WWF

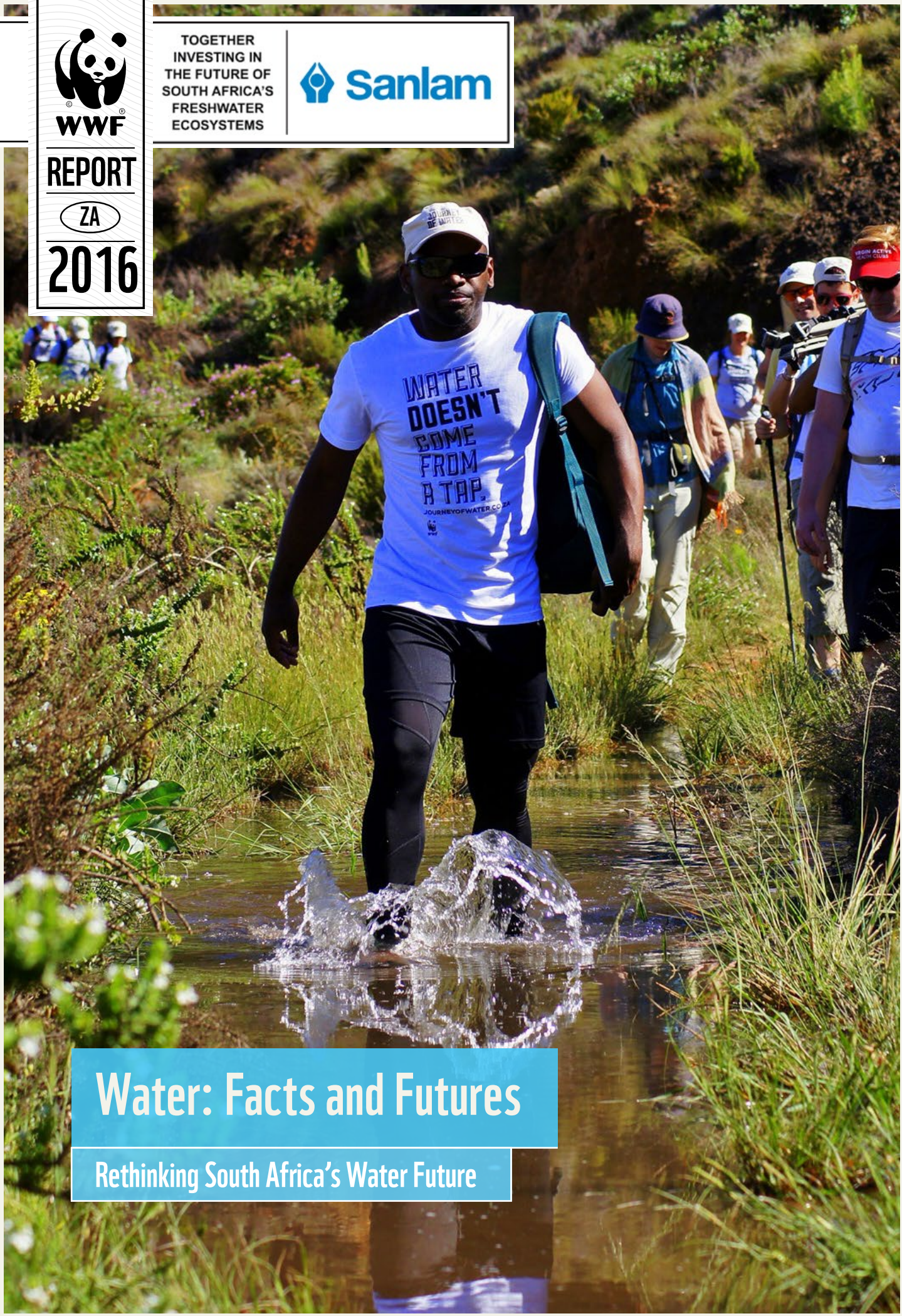
REPORT

ZA

2016

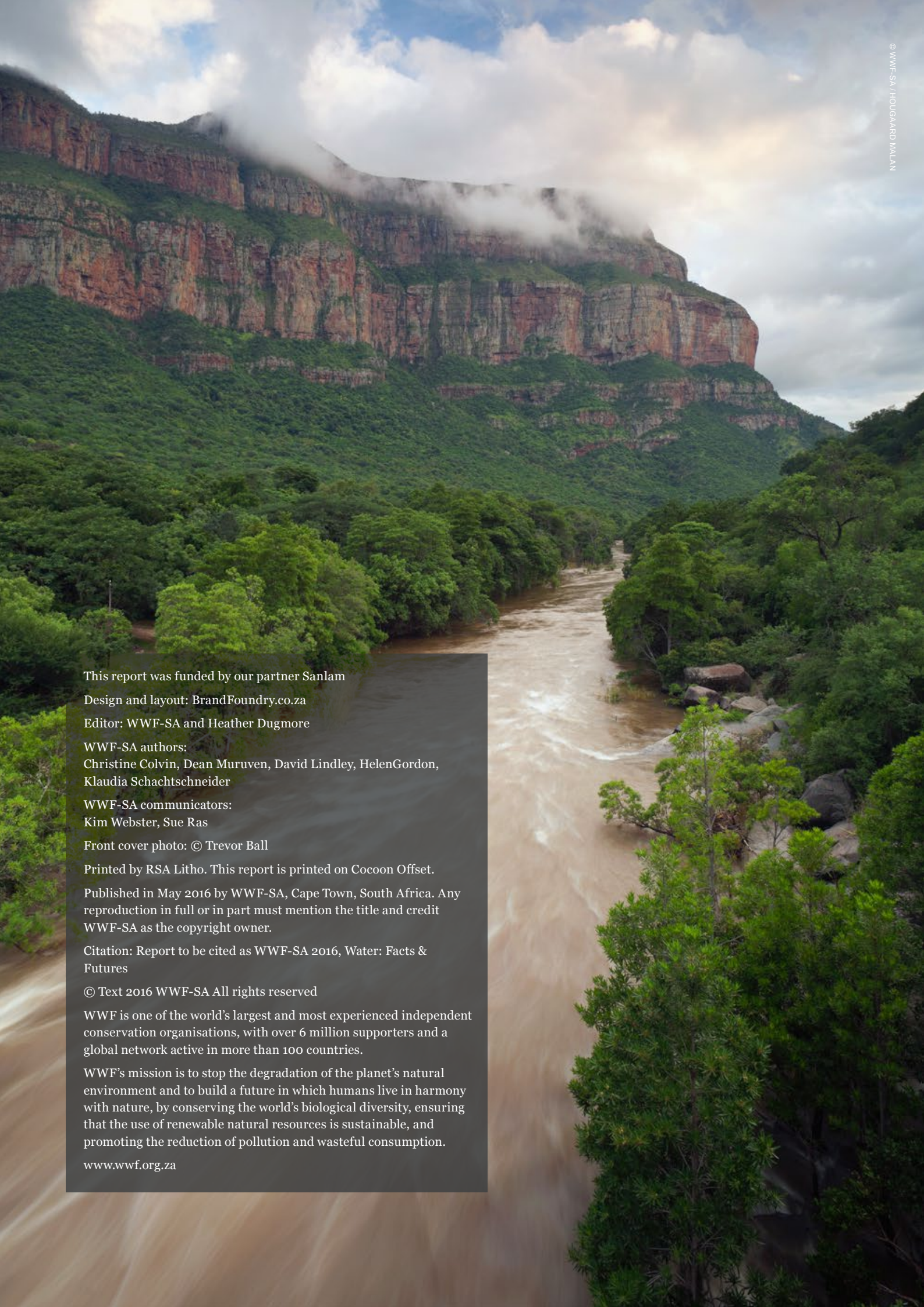
TOGETHER INVESTING IN THE FUTURE OF SOUTH AFRICA'S FRESHWATER ECOSYSTEMS

Sanlam



Water: Facts and Futures

Rethinking South Africa's Water Future



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WWF is one of the world's largest and most experienced independent conservation organisations, with over 6 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.

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FOREWORD

With agriculture having lost billions of rands and thousands of jobs over the last year of drought, we are reminded of Thomas Fuller's words – "We never know the worth of water 'til the well runs dry."

Christine Colvin,
Freshwater Senior Manager,
WWF-SA

Water has been in the headlines in South Africa for all the wrong reasons since late 2015. We have been gripped by the drought crisis, joining other regions of the world which are experiencing low rainfall in a warming world. Having been spared widespread shortages since the early 1990s, we had grown complacent and forgotten our natural claim to water scarcity.

Now that we have a heightened sense of the worth and importance of water, we want to know more about it and our future prospects. Where does it come from? Who has it? Why is it so polluted? What lives in it? Who is responsible for it? What can we do to secure a better (wetter?) future? What are my water rights?

WWF-South Africa's Freshwater programmes have been working in South African catchments for nearly two decades. As an independent, science-based, environmental NGO we are continually learning about South Africa's water resources, the many public institutions that influence their governance, and how the private sector can play a stronger, positive role in responding to increasing water risks. WWF-SA is particularly focused on the role of nature in securing healthy water resources, essential for our economic survival and growth. Nature, water, food and people are inseparably entwined in our vulnerable landscapes.

Nature, water, food and people are inseparably entwined in our vulnerable landscapes

South Africans increasingly want to know the facts behind our water system, and whether we are headed in the right direction for a sustainable future with enough water to meet our needs.

Water: Facts and Futures introduces the reader to the interesting facts behind the state of our nation's water. This is the tip of the iceberg, and we encourage you to dig deeper in the many comprehensive sources of information available. We have also shared some signposts for the future, some of the success stories that South Africans can be proud of. These are examples that can lead us to a sustainable water future.

"In order to achieve (our) Strategic Priorities we have realised that there is a need for increased impetus and pace. This calls for a revolution, a Water and Sanitation Revolution to reclaim and better manage our water in order to tackle the triple challenges of inequality, poverty and unemployment."

– Minister for Water and Sanitation Nomvula Mokonyane, 2015 Budget Speech to parliament

One thing is clear: we need a fundamental rethink of our water sector and water's place in the economy. Our current drought is expected to be a taste of the future, so we need to learn quickly and adapt. Demand for water is increasing, a growing

2°C
INCREASE IN GLOBAL TEMPERATURES MEANS A
4°C
INCREASE FOR SOUTH AFRICA

economy needs reliable, safe water supplies. Those needs will be met in an increasingly uncertain, volatile and warmer climate. A two-degree increase in global temperatures means a four degree increase for South Africa. Less rain is predicted in the western half of the country and potentially more intense flood events in the east.

Our water resources are the foundation of our water supplies and include catchments, rivers, wetlands and aquifers. If these resources are degraded, downstream investments are left high and dry. And yet, we still plan development without considering this essential 'ecological infrastructure'. A water secure future requires that our water source areas, the 8% of our land that generates 50% of our river flows, is afforded special consideration, protection and cleared of thirsty alien vegetation.

We have proven our 'hydro-ingenuity' since the first dam was built in 1663

We have proven our 'hydro-ingenuity' ever since the first dam was built in 1663. South Africa has an impressive, but ageing and failing network of engineered infrastructure that has stored and transferred water to where we need it. Most of the surface water that we can reliably use has been allocated, so future growth in storage and supply will need to come from underground. We have proven that managed aquifer recharge offers an evaporation-proof means of 'water banking'. Some towns are already using this technology. This will be a critical element of a water secure future for many towns and cities.

South Africa has done an incredible job of supplying previously disadvantaged households with water and sanitation during democracy. Difficult underserviced areas remain – in remote rural areas and quickly growing informal settlements – plus we have very little water available to meet additional needs. We need to think about water provision differently in remote rural locations, using decentralised systems and point-of-use household treatment technologies to make sure the water is safe to drink. This requires village-level maintenance training and acceptance.

Difficult underserviced areas remain in remote rural areas and quickly growing informal settlements

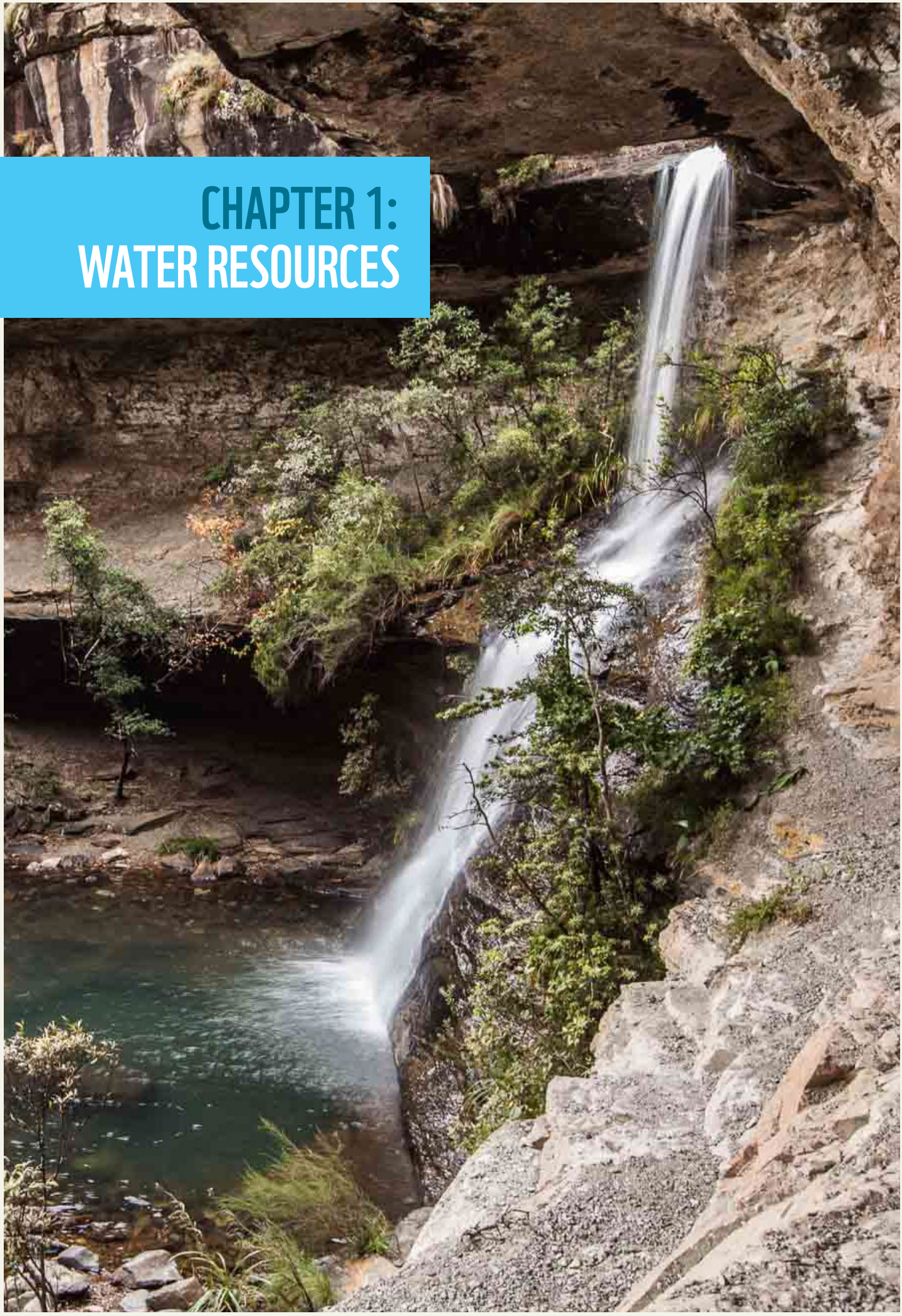
We have proven that new technologies, approaches and management models can work. South Africa has ground-breaking legislation that recognises the importance of the whole water cycle and grants the environment and people a basic right to water. Alien vegetation clearing programmes that include the private and public sectors, are grappling with the overwhelming challenge of alien vegetation invasion, and creating jobs for the unemployed. There are many rays of hope in this challenging sector, but we need to urgently focus on bringing these together quickly to ensure a brighter future.

