
11. Bathinda, India
12. Meerut, India
13. Tbilisi, Georgia
14. Madrid, Spain
15. João Pessoa, Brazil
16. Santiago, Chile
17. Chengdu, China
18. San Diego, USA
19. Gurgaon, India
20. Siliguri, India

NOTES

CONTRIBUTORS

WWF SOUTH AFRICA IS GRATEFUL TO THE CONTRIBUTORS OF THE VARIOUS WEDNESDAY WATER FILES:

GETTING TO GRIPS WITH GROUNDWATER
Marlese Nel (University of the Western Cape)
Fanus Fourie (Department of Water and Sanitation)
Roger Parsons (Groundwater Division of the Geological Society of South Africa)
John Holmes and Chris Hartnady (Umvoto Africa)

DEBUNKING DESALINATION
Researchers from the Centre for Renewable and Sustainable Energy Studies at Stellenbosch University

HOW TO SECURE SAFE DRINKING WATER
Bettina Genthe (CSIR)
Gideon Wolfaardt (Stellenbosch University)

WHEN YOU CAN'T FLUSH THE LOO
Bernelle Verster (UCT Future Water Institute)
Chris Buckley (Pollution Research Group, University of KwaZulu-Natal)
Dave Martin (Bulungula Incubator)
Richard Holden (Trans-Caledon Tunnel Authority)
Mark Botha (Consultant: Conservation, Strategy, Tactics and Insight)

KEEPING THE DOORS OF BUSINESS OPEN
Claire Pengelly (GreenCape)

THE POWER OF PULLING TOGETHER
Justin Friedman (For Love of Water)
Marcela Guerrero Casas (Open Streets)
Kevin Winter (UCT)
Andrew Boraine and Sean Andrew (Western Cape Economic Development Partnership)

LIVING THE WATER-LESS LIFE
Western Cape Watershedders Facebook group and other sources

WE ARE NOT ALONE
WWF offices in Mexico, Spain, Kenya, Pakistan, Brazil, the USA and Australia

SOUTH AFRICA'S WATER CRISIS

2018

The year that Cape Town nearly ran out of water in its taps after a historic drought with below average rainfall for three years.

50 LITRES

Unprecendented level 6B water restrictions have limited Cape Town citizens to 50 litres per person per day.

22

The number of strategic water source areas in South Africa that make up the 10% of land in the high-lying mountainous parts of the country.

10%

The total land area of South Africa that supplies half of the country's river flow.

Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

wwf.org.za