"WWF-SA works with many partners in the water sector. We thank them and acknowledge their commitment to bringing about positive change."

- Christine Colvin


“Water runs through our every aspiration as a society.” - Kader Asmal

CHAPTER 1: WATER RESOURCES



WATER DOESN'T COME FROM A TAP

Easy access to our most critical natural resource often leads to an undervaluing of it, and distances us from the origins of our water supply

South Africa's water security depends on the sustained supply from our water resources. These are the natural capital on which all our investments into the water sector depend. It is imperative that they are conserved, restored, maintained, monitored and carefully managed.

Surface water includes rivers and lakes, and is often used for large urban water supply. Groundwater includes all subsurface or underground water, stored in soil, rock pores, crevices and aquifers. It emerges as springs and seeps and is abstracted via boreholes or wells. Many rural communities are solely dependent on groundwater for their water supply.

Rivers, wetlands, estuaries, springs and aquifers are all water resources from the natural environment, replenished by rainfall.

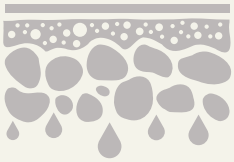
SOUTH AFRICA'S RAINFALL

9%

GOES INTO RIVERS AND SURFACE WATER

4%

RECHARGES GROUNDWATER



"Ecological infrastructure is defined as the naturally functioning ecosystems that produce and deliver services that are of value to society - fresh water, climate regulation, soil formation and disaster risk reduction. Ecological infrastructure is the nature-based equivalent of built infrastructure... equally important for providing services and underpinning socio-economic development. "

– Department of Environmental Affairs (DEA) and South African National Biodiversity Institute (SANBI)

THE POLICY THAT GOVERNS OUR WATER

South Africa's waters are governed by the Water Services Act of 1997 and the National Water Act (NWA) of 1998. The NWA is founded on the principle that all water forms part of a unitary, interdependent water cycle, and should thus be governed under consistent rules. It contains comprehensive provisions for the protection, use, development, conservation, management and control of South African water resources. The strategic objectives are stipulated in the National Water Resource Strategy (NWRS; DWAF 2013). Transformation in the water resource sector includes a shift from central management to decentralised institutions, including the establishment of Water Management Areas, defined largely by hydrological catchment borders, and administered by Catchment Management Agencies.

FACTS

490mm

SOUTH AFRICA'S ANNUAL RAINFALL IS HALF THE WORLD AVERAGE

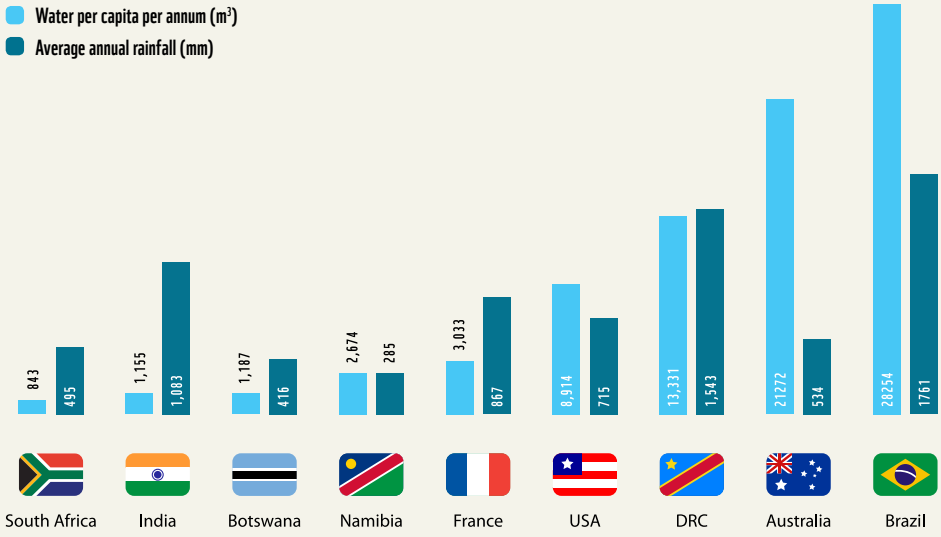
Rainwater: first things first

The primary input to our water resources is rainwater and South Africa's rainfall, at 490mm per year, is half the world average. Our rainfall is highly seasonal and variable, with greater variability in the dry interior. With low inputs and a large population, South Africa is, in relative terms, more water scarce than neighbouring Namibia, despite the fact that Namibia has approximately half of South Africa's average annual rainfall.

National demand to increase to 17.7 billion m³

In 2000, water stress was already experienced in what were then the Olifants, Inkomati, Thukela, Mvoti and Gouritz Water Management Areas. National demand is projected to increase by 32% (to 17 700 million m³) by 2030 due to population growth and industrial development.

FIGURE 1.1: WATER AVAILABILITY PER PERSON PER YEAR IN SELECTED COUNTRIES



Source: NWRS 2 DWA 2013

Our biggest catchment is the Orange-Vaal-Senqu: over 600,000 km² in South Africa and a further 400,000 km² in Lesotho, Botswana and Namibia

Transboundary flow: sharing with our neighbours

A total of 60% of the river basins in South Africa include flow to or from another country. The headwaters of the Orange-Senqu are in Lesotho, and tributaries flowing into the Pongola come from Swaziland. The Limpopo and the Inkomati rivers flow into Mozambique. The Karoo aquifer sequence on the Kalahari is also a major transboundary resource shared with Botswana and Namibia. South Africa has international obligations under the National Water Act, to ensure that we sustainably manage a portion of the flow across our borders.

Water to the environment as a right

South Africa was one of the first countries to enact a law that allocates water specifically for use by the environment. This aims to ensure that our water systems have enough water to sustain them, which, in turn contributes to the sustainability of the living resources on which we depend. This water is called the Ecological Reserve.

The Ecological Reserve: the quantity and quality of water required to protect aquatic ecosystems in order to secure ecologically sustainable development and the use of the relevant water resource (National Water Act, 1998).

Water Source Areas (WSAs) – where our water comes from

16%
OF SOUTH AFRICA'S WATER SOURCE AREAS ARE PROTECTED

South Africa's WSAs can be grouped into 21 areas (see Figure 1.2 on pages 10 & 11). The dominant land cover within the WSAs is natural vegetation, often because slope and altitude have prevented more intense development.

The overlap of coal deposits and WSAs is less than 1%, but it is nevertheless significant in WSAs such as the Enkangala Drakensberg and the Mfolozi headwaters (the upper tributaries, close to or forming part of its source) where 30% of these water source areas overlap with coalfields. An added concern is that more than 50% of Mpumalanga is under either a prospecting or mining licence for coal. This could result in widespread acid mine drainage pollution.

What should be raising a national red flag is that these areas need to be secured and well-managed for South Africa's long term water security. Only 16% of South Africa's Water Source Areas (WSAs) are formally protected as nature reserves or parks. The highest protection is found in the Western Cape. WSAs in the Eastern Cape have very low or no protection.

LAND COVER IN WATER SOURCE AREAS

63%
NATURAL VEGETATION

28%
FARMING AND FORESTRY

3%
DEGRADED LAND

1%
MINING FOR FOSSIL FUEL

The water security challenge

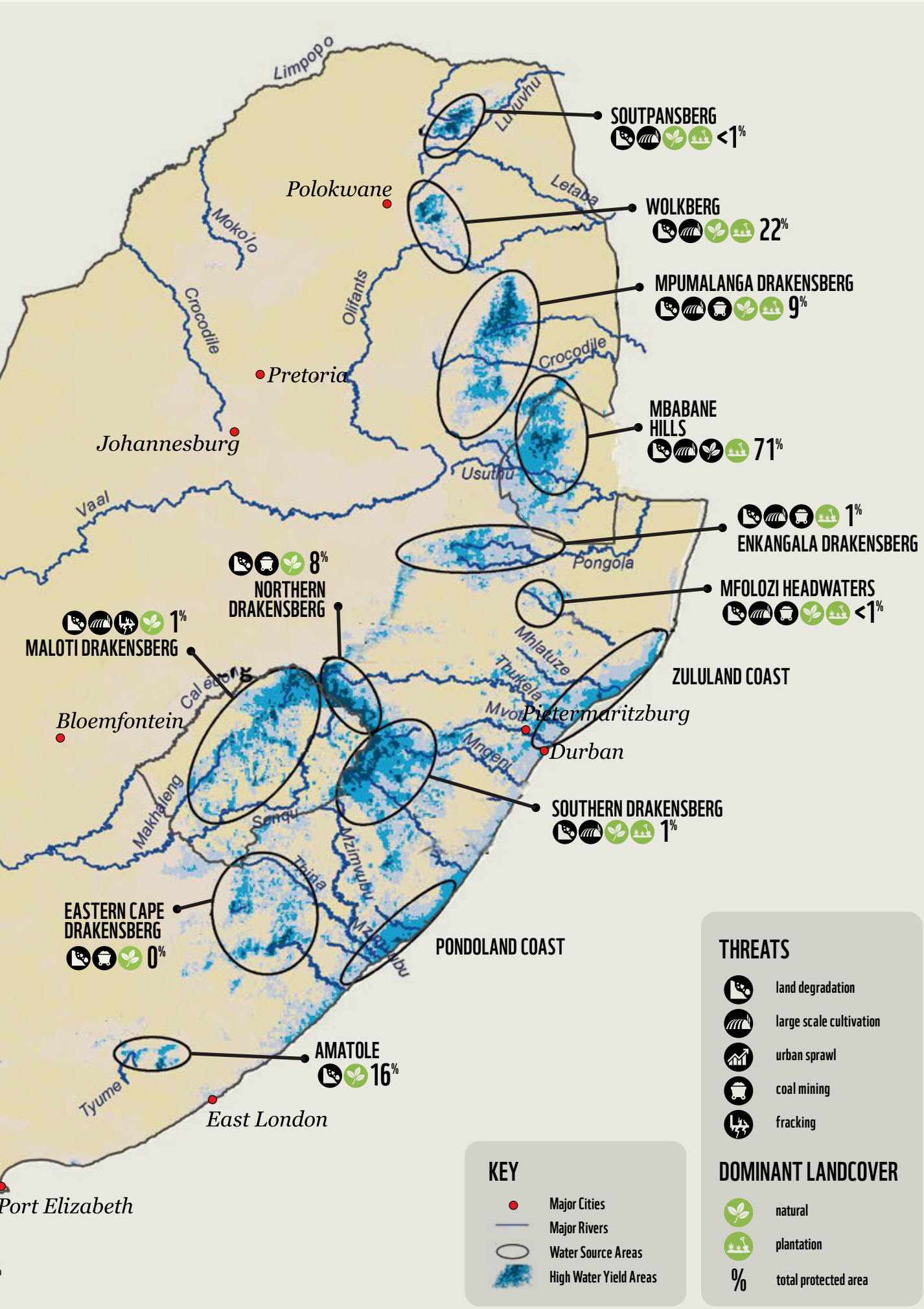
Groundwater resources will play an increasingly strategic role in Africa

Understanding and unlocking South Africa's groundwater potential is crucial to addressing the national water security challenges. Currently only 15% of the country's total water consumption is obtained from groundwater sources. Very often the communities that depend on groundwater have no other viable sources. In 2008, the African Ministers Council on Water highlighted that groundwater resources will have to play an increasingly strategic role in Africa, particularly for the most vulnerable and neglected rural communities.

8% OF SOUTH AFRICA'S LAND AREA CONTRIBUTES 50% OF THE WATER IN OUR RIVERS

South Africa's water resource base is dominated, in volume, by surface water from our river systems. Yet only 8% of South Africa's land area produces the runoff (water that drains from the surface of an area of land into the river systems) that generates 50% of the volume of water in our river systems. This 8% has been delineated as 'Water Source Areas' (WSAs), and these are arguably our most important natural national assets.

FIGURE 1.2: MAP OF SOUTH AFRICA'S WATER SOURCE AREAS


Limpopo
Luvuvhu
SOUTPANSBERG
<1%
Polokwane
Letaba
WOLKBERG
22%
Mokolo
Olifants
MPUMALANGA DRAKENSBERG
9%
Crocodile
Crocodile
Pretoria
Johannesburg
MBABANE HILLS
71%
Usutu
Vaal
1%
ENKANGALA DRAKENSBERG
Pongola
8%
NORTHERN DRAKENSBERG
MFOLOZI HEADWATERS
<1%
1%
MALOTI DRAKENSBERG
Mhlatuze
Thukela
ZULULAND COAST
Caledon
Bloemfontein
Mvoti
Pietermaritzburg
Durban
Mngeni
Makhaleng
Sengu
SOUTHERN DRAKENSBERG
1%
Mzimvubu
Thina
EASTERN CAPE DRAKENSBERG
0%
PONDOLAND COAST
Mzimvubu
AMATOLE
16%
Tyume
East London
Port Elizabeth
KEY
Major Cities
Major Rivers
Water Source Areas
High Water Yield Areas
THREATS
land degradation
large scale cultivation
urban sprawl
coal mining
fracking
DOMINANT LANDCOVER
natural
plantation
%
total protected area

THE FUTURE

Managing our landscapes that give us water

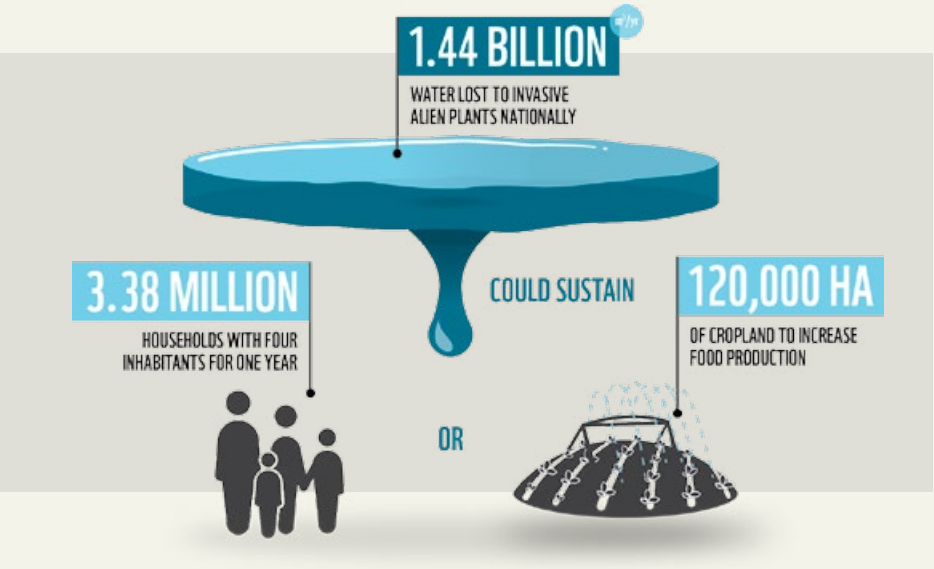
We have some critical starting points for success when it comes to the management of our water resources. Catchment Management Agencies (CMAs) are being developed to ensure coordinated planning for water security. At the highest level, South Africa's National Development Plan (NDP) recognises water scarcity as a binding constraint to national development. This highlights the importance of carefully managing this limited resource.

932
WETLANDS REHABILITATED

Working for Water

Working for Water, which focuses on the control of invasive alien plants, was the first programme to be established in 1995 as part of the Natural Resource Management (NRM) Programmes of the Department of Environmental Affairs (then the Department of Water Affairs and Forestry). The NRM programme now also includes Working on Fire, Working for Wetlands, Working for Ecosystems and Working for Forests. These programmes have provided years of work to 51 300 people (over the last 3 years), with particular focus on women and youth.

WATER LOST TO INVASIVE ALIEN PLANTS



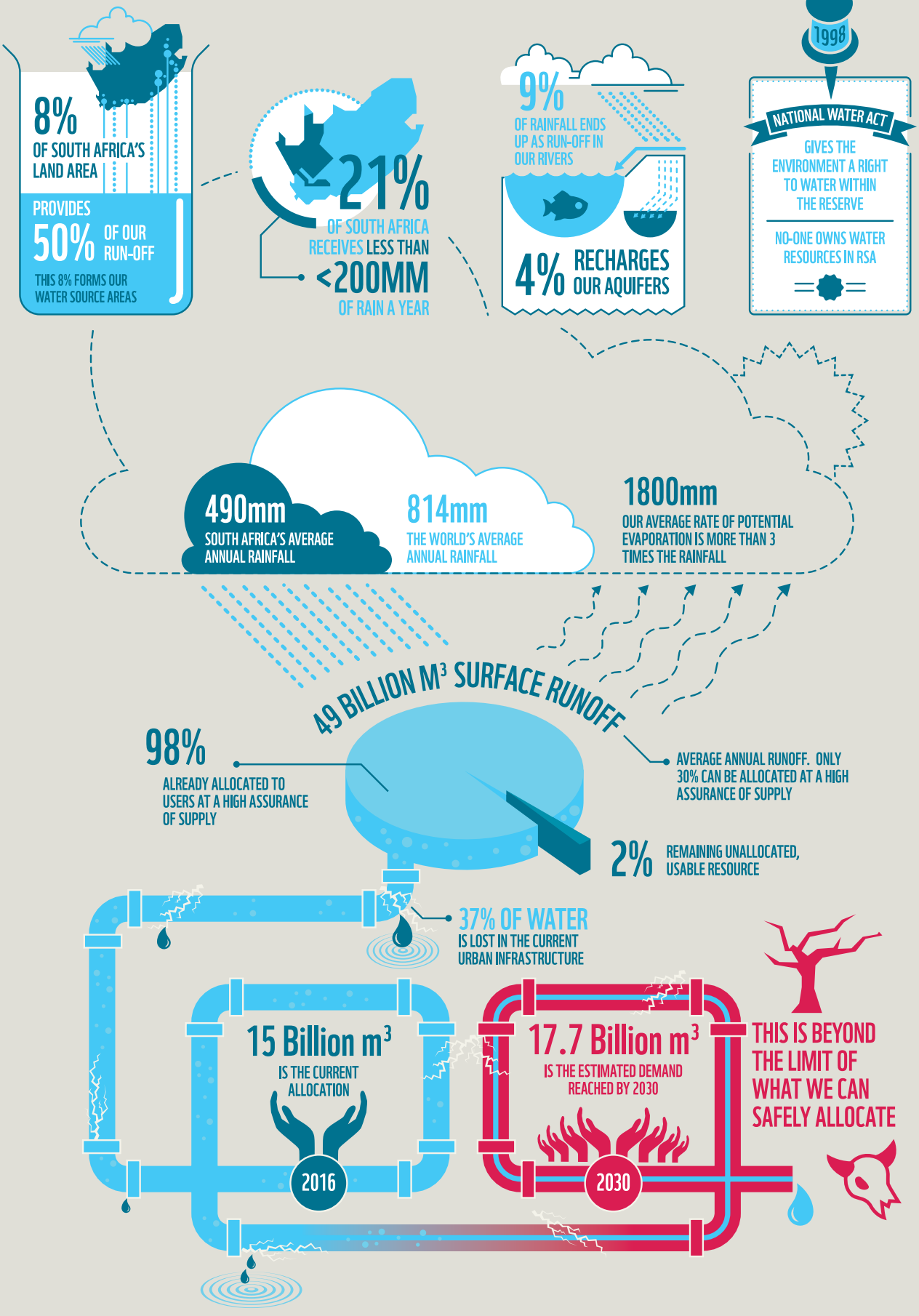
The thirsty invaders

Invasive alien trees and shrubs often use more water than surrounding indigenous vegetation and this lowers water availability by up to 4%. If left to spread uncontrolled, this figure could escalate to around 16%. Invasive alien plants can dramatically reduce available water resources, with significant impact on stream flows, and the associated increase in siltation and degrading water quality.

Creating value out of 'waste' wood

There are several clearing programmes, both government and private, that are attempting to eradicate alien plants countrywide. But once the wood is cut down it is often left behind, causing damage to river systems in flood and posing a fire risk.

SOUTH AFRICA'S WATER RESOURCES BY NUMBERS



CLEARING ALIEN VEGETATION

Recent projects have looked to turn the alien plant biomass into a usable raw material rather than waste. Opportunities include the generation of compost, furniture manufacturing, and the production of wood/plastic composites.

2,7 MILLION
HECTARES OF LAND HAVE BEEN CLEARED OF INVASIVE ALIEN PLANTS

A partnership between WWF-SA, NCC and Danish partner Linddana in the Riviersonderend catchment uses a wood chipper to demonstrate how value can be created out of 'waste' wood generated from clearing alien plants – while also freeing up more water. Most of the farmers in this area produce export apples and livestock.

"The wood chips provide extremely good mulch for our apple orchards. It protects the soil and increases its carbon content and fertility, which, in turn, leads to better fruit production.... We do not need to irrigate as much when the soil is well protected because the water does not evaporate as quickly. Healthier soil means we do not need to use as much fertiliser."

– Carl van Lingen, Farmer on Meulrivier Farm, Riviersonderend catchment.

Investment, protection and restoration

Going forward, we need to invest even greater effort, coordination and finance into restoring living landscapes, which underpin our water security.

Our National Development Plan is clear about the need for change in the management of our natural resources. The expansion of formally protected areas, the implementation of the Ecological Reserve and wider support for conservancies and stewardship programmes will all play a role in improving protection.

WATER STEWARDSHIP MEANS LEAVING A LIVING LEGACY

As South Africans we all carry the responsibility of protecting our natural environment in all respects, leaving subsequent generations with an endowment of at least equal value. WWF would like to see Water Source Areas (WSAs) prioritised within catchments for restoration and protection. This may include expanding the current network of protected areas and conservancies into WSAs, as well as implementing broader stewardship initiatives in key sectors such as forestry.

We have to start planning from the basis that water is a key national asset

We have to start planning from the basis that water is a key national asset and projects such as the 19th Strategic Integrated Project, known as 'SIP 19: Ecological Infrastructure for Water Security', need to be wholeheartedly supported and recognised as a key part of the plan. If successful, SIP 19 will make a significant contribution to the overall goal of ensuring a sustainable supply of fresh, healthy water to equitably meet South Africa's social, economic and environmental water needs for current and future generations.

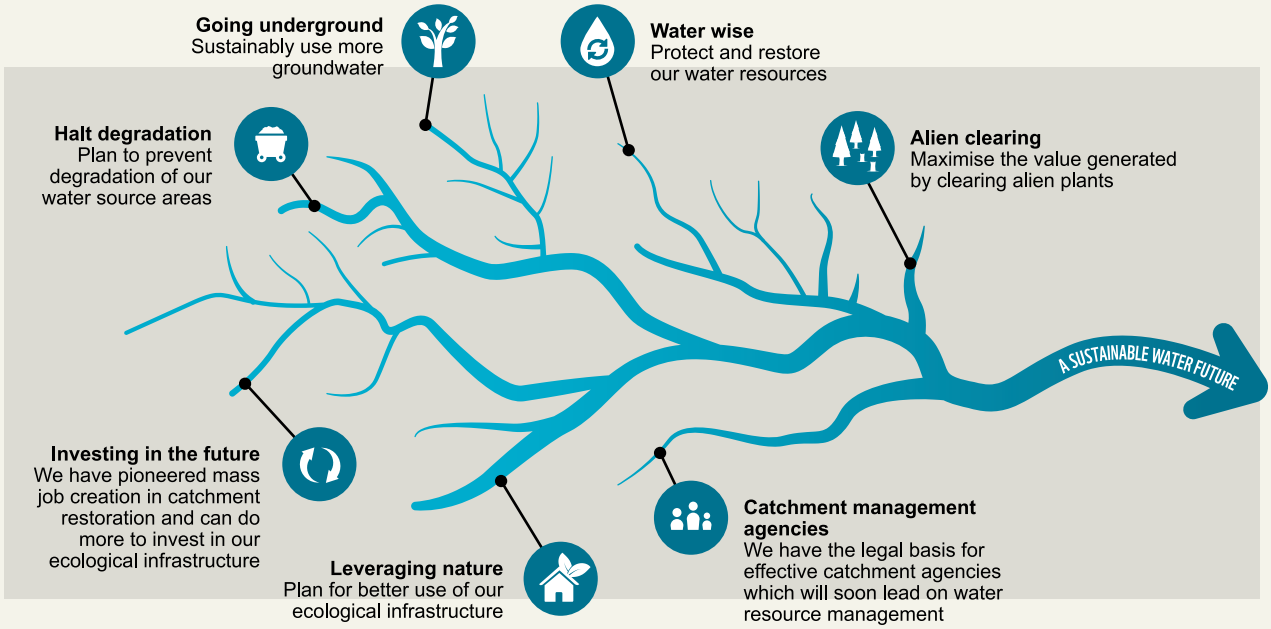
Cost benefits of maintaining ecological infrastructure

The importance of maintaining intact ecological infrastructure, comprising wetlands and riparian zones (areas near river banks) is unquestionably highlighted when compared to water purification costs.

THE VALUE OF WETLANDS

At the Voëlvlei Dam, one of the supply dams for Cape Town, the output of the purification plant during 2006/07 was 120 000 m^3 per day. At the time, the cost of treating algal blooms and additional chemicals was R4.7 million per year. If the wetlands in the water catchment area had been kept intact, these costs could have been substantially reduced or prevented.

LOOKING AHEAD: LAYING THE FOUNDATIONS FOR A SUSTAINABLE WATER FUTURE



FURTHER INFORMATION

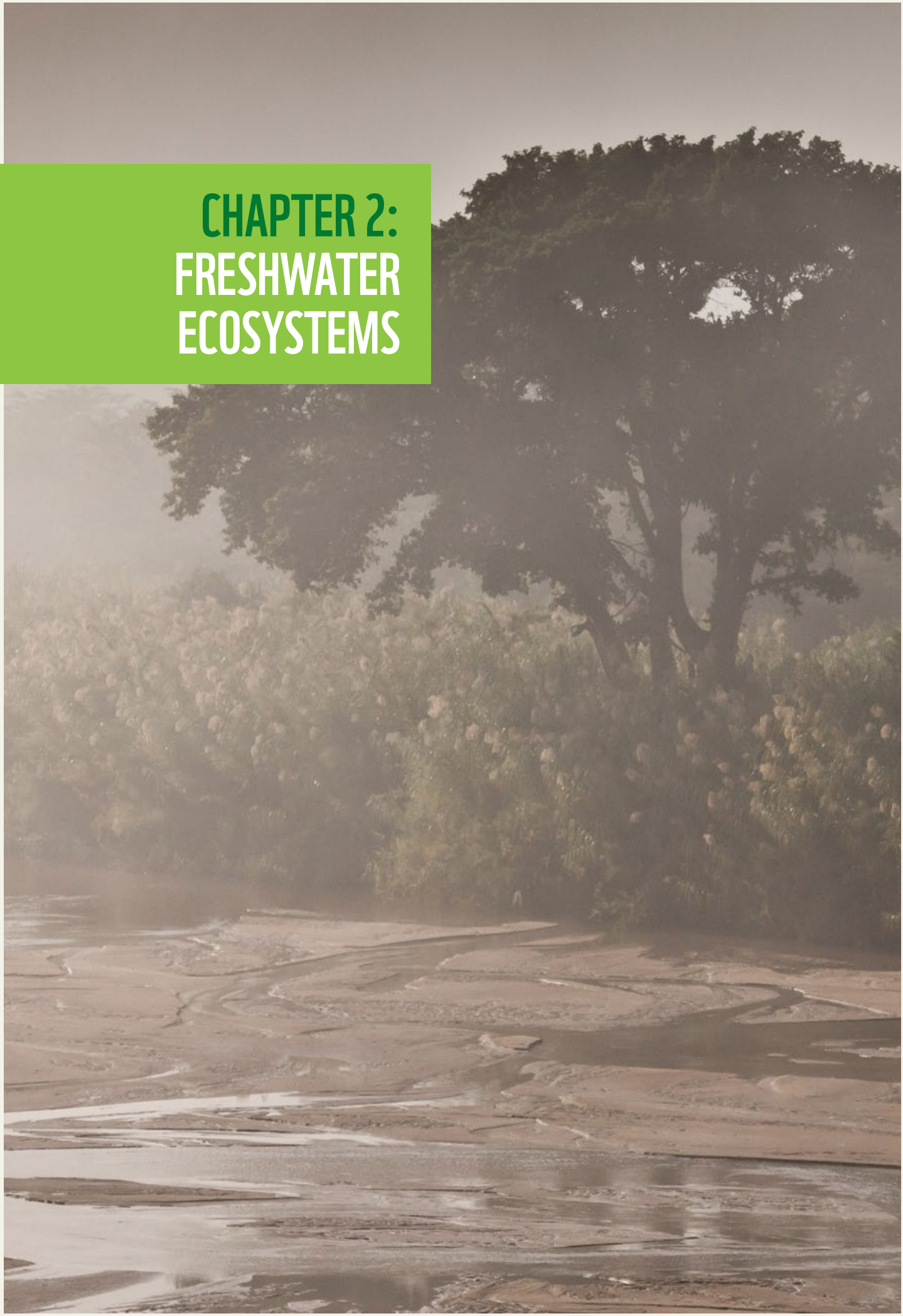
www.journeyofwater.co.za

http://www.wwf.org.za/what_we_do/freshwater/

An Introduction to South Africa's water source areas, WWF-SA, 2013 http://awsassets.wwf.org.za/downloads/wwf_sa_watersource_area10_lo.pdf

Water Resources 2012 (WR2012) http://waterresourceswr2012.co.za/

CHAPTER 2: FRESHWATER ECOSYSTEMS



THE DIVERSITY OF OUR LIVING WATERS

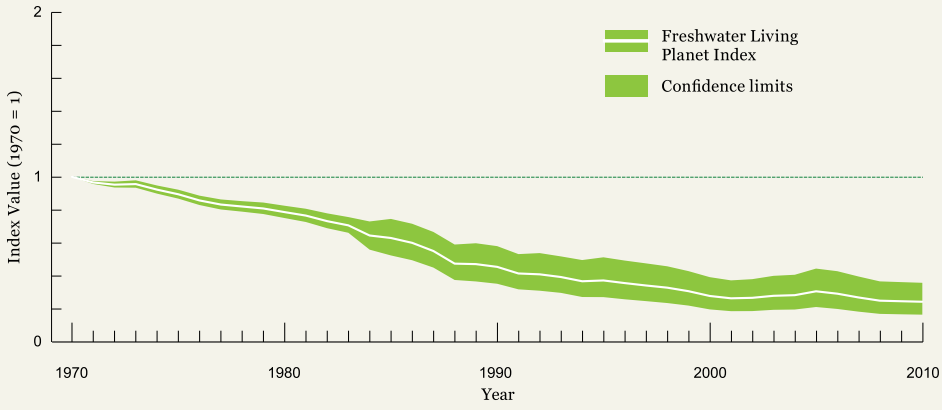
South Africa is one of the most biodiverse countries in the world and this diversity extends to our freshwater ecosystems, with around 1,000 different types of river and wetland ecosystems.

This diversity is a result of our geologically and climatically complex landscapes, ranging from sub-tropical in the north-eastern part of the country, to semi-arid and arid in the interior, to the cool, temperate fynbos biome in the south-west.

Worldwide, freshwater ecosystems have suffered the highest level of loss in recent decades. WWF reported in its 2014 Living Planet Report that the loss of wildlife populations in freshwater ecosystems was 76% between 1970 and 2012. Our water resources are clearly not doing well. Healthy catchments need living healthy ecosystems to keep cleaning and yielding water.

Biodiversity: Biological diversity – or biodiversity – is the term given to the millions of different biological species of plants, animals and micro-organisms on Earth, and the ecosystems within which they live and interact.

FIGURE 2.1: THE FRESHWATER LPI SHOWS A DECLINE OF 76% BETWEEN 1970 AND 2010



Source: WWF, 2014. Living Planet Report

FACTS

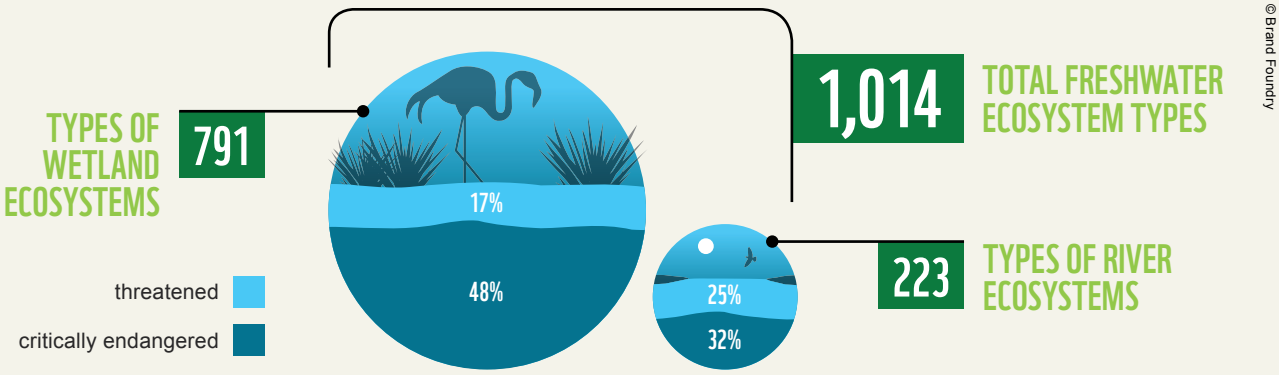
...rivers inside protected areas are in a better condition compared to those outside

Highly threatened and poorly protected

The majority of South Africa's wetland and river ecosystem types are threatened. This is of enormous concern given that wetlands make up only 2.4% of the country's surface area, yet they play a crucial role in delivering ecosystem services, such as water purification, flood regulation and drought mitigation.

Less than a third of the country's river, wetland and estuary ecosystem types can be considered moderately to well-protected. Although inclusion in a protected area does not guarantee conservation, rivers inside protected areas are in a better condition compared to those outside, despite some being degraded by upstream human activity before entering the protected area.

A BREAKDOWN OF SOUTH AFRICA'S FRESHWATER ECOSYSTEMS



Source: National Biodiversity Assessment 2011

4%
OF SOUTH AFRICA'S RIVERS ARE FREE-FLOWING

Dams alter freshwater ecosystems

Globally, there are very few large rivers that remain dam-free or 'free-flowing', and the same is true in South Africa where free-flowing rivers are rare features in our landscape. They are regarded as part of our natural heritage, offering considerable social, economic and conservation value, and supporting the livelihoods of a great many people along the catchment ranging from communities to farmers to industry.

Dams significantly alter the ability of freshwater ecosystems to support the provision of good quality water along their full course as they disrupt the natural sequence of floods and low flows and the subsequent movement of sediment in the main course and out onto the flood plain.

Free-flowing river: A large river that has not been dammed and flows undisturbed from its source to its confluence with another large river or out to sea. Free-flowing rivers represent only 4% of our total river matrix.

8.8%
OF HOUSEHOLDS IN SOUTH AFRICA DO NOT HAVE ACCESS TO WATER FROM A TAP

Rural communities rely most on natural waters

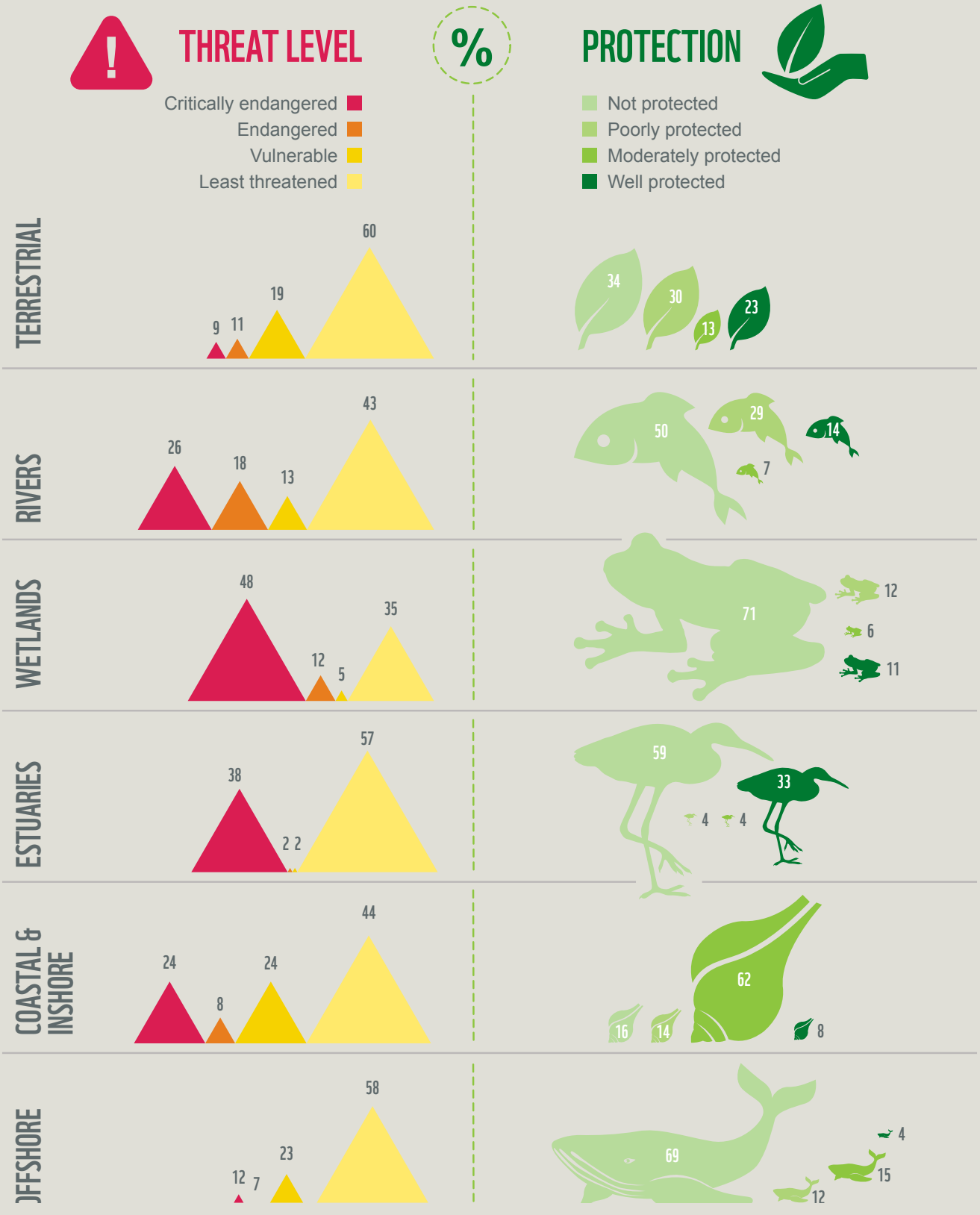
Poor rural communities whose livelihoods are closely linked to a river, are likely to be seriously impacted by pollution, dams and over-abstraction. The 2011 census showed that 8.8% of South African households still do not have access to water from a tap. The percentage increases to 22% in the Eastern Cape. These households directly rely on rivers, springs and wells.

Tributaries are generally in better condition than main rivers

Most of our rivers are hard-working water suppliers, supporting multiple levels of use. Healthy tributaries and wetlands are key support mechanisms to maintain the sustainability of hard-working rivers by providing natural flow and sediment pulses, as well as offering refuge for many freshwater species. Tributaries, therefore, often hold good conservation potential.

OUR THREATENED ECOSYSTEMS

South Africa has one of the highest levels of biodiversity in the world – we are a biodiversity super-power! But wetlands, estuaries and rivers have the highest levels of threat.



Source: SANBI National Biodiversity Assessment (2011)

Palmiet: an indigenous, semi-aquatic wetland plant essential for water storage, sediment stabilisation and slowing down floodwaters.

31%
OF INDIGENOUS FISH SPECIES ARE THREATENED

Fish threaten fish

The greatest threat to freshwater fish biodiversity, especially in the Cape fynbos region, has been invasive alien fish species in terms of predation on and competition with indigenous species. A large number of alien fish species were introduced to South African waterways for angling purposes (such as black bass, trout, carp, Mozambique tilapia, bluegill sunfish) and have proliferated.

Excessive water abstraction from naturally perennial rivers poses another severe threat to our indigenous freshwater fish, especially during dry summers. Often, levels of abstraction are so high that rivers stop flowing, resulting in habitat depletion or water that is too warm to sustain river species.

Farming impacts freshwater

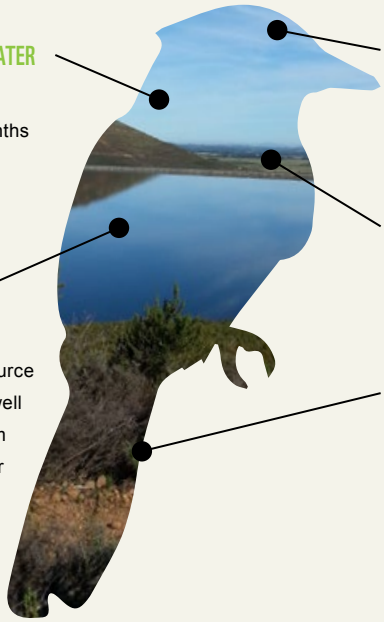
...use of bulldozers to construct canal systems compromises the vital riparian zone

Rivers in farming areas are often canalised by bulldozing to regulate water supply and stop flood damage to orchards and crops, which are frequently planted in floodplains. This can affect the structure and functioning of a river.

The use of bulldozers to construct canal systems damages the river banks and beds, and compromises the vital riparian vegetation zone, which is essential for river bank stabilisation and nutrient cycling in the river, causing substantial erosion and movement of sediment, which then fills pools with sand downstream. This has a major impact on the indigenous rock catfishes that live in crevices between rocks.

A growing problem is also the excessive use of fertilisers and harmful pesticides on crops, vineyards and orchards. Again, this problem is exacerbated when crops and orchards are planted near or within river flood zones, because fertilisers and pesticides then readily enter watercourses and rivers, which can have lethal effects on aquatic life.

THE FIVE SOUTH AFRICAN THREATS TO FRESHWATER BIODIVERSITY



1 OVER-ABSTRACTION OF WATER

Removal of too much water, especially during the dry months of the year, exacerbated by invasive alien plants.

2 POOR WATER QUALITY

Water quality problems associated with non-point source pollution from fertilisers, as well as point-source pollution from mining and failing wastewater treatment works.

3 INVASIVE ALIENS

Impacts of invasive alien vegetation in the riparian zone and alien fish species.

4 DEVELOPMENT

Urban development in estuarine functional zones.

5 HABITAT DESTRUCTION

Destruction of freshwater habitats, especially from bulldozing in the riparian zone.

Source: CSIR

Climate change is expected to exacerbate pressures on water resources

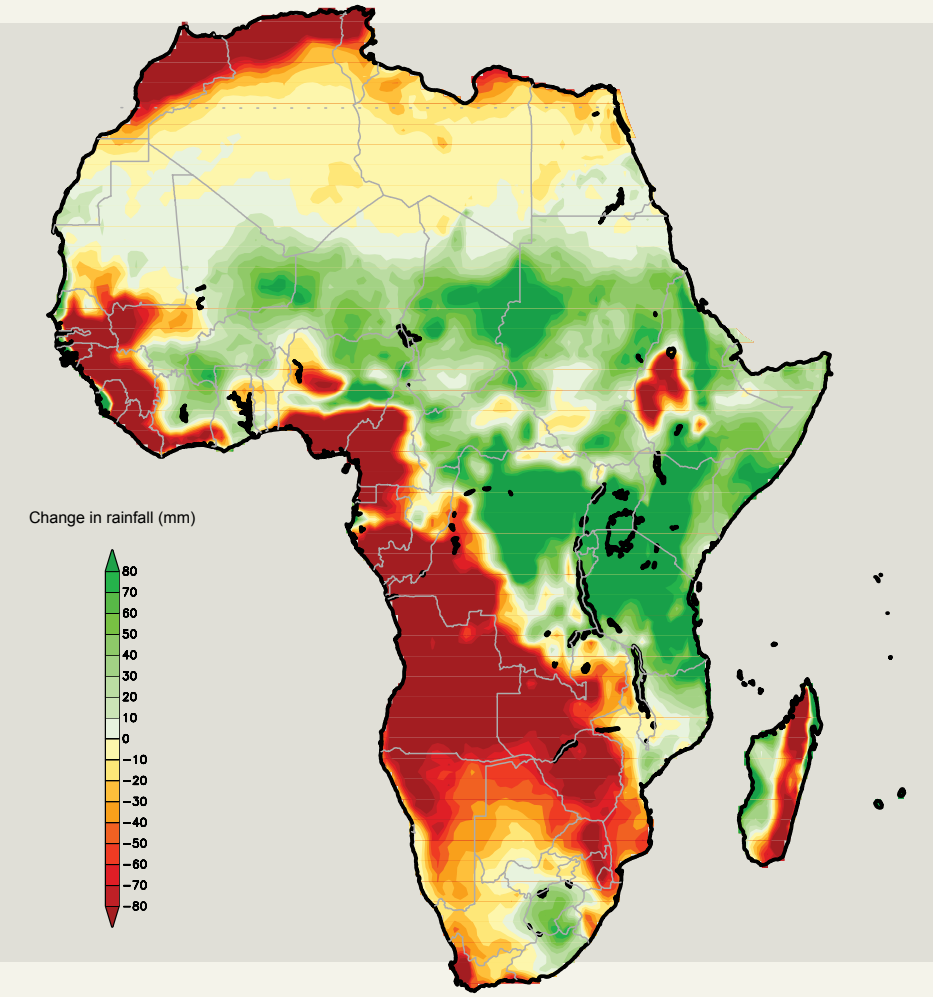
Global climate change, in particular predicted changes in temperature and precipitation, is likely to exacerbate the current pressure on South Africa's water resources. Indigenous aquatic organisms are highly sensitive to these changes.

The anticipated ecological consequences include adverse effects on water quantity and quality, aquatic habitats, aquatic organisms and, ultimately, biodiversity.

"We are the first generation that can end poverty – and the last generation to tackle climate change before it is too late."

– Ban Ki-Moon, UN Secretary General

FIGURE 2.2: PROJECTED CHANGE IN ANNUAL RAINFALL FROM 2071-2100 RELATIVE TO 1961-1990



Source: Engelbrecht et al, 2015. Projections of rapidly rising surface temperatures over Africa under low mitigation. *Environmental Research Letters.*

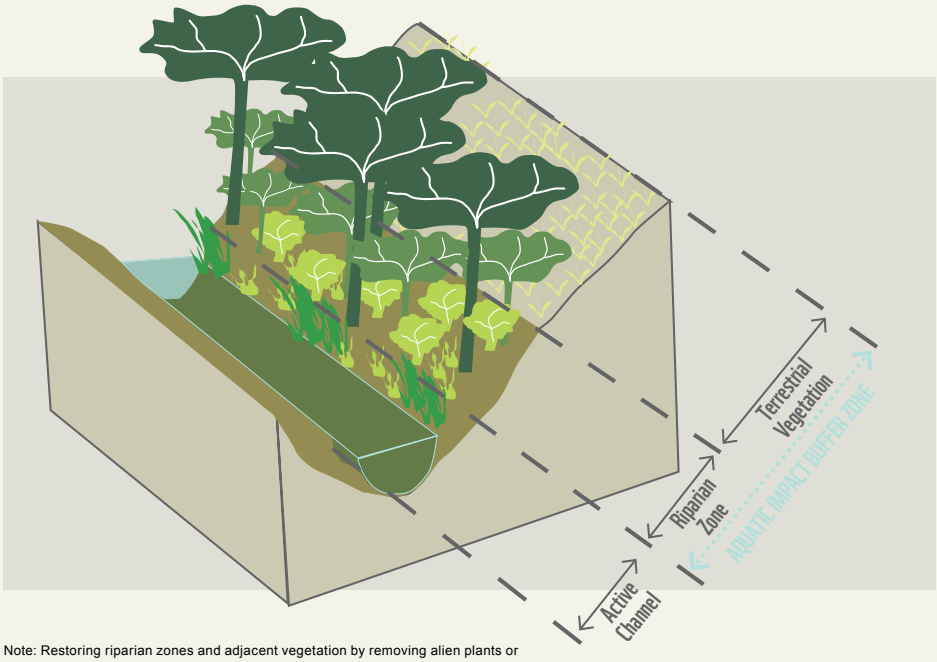
THE FUTURE

Freshwater ecosystems – lakes, ponds, rivers, streams, springs and wetlands – are generally the lowest points in the landscape, making them 'receivers' of water runoff but also of waste, sediment and pollutants. This renders them highly susceptible to upstream and upland impacts.

Re-establish healthy buffers of natural vegetation along rivers

Buffers of vegetation surrounding all freshwater ecosystems have a critical role to play in reducing the impacts of land-use practices, maintaining basic aquatic processes and preventing further degradation of our water resources.

FIGURE 2.3: HEALTHY BUFFER ZONES BUILD HEALTHY RIVERS



Note: Restoring riparian zones and adjacent vegetation by removing alien plants or intensive agriculture, improves the quality and quantity of water in rivers if natural vegetation can grow again.

Guidelines and an associated water stewardship tool were compiled in 2014 (Water Research Commission Project: K5/2200) and take users through a process for defining appropriate buffer requirements for any new or existing developments.

Increase investment for improved catchment health

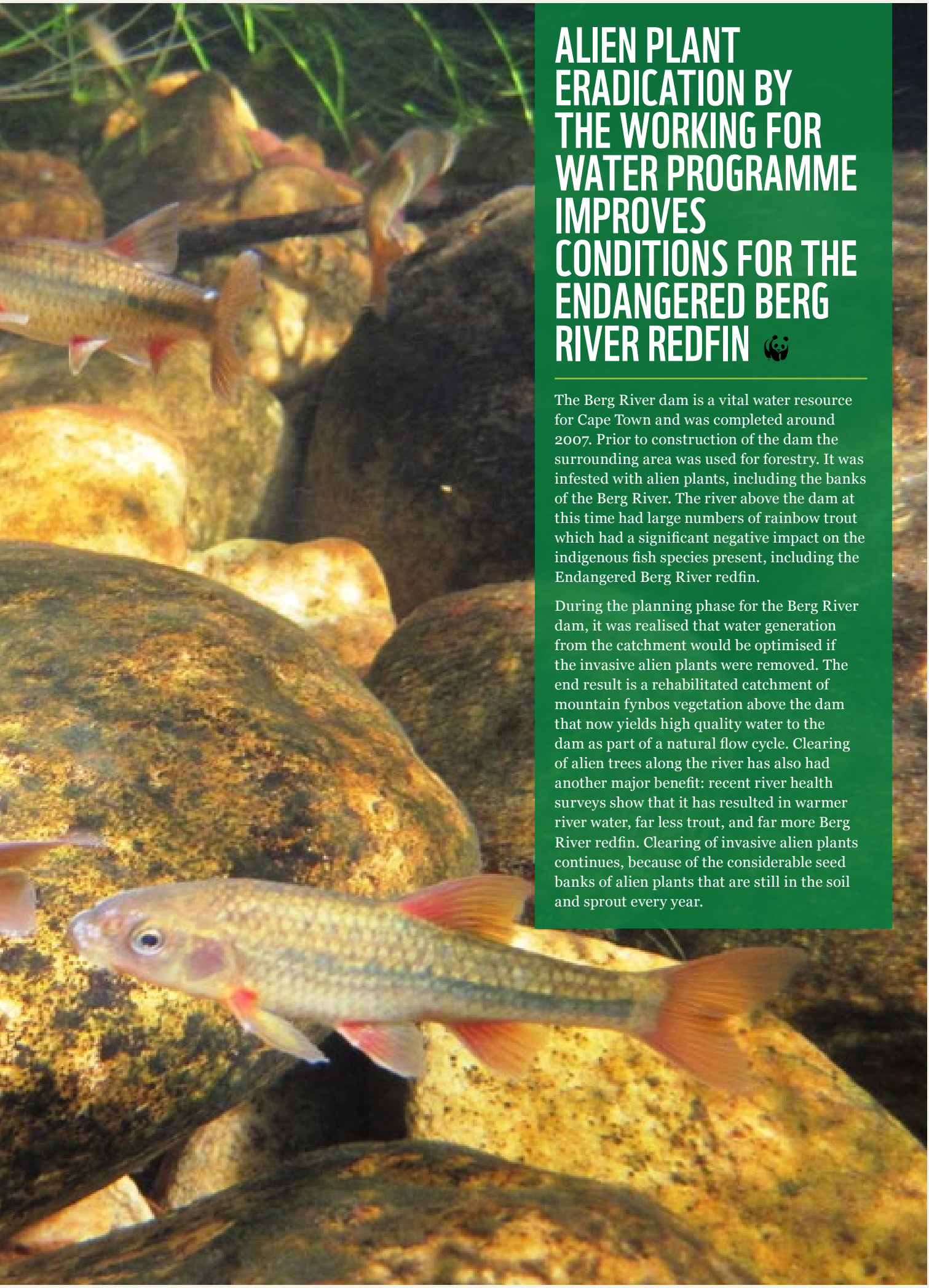
Co-financing is needed from private and civil society to substantially decrease the area invaded by alien plants

Given the increasing threat of alien vegetation to our catchments, we need to increase the level of financial investment into alien clearing programmes. While government, through the Working for Water Programme, has tackled this challenge for the last 20 years and cleared 2.7 million hectares, co-financing is required from private and civil society if we are to substantially decrease the area invaded by alien plants. WWF, through its Water Balance Programme, is working together with corporates (such as Nedbank, Woolworths, Sanlam & Sonae Novobord) to grow co-investment in addressing this issue. The Working for Water programme has also offered co-funding to support private clearing operations through the Land User Incentive scheme.

STRATEGIC SAVING

Freshwater Ecosystem Priority Areas (FEPAs) have been identified across South Africa, providing strategic spatial priorities for conserving South Africa's freshwater ecosystems and associated biodiversity. Together with the National Protected Area Expansion Strategy (Government South Africa 2010), FEPAs will help to address the gaps in the protected area system for freshwater ecosystems. FEPAs need not be fenced off from human use, but they should be supported by good planning, decision-making and management to ensure that human use does not impact on the condition of the resource.

With careful planning, which includes managing 22% of South Africa's river length and 38% of wetland areas as priority areas and ensuring that these are minimally impacted, South Africa will be able to more effectively conserve its diverse freshwater ecosystems. This will simultaneously contribute to sustainable development of water resources in the country.



ALIEN PLANT ERADICATION BY THE WORKING FOR WATER PROGRAMME IMPROVES CONDITIONS FOR THE ENDANGERED BERG RIVER REDFIN

The Berg River dam is a vital water resource for Cape Town and was completed around 2007. Prior to construction of the dam the surrounding area was used for forestry. It was infested with alien plants, including the banks of the Berg River. The river above the dam at this time had large numbers of rainbow trout which had a significant negative impact on the indigenous fish species present, including the Endangered Berg River redfin.

During the planning phase for the Berg River dam, it was realised that water generation from the catchment would be optimised if the invasive alien plants were removed. The end result is a rehabilitated catchment of mountain fynbos vegetation above the dam that now yields high quality water to the dam as part of a natural flow cycle. Clearing of alien trees along the river has also had another major benefit: recent river health surveys show that it has resulted in warmer river water, far less trout, and far more Berg River redfin. Clearing of invasive alien plants continues, because of the considerable seed banks of alien plants that are still in the soil and sprout every year.

SINCE 1913 IN SOUTH AFRICA

106

BIOLOGICAL CONTROL AGENTS HAVE BEEN RELEASED AGAINST

48

INVASIVE ALIEN PLANT SPECIES, SAVING

R6.5 BILLION

OF ECOSYSTEM BENEFITS ANNUALLY

Support active restoration measures

Restoration through the establishment of indigenous vegetation can be crucial in suppressing alien regrowth and the long-term control of invasive alien plants. The WWF pilot restoration project in the Kouga catchment proved that following the clearing of dense invasive alien plant stands, indigenous vegetation can be successfully re-established through planting seeds and propagated plants.

THE WWF WATER BALANCE PROGRAMME

The following benefits were shown by WWF's pilot restoration project:

- Suppression of regrowth and the prevention of re-invasion, thus reducing long-term costs and environmental damage;
- Prevention of erosion, sedimentation and the loss of valuable topsoil;
- Prevention of the silting up of downstream dams and reservoirs;
- Increased infiltration of water; and
- An increase in productive land and biodiversity.

Use biological controls to manage invasive alien plants

Biological control is the use of natural enemies of invasive alien plants and fish to reduce the economic and environmental damage they cause. These natural enemies (or agents) can be insects, mites or fungi. Most agents are sourced from the country of origin of the invasive alien plants and can only be released in South Africa following extensive safety testing. Use of these biological control agents should be integrated together with mechanical and chemical control options to maximise their effectiveness and reduce costs of control programmes.

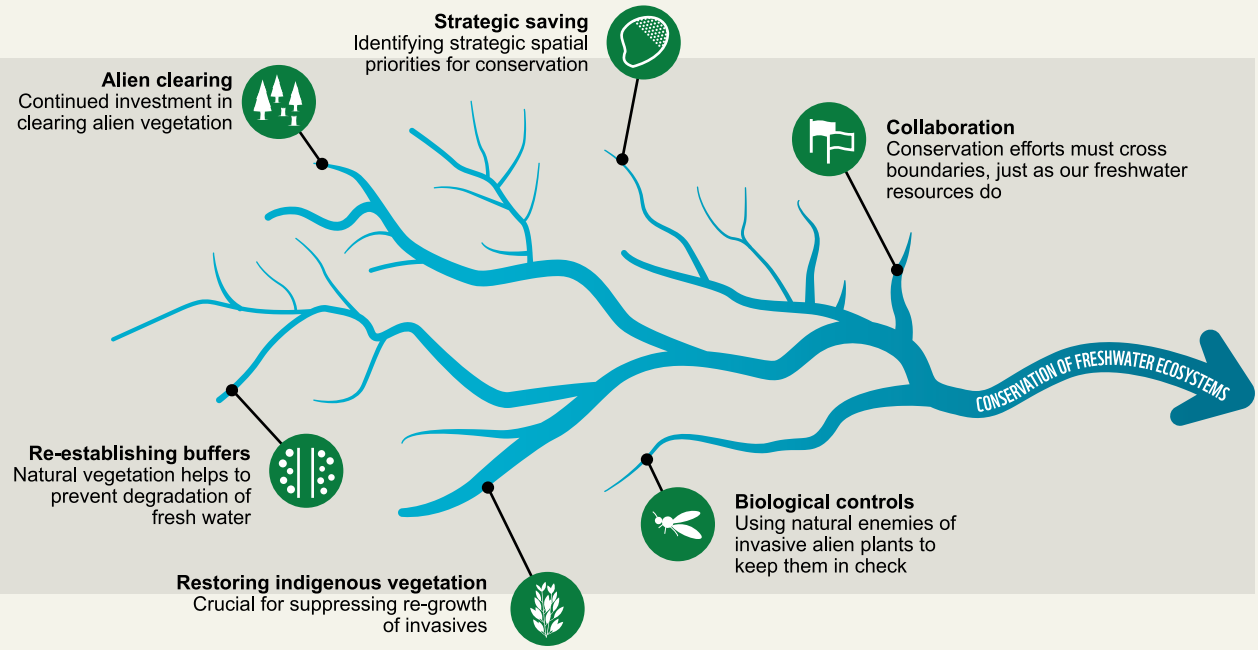
Biological control agents can only be released in South Africa following extensive safety testing

Since 1913, biological control agents have been used to target invasive alien plants in South Africa. The result is that 10 invasive alien plants species are now classified as being under complete control and a further 18 under substantial control. It has been estimated that biological control of invasive alien plants saves South Africa approximately R6.5 billion annually in ecosystem benefits (water, grazing and biodiversity). While not all of the agents have been successful, the positive results and benefit-to-cost ratio of biological control of invasive alien plants justifies continued effort being spent to develop additional agents.

Working together for water on the garden route

This collaborative approach was successfully achieved by the Southern Cape Landowners Initiative (SCLI) on the Garden Route. The SCLI was established to serve as a public platform to obtain maximum input and collaboration between landowners, land managers, Working for Water, Disaster Management, Working on Fire, the media and the public on how best to deal with the immense scale of invasive alien species. Three years into operation, SCLI has successfully garnered the support of not only all official local conservation entities but also major land managers such as Eskom, SANRAL and key research units, notably Nelson Mandela Metropolitan University's Sustainability Research Unit. Teaming up with WWF, SCLI is now co-funded through the Table Mountain Fund (TMF) and has contributed to IAP clearing of approximately 10,000 hectares with the associated water and conservation benefits.

LOOKING AHEAD: LAYING THE FOUNDATIONS TO CONSERVE FRESHWATER ECOSYSTEMS



FURTHER INFORMATION

WWF Living Planet Report, 2014 – http://wwf.panda.org/about_our_earth/all_publications/living_planet_report
http://www.csir.co.za/impact/docs/Final_Freshwater_Atlas_Article.pdf

National Freshwater Ecosystem Priority Areas – http://bgis.sanbi.org/nfepa/NFEPAmap.asp

WRC, Buffer Zone –http://www.wrc.org.za/Lists/Knowledge%20Hub%20Items/Attachments/11106/Deliverable%201%20-%20Final%20Literature%20Review.pdf

https://www.environment.gov.za/projectsprogrammes#workingfor

https://www.environment.gov.za/projectsprogrammes#biodiversity

ENVIRONMENTAL FLOWS

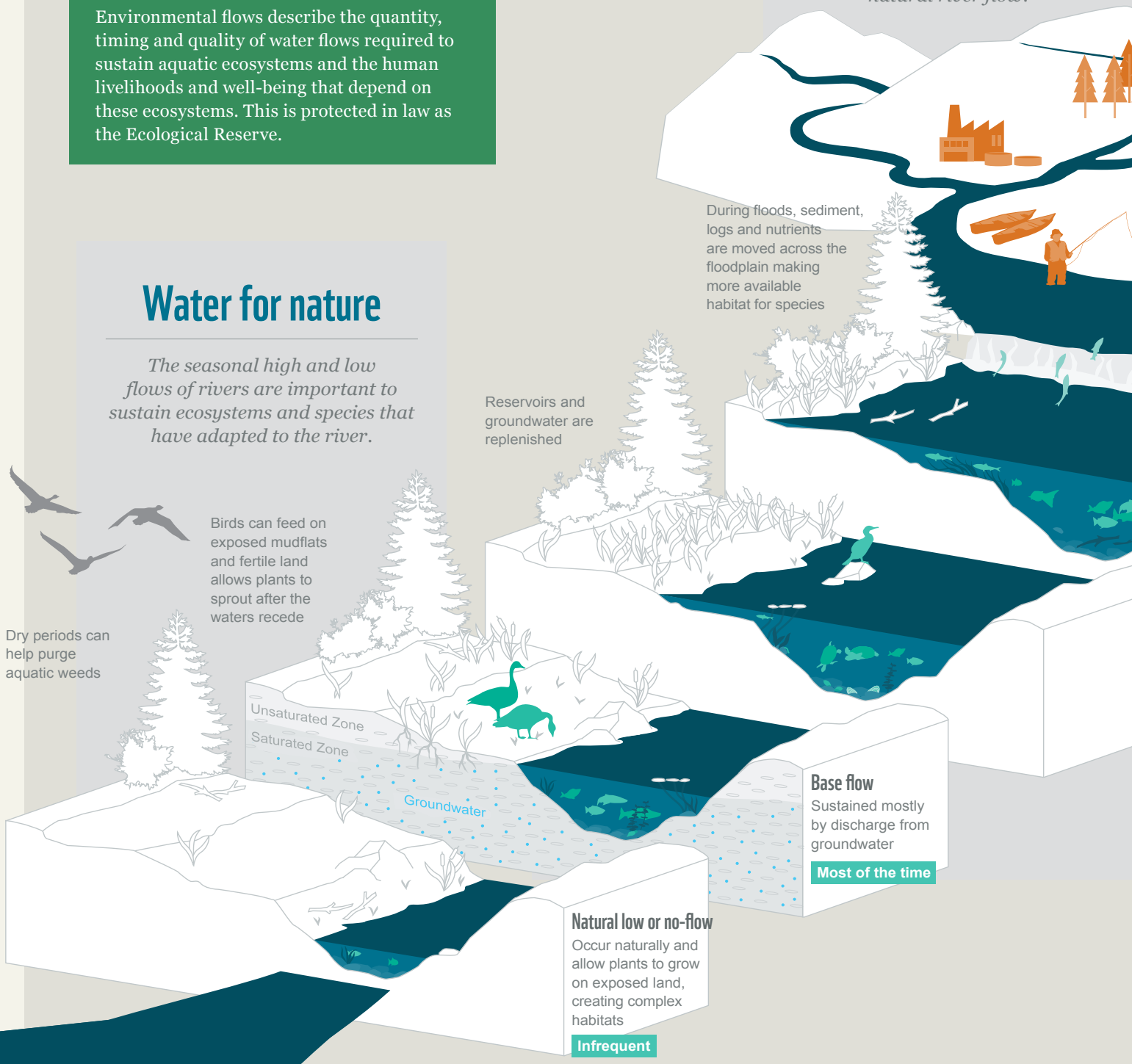
Environmental flows describe the quantity, timing and quality of water flows required to sustain aquatic ecosystems and the human livelihoods and well-being that depend on these ecosystems. This is protected in law as the Ecological Reserve.

Water for people

Humans use water to sustain communities, altering natural river flow.

Water for nature

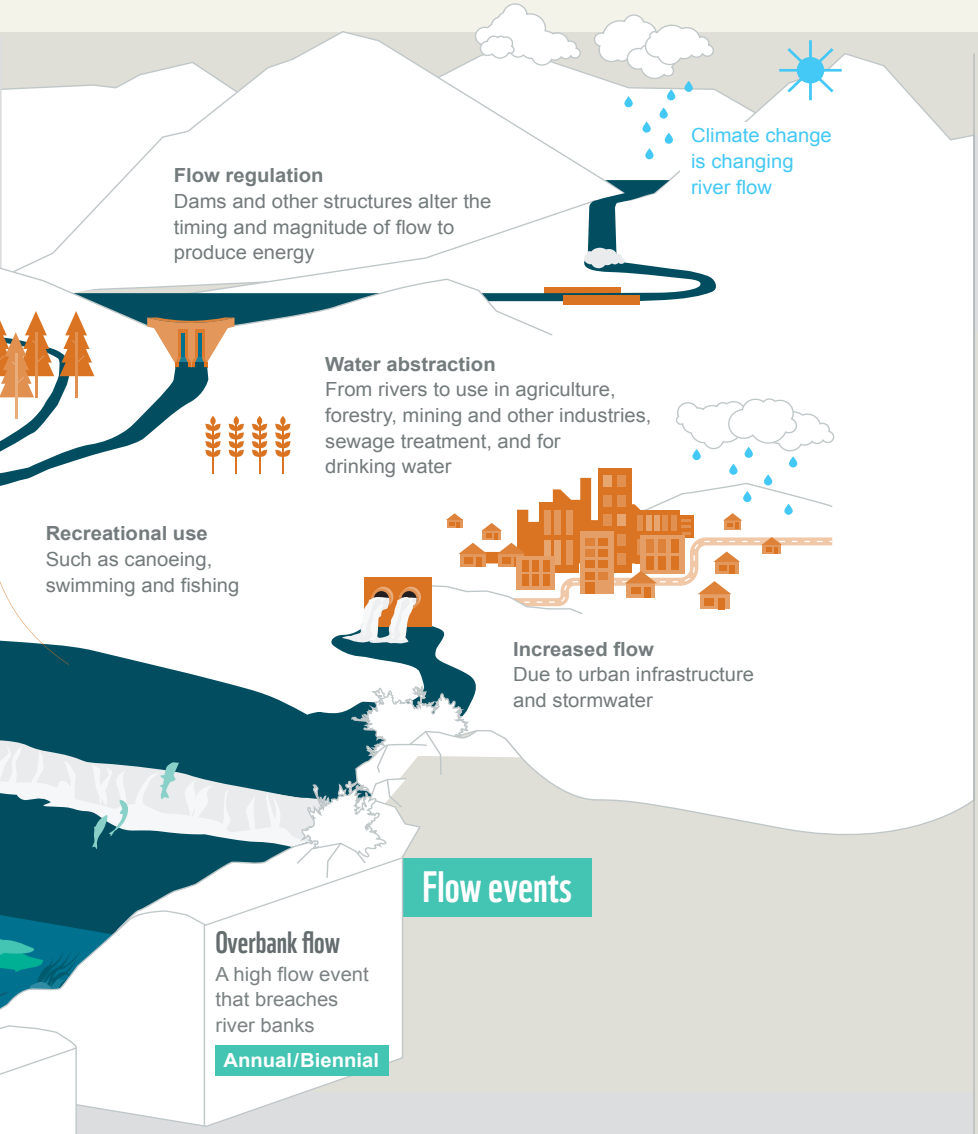
The seasonal high and low flows of rivers are important to sustain ecosystems and species that have adapted to the river.



For more information, visit

WWF.ORG.ZA/WHAT_WE_DO/FRESHWATER

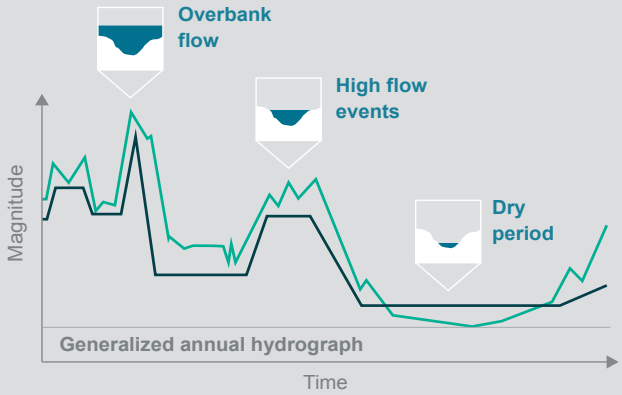
WWF



Mimic natural flows

Environmental flows mimic the natural flow of a river, which supports ecosystem functions and allows for human water consumption.

Environmental flow patterns



Ecosystem base flow
A low-flow threshold below which all water withdrawals should cease. Below this threshold aquatic life requires all of the available water in a river. This occurs very infrequently, in very, very dry years.

Natural flow regime

Environmental flow

Ecosystem base flow

Source: WWF-Canada

Five key components of environmental flow

Hydrology

To describe the movement of water over time by quantifying the magnitude, timing, duration, frequency, and rate of change of flow events.

Geomorphology

To document the composition and shape of stream channels and floodplains and evaluate the physical processes that form and maintain them.

Biology

To consider the interaction between river flow and the number and type of species found in the aquatic environment.

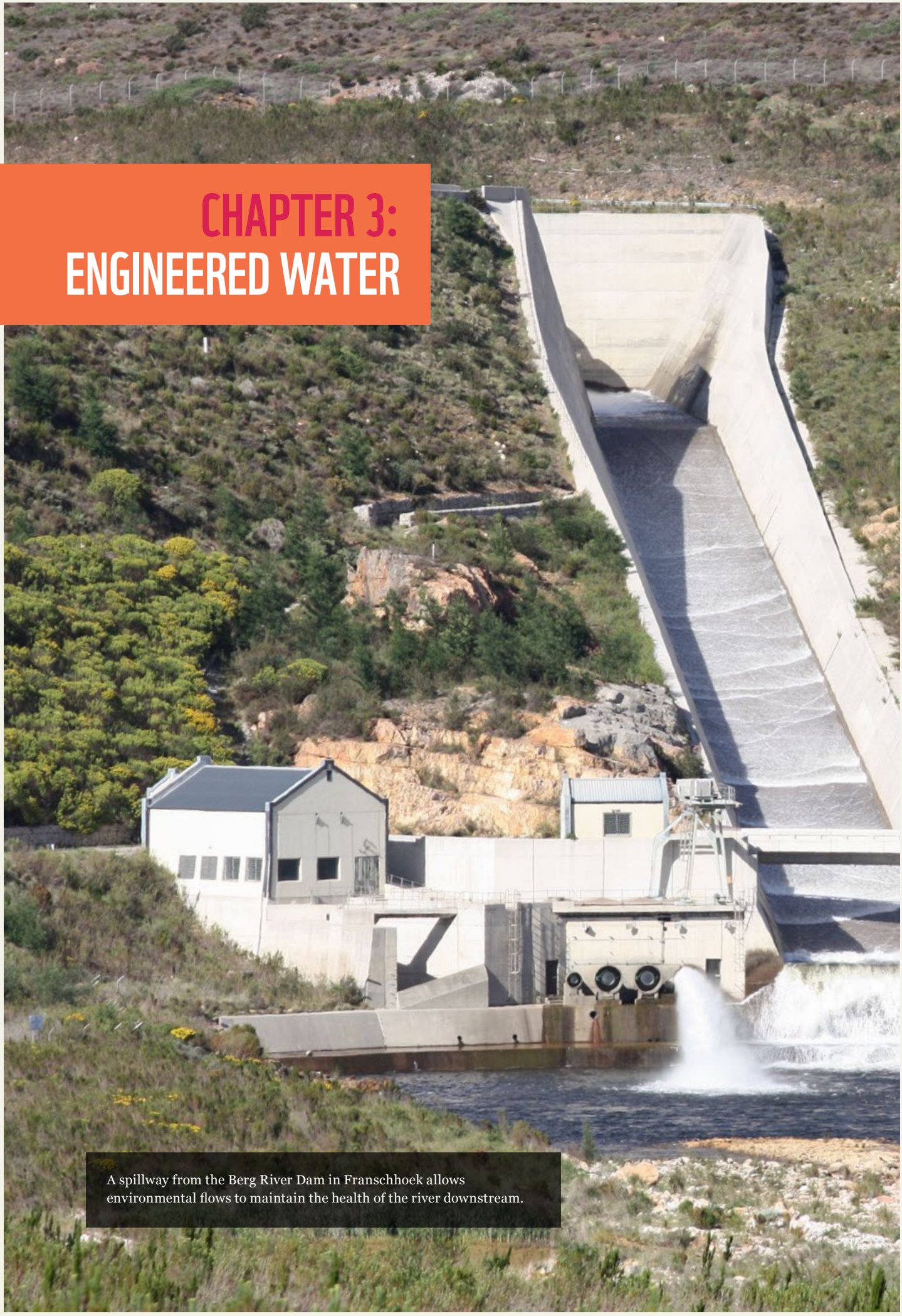
Water quality

To study the physical, biological and chemical attributes of water and the connections to hydrological and biological aspects.

Connectivity

To analyse the movement of organisms, energy and matter through the river system, as well as the impacts of natural and artificial barriers by considering connections among hydrologic, geomorphic, biological and chemical aspects.

CHAPTER 3:
ENGINEERED WATER



A spillway from the Berg River Dam in Franschhoek allows environmental flows to maintain the health of the river downstream.

GETTING WATER TO WHERE IT'S NEEDED

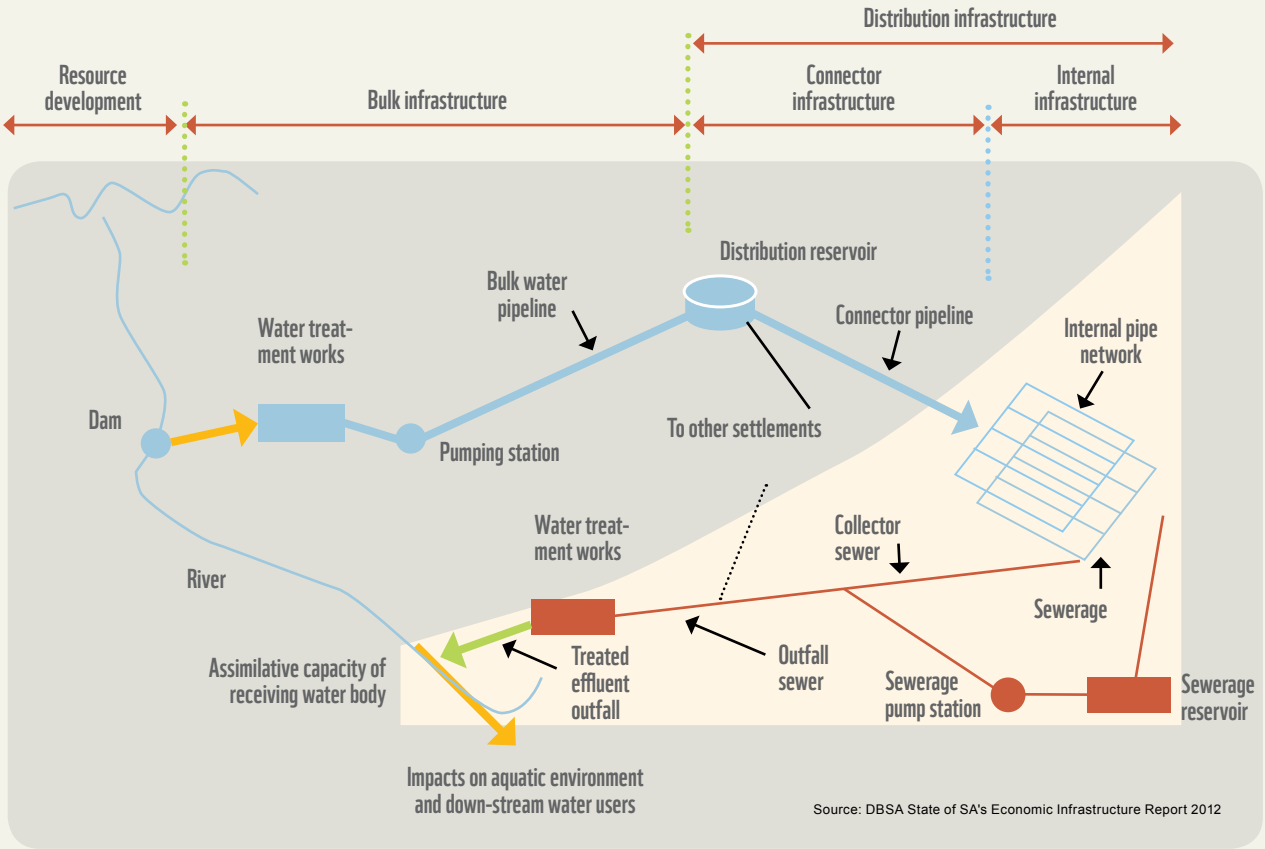
The goal of water engineering is to ensure a sustainable supply of water, where it is needed, when it is needed.

South Africa's national storage capacity for water is nearly equal to its annual river flow.

The highly seasonal rainfall in South Africa means that the storage of water is critical to ensure year-round supply. Dams and inter-basin transfer schemes form the backbone of our engineered or 'hard' infrastructure for water. Smaller-scale engineered infrastructure, from the bulk water supply to urban, irrigation and wastewater systems, is critical for getting water to taps and for sanitation. Dams give us regulated, more consistent, year-round flows and fewer floods. However, the disruption of natural flow regimes degrades the natural state of our rivers.

Interbasin Transfer Schemes (ITSs): Constructed conveyance schemes which move water from one river basin where it is available, to another basin where water is less available and is required for agriculture, cities, development, etc.

FIGURE 3.1: ENGINEERED INFRASTRUCTURE OF SOUTH AFRICAN WATER SYSTEMS



FACTS

South Africa has approximately 4,718 dams registered with the Dam Safety Office, including those owned by the Department of Water and Sanitation (DWS) and those owned privately.

305 dams with a total capacity of 29.2 billion m³ are owned by the Department of Water and Sanitation

The DWS owns approximately 305 dams with a total capacity of 29.2 billion m3. This accounts for 70% of the total dam capacity in the country. The largest DWS-owned dam in South Africa is the Gariep Dam on the Orange River between the Eastern Cape and Free State, with a capacity of approximately 5,500 million m3.

More than 25% of DWS-owned dams are located in the Eastern Cape and 15% in Mpumalanga. Farm dams are not well monitored but it is estimated that there are between 150,000 and 400,000 throughout the country.

Other significant dam owners and operators are Water User Associations and Water Boards (such as Umgeni Water), local municipalities, metropolitan municipalities, and the Trans Caledon Tunnel Authority (TCTA).

THE TEN BIGGEST DAMS (IN ORDER OF CAPACITY) IN SOUTH AFRICA

DAM	PROVINCE	CAPACITY (IN MILLION M³)	RIVER
Gariep	FS	5,500	Orange
Vanderkloof	FS	3,171	Orange
Sterkfontein	FS	2,616	Nuwejaars Spruit
Vaal	FS	2,603	Vaal
Pongolapoort	KZN	2,267	Pongola
Bloemhof	FS	1,240	Vaal
Theewaterskloof	WC	480	Riviersonderend
Heyshope	MPU	451	Assegaai
Woodstock	KZN	373	Tugela
Loskop	MPU	362	Olifants
DAMS IN LESOTHO	**PROVINCE**	**CAPACITY (IN MILLION M³)**	**RIVER**
Katse	Lesotho	1,519.1	Malibamatso
Mohale	Lesotho	857.1	Senqunyane

World Commission on Dams

The World Commission on Dams (WCD), established under the patronage of former President Nelson Mandela, developed new holistic guidelines for dam building. These include an innovative framework for the planning of water and energy projects that is intended to protect dam-affected people and the environment, and ensure that the benefits from dams are more equitably distributed.

Recommendations of the World Commission on Dams form the basis of many decision-making processes for dams globally

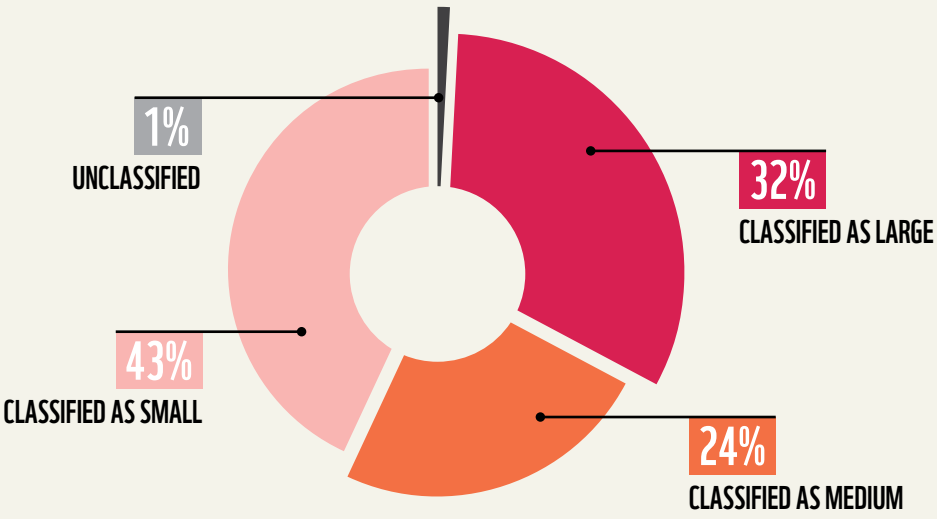
THE WORLD COMMISSION ON DAMS FRAMEWORK

The WCD framework covers key areas for improved planning of dams, including:

- The need to fully assess all available options for meeting water and energy needs;
- Addressing outstanding social issues regarding existing dams before building new ones;
- Addressing the importance of protecting and maintaining healthy river systems when planning dams; and
- Gaining public acceptance for key decisions.

The WCD recommendations form the basis of many decision-making processes for dams around the world and constitute international soft law (guidelines, policy declarations or codes of conduct that set standards but are not directly enforceable). They are also being adapted to national contexts around the world.

SIZE OF DAMS OWNED BY THE DEPARTMENT OF WATER AND SANITATION



1663
THE YEAR SOUTH AFRICA'S OLDEST DAM WAS BUILT

Dams from old to new

South Africa's oldest hydraulic structure or masonry weir is the Waegenaars Dam in Cape Town, built in 1663 to supply freshwater to ships in transit from Europe to India.

The Van Wyksvlei Dam in the Northern Cape, built in 1882, is South Africa's first state-funded dam and the first large fill dam in the country, with a reservoir of 75 million m3 capacity.

South Africa's newest dam is the De Hoop Dam opened in March 2014. It was built at a cost R3 billion and has a capacity of 347 million m3.

CAPE TOWN'S IMPRESSIVE WATER ENGINEERING

The engineered infrastructure in Cape Town is extremely impressive, from its early wood and lead pipelines to the now 554km of treated water pipelines and 100km of raw water pipes. Cape Town owns 11 storage dams and 24 service reservoirs.

The Woodhead Dam on Table Mountain, constructed in 1896, was recognised in 2008 as an International Historic Civil Engineering Landmark by the American Society of Civil Engineers. The original water supply to the City was the naturally brown (*thee*) water from the fynbos-covered mountainous catchment areas. This was supplied without any treatment and, as a result, the authorities were very strict about catchment management.

The first water treatment system in the City was the Platteklip Stream slow-sand filter beds, constructed in 1869 and no longer in use. The City now has 12 water treatment plants with a total capacity of 1,615 megalitres/day (Ml/day).

Cape Town's peak week demand in 2014 was 7,981 Ml/week and despite the City's very successful water demand management efforts, the demand for water in the City continues to grow, and therefore necessitates enhanced water resources.

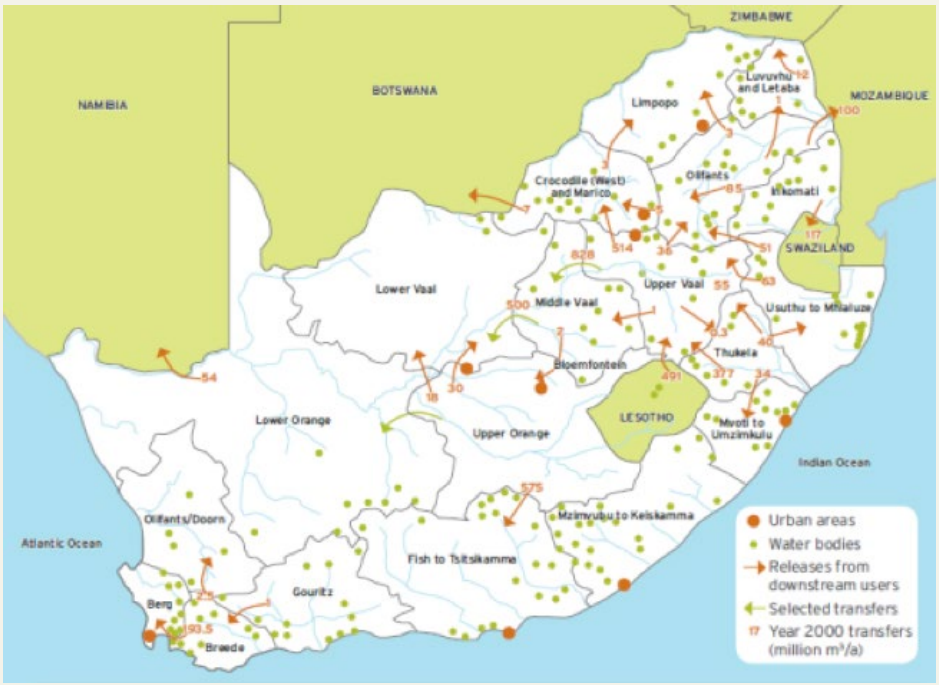
There is a limit to how far the surface water resources in the catchments near the City can be developed. Other options to meet the demand that are being considered include groundwater, desalination and water re-use.

Interbasin Transfer Schemes

26
IBTs MOVE WATER TO WHERE IT'S NEEDED

South Africa has approximately 26 Interbasin Transfer Schemes (IBTs). These conveyance schemes move water from one river basin where it is available, to another basin with less water. The development of IBTs was largely driven by the need to meet water demand for economic activities located far from water resources. The key demand centres are metropolitan areas and large towns.

FIGURE 3.2: MAJOR TRANSFER SCHEMES BETWEEN WATER MANAGEMENT AREAS



Source: DBSA State of SA's Economic Infrastructure Report 2012

Lesotho Highlands Water Project

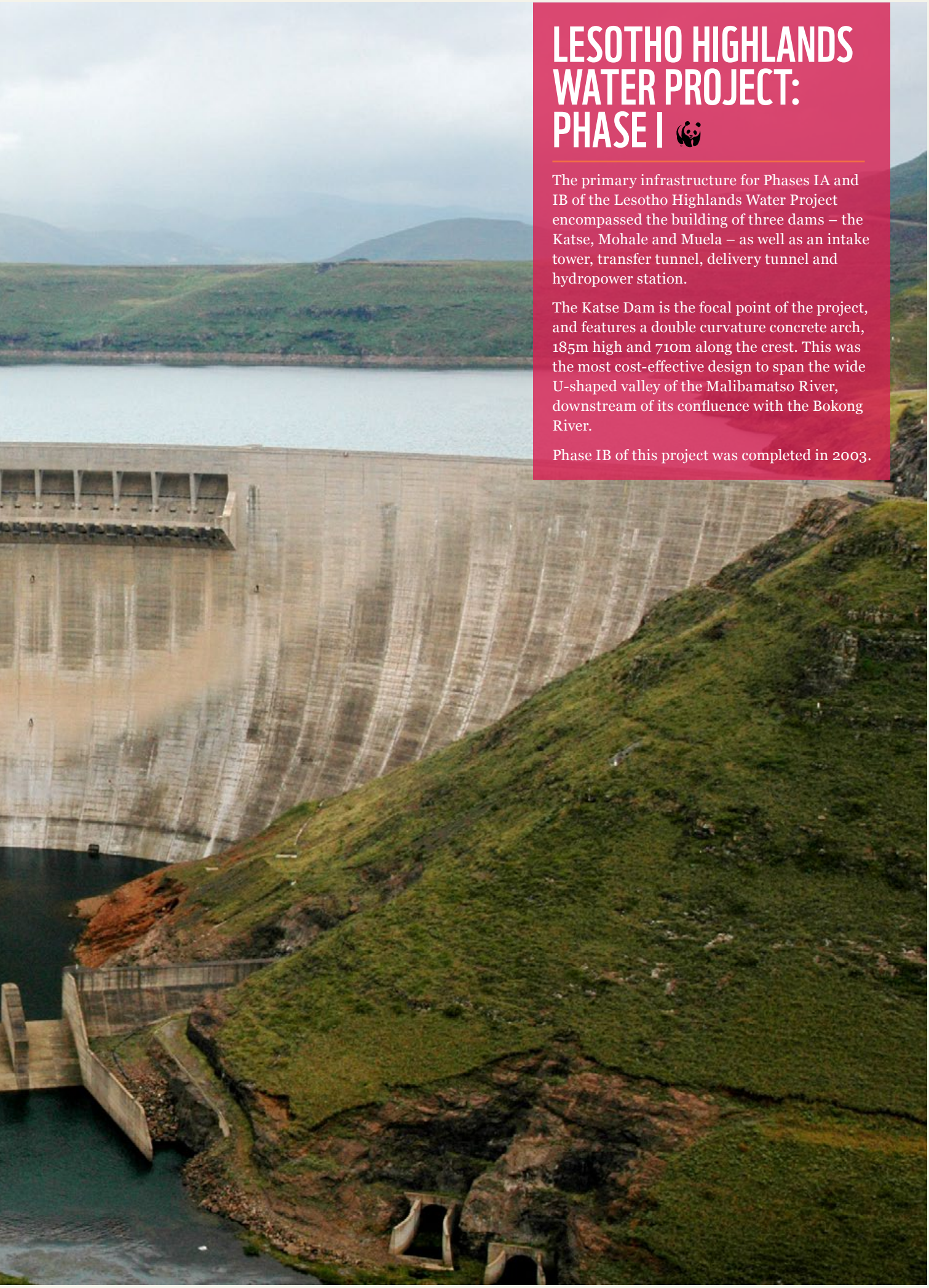
40%
OF THE WATER IN THE VAAL RIVER IS FROM LESOTHO

The Lesotho Highlands Water Project was instituted as a bi-national project, spanning the borders of South Africa and Lesotho, in accordance with a treaty signed in 1986, to provide water for South Africa and hydroelectricity for Lesotho.

An astounding engineering feat, it diverts water from the Senqu River System in Lesotho to South Africa's water-stressed economic hub, the Gauteng region. The importance of this transfer scheme is highlighted by the fact that 40% of the water in the Vaal River is from Lesotho.

A multipurpose undertaking, the Lesotho Highlands Water Project transfers 780 million m3 of water and generates 72 megawatts (MW) of hydropower at the Muela Power Station. Revenue from the sale of raw water from the project amounted to over R2,708 million in 2010.

The Lesotho Highlands Development Authority is responsible for the project's overall implementation works such as dams, tunnels, power stations and infrastructure on Lesotho's borders. It reports to the Lesotho Highlands Water Commission (LHWC; previously the Joint Permanent Technical Commission), a bi-national commission consisting of three delegates from each country responsible for monitoring the project. The project is being undertaken in phases.



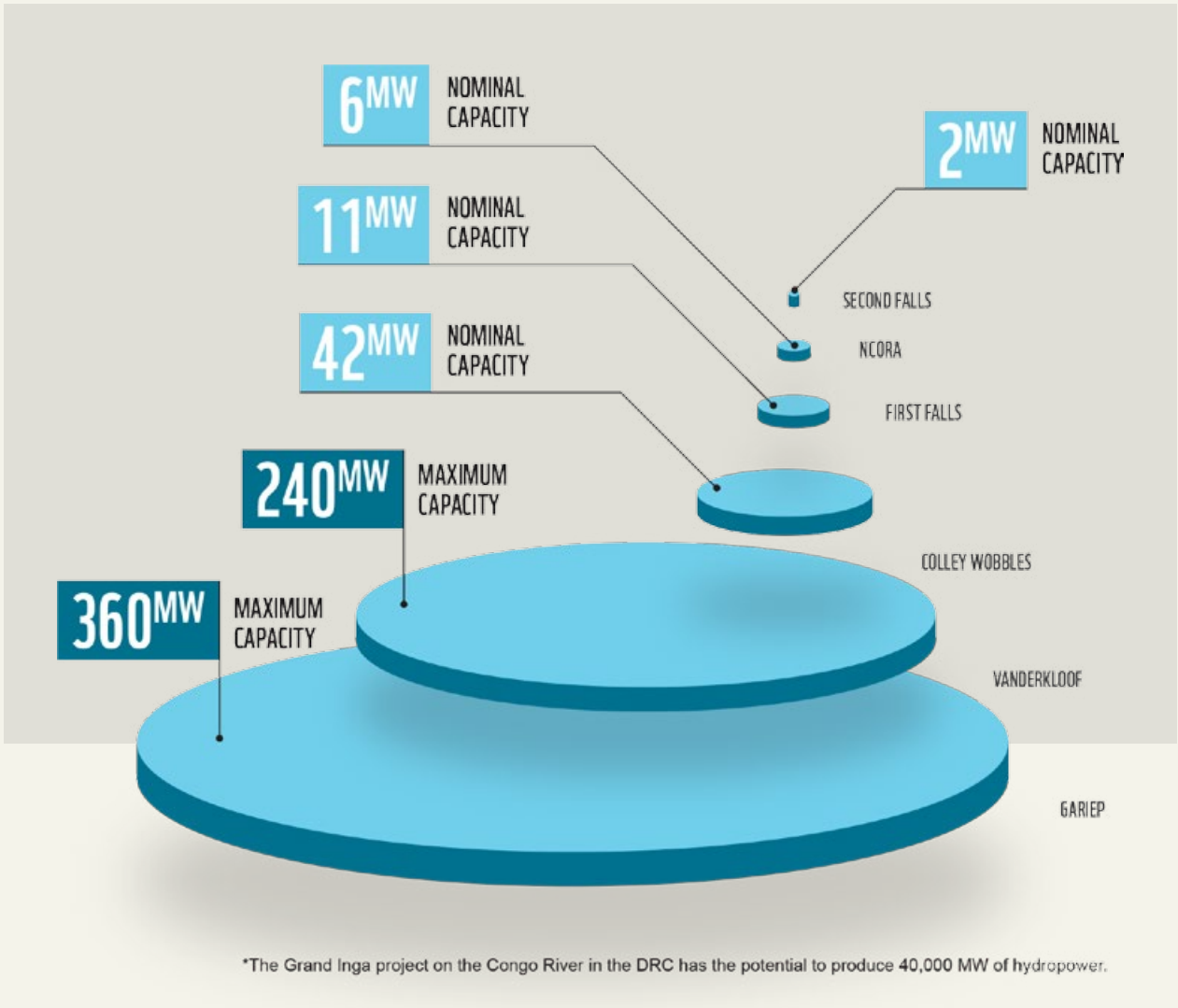
LESOTHO HIGHLANDS WATER PROJECT: PHASE I

The primary infrastructure for Phases IA and IB of the Lesotho Highlands Water Project encompassed the building of three dams – the Katse, Mohale and Muela – as well as an intake tower, transfer tunnel, delivery tunnel and hydropower station.

The Katse Dam is the focal point of the project, and features a double curvature concrete arch, 185m high and 710m along the crest. This was the most cost-effective design to span the wide U-shaped valley of the Malibamatso River, downstream of its confluence with the Bokong River.

Phase IB of this project was completed in 2003.

FIGURE 3.3: SOUTH AFRICA'S CURRENT OPERATIONAL HYDROPOWER CAPACITY AT LARGE DAMS



South African Government has approved the second phase of the project at an estimated cost of R9.3 billion

Lesotho Highlands Water Project: Phase II

The South African Government is negotiating the second phase of the project at an estimated cost of R9.3 billion (2010 price levels) for the water transfer segment.

Phase II includes the construction of the Polihali Dam, a transfer tunnel from Polihali Dam to the Katse Dam, advanced infrastructure, and environmental and social development programmes in Lesotho.

Phase II will also include a pump storage scheme to generate 1,200 MW of electricity using the existing Katse Reservoir as the lower reservoir and a new upper reservoir in the Kobong Valley, or any other similar scheme close to Katse Dam. The pump storage scheme will start generating electricity in January 2018. The estimated cost of the pump storage scheme is R7.6 million (2010 price levels) and will be borne by Lesotho.

R63 BILLION
WORTH OF WATER INFRASTRUCTURE IS OWNED BY THE DEPARTMENT OF WATER AND SANITATION

The value of South Africa's water infrastructure

Dams, canals, pipelines, tunnels, measuring facilities and other infrastructure owned by the DWS was valued at R63 billion in 2011. The current replacement value of the water resources infrastructure is R139 billion, with an additional R7.3 billion in land valuation, according to South African Institute of Civil Engineering's (SAICE) Infrastructure Report Card 2011.

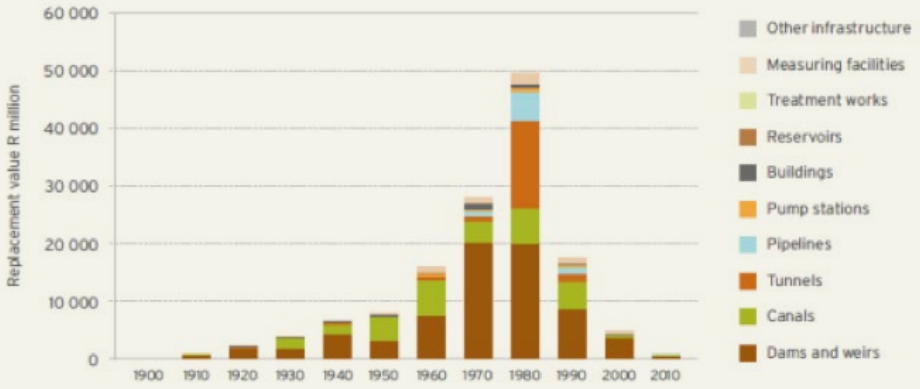
If we look at wastewater alone, 7 600 000 m3 of wastewater are processed on a daily basis. In 2012, wastewater treatment infrastructure had a capital replacement value of approximately R23 billion and operational expenditure of approximately R3.5 billion per annum.

The Department of Water and Sanitation has onerous funding challenges and estimates an investment requirement of R1.4-billion each year, solely to maintain current infrastructure. It has been estimated that they will require an additional R63 billion per annum to upgrade and repair infrastructure to meet projected demands.

Infrastructure lifespan

The figure below from the Development Bank of Southern Africa provides an overview of the original construction dates of different components of DWS infrastructure. The expected lifespan of infrastructure varies according to the size and complexity of the components – from 10 years (for some small motors) to 300 years (for certain dam walls). The weighted average with respect to South Africa's water infrastructure is 39 years.

FIGURE 3.4: AGE PROFILE OF ASSETS



Source: DBSA State of SA's Economic Infrastructure Report 2012

THE FUTURE

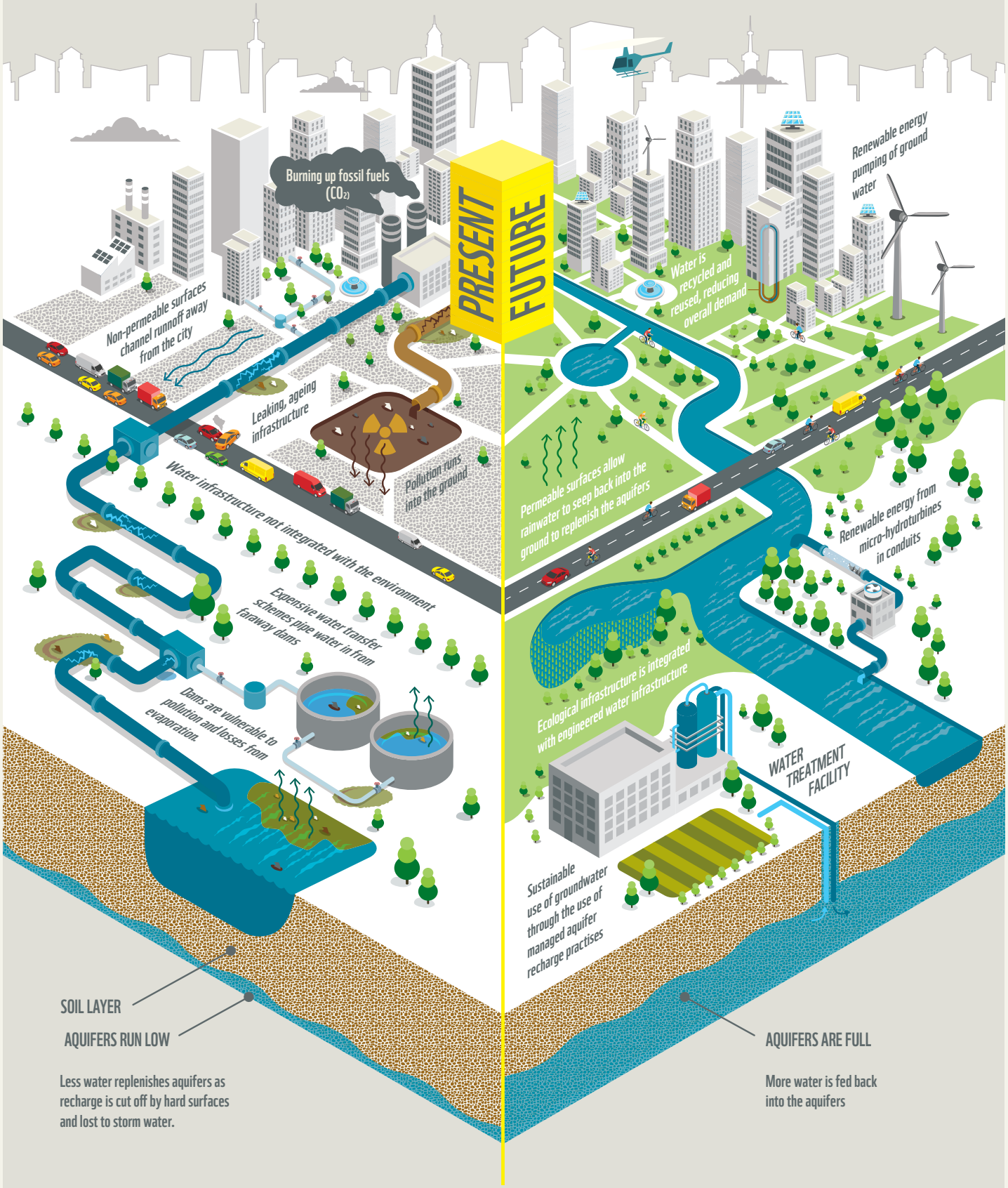
Mzimvubu Water Project

The Mzimvubu Water Project in the Eastern Cape is South Africa's proposed next big series of dams. Two dams are designed to store 145 million m³ of water (73 million m³ per year) and expected to cost nearly R7 billion.

One of these dams, the 490-million m³ Ntabelanga Dam, to be built in Ntabelanga on the Tsitsa River, a tributary of the Mzimvubu River, would be South Africa's 10th largest dam once completed. It will help to meet the province's domestic, agricultural and industrial water requirements, and supply the Orange/Vaal River System in the longer term. The Mzimvubu/Vaal will become the largest transfer scheme in the country once completed.

CITIES OF THE PRESENT AND FUTURE

Water-sensitive urban design reconfigures cityscapes with softer surfaces that slow flow and allow percolation. More water is reused and recycled, limiting demand.



Dams are only viable when upstream catchments are well managed

The Environmental Impact Assessment was completed in 2015 and the project is currently awaiting a water use licence and a record of decision from DWS and DEA respectively. Once awarded, a detailed design will be completed and the project will go out to tender.

In advance of this project, there has been widespread investment into the upper catchment of the associated rivers to remove alien vegetation.

It needs to be emphasised that all current and future dams are viable only if the catchments upstream are well managed, with minimal sediment and pollution flowing into the dams.

The importance of groundwater

Aquifers are nature's dams

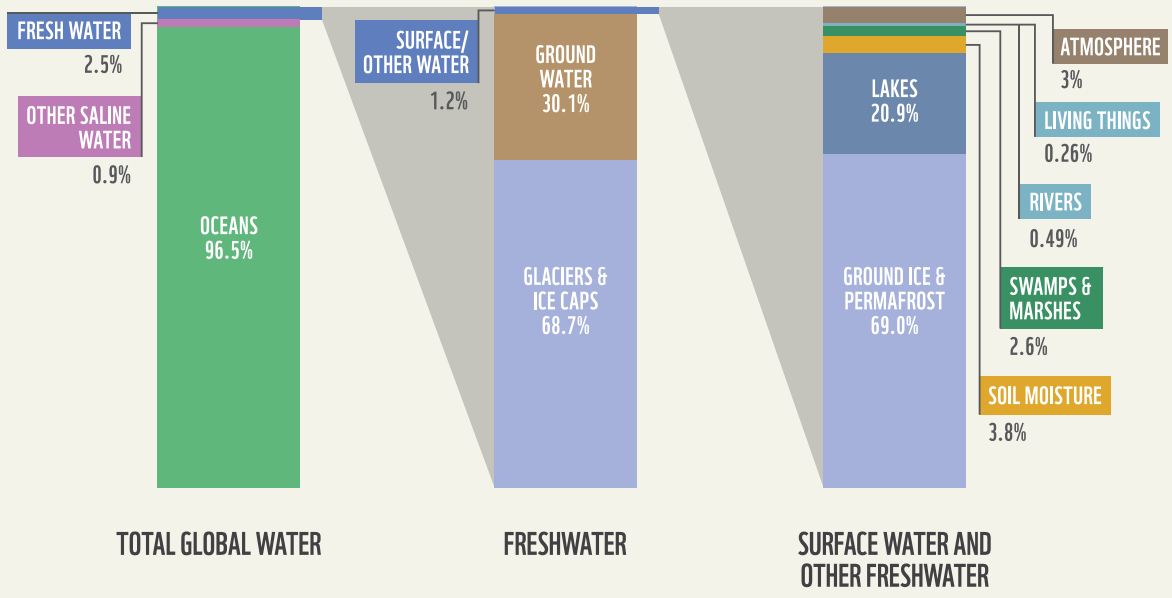
Historically, groundwater took a back seat while surface water resources dominated large-scale water infrastructure development. This is no longer the case, and groundwater is increasingly being relied upon as a vital water source at different levels – from small-scale supply from an individual borehole to large-scale, sophisticated supply schemes.

Groundwater also serves as a potential buffer during droughts, because the volume of water stored in underground aquifers can be significant. Consider that the storage volume of surface water dams is generally equivalent to a few times greater than the volume of the mean annual runoff in the catchment, whereas an aquifer can have a storage volume several thousand times greater than the annual recharge. This stored volume is also not subject to the water evaporation losses of dams.

>300
SOUTH AFRICAN TOWNS ARE ALREADY USING GROUNDWATER

In an aquifer that is already heavily used, additional stored volumes can be accessed during a drought (if the short-term impacts are considered acceptable), and then replenished by reducing abstraction in subsequent non-drought years.

FIGURE 3.5: WHERE IS EARTH'S WATER?



Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources.
Note: Numbers are rounded, so percent summations may not add to 100.

GROUNDWATER CASE STUDY: HERMANUS

The coastal town of Hermanus has included groundwater in its water supply mix as a result of planning and foresight that suggested additional resources, other than its surface water dam, were required to meet future demand.

The use of groundwater was the town's saving grace when the Southern Cape region experienced a drought in 2009–2010. The surface water supply of De Bos dam reached a record low and enhanced abstraction from groundwater during the drought, kept the taps flowing.

Unvoto Africa have ensured that the wellfield supplying Hermanus makes use of state of the art technology, in which borehole pumps and booster pumps can be controlled remotely by telemetry systems with several automatic shut offs.

GROUNDWATER CASE STUDY: CAPE TOWN

The City of Cape Town completed an exploration of the Table Mountain Group (TMG) aquifer in 2012, which included drilling numerous boreholes and widespread monitoring of baseline conditions. Further exploration is planned for the potential development of a pilot groundwater wellfield to abstract 5 million m3 per annum in 2017.

The order in which reconciliation options (water re-use, desalination and large-scale abstraction from the TMG aquifer) will be implemented is yet to be decided by the City, and will be based on the outcome of various feasibility studies. Nevertheless, the large-scale use of up to 50 million m^3 of groundwater per annum from the TMG by 2028 remains an option (DWS, 2014).

Managed aquifer recharge

Managed aquifer recharge represents Water Banking

Actively injecting water underground or enhancing infiltration to aquifers aims to capitalise on aquifers as large storage facilities. In 2007, the then Department of Water Affairs and Forestry published the first Artificial Recharge Strategy with a clear vision of maximising the use of natural sub-surface storage where it is technologically, economically, environmentally and socially feasible to do so (DWAF, 2007). Municipalities, farms or facilities that use artificial recharge are banking water and are better buffered from drought and prolonged dry seasons.

The strategy calculated that in particular areas where conditions are favourable for infiltration, the potential artificial recharge volume can exceed 100,000 m^3/km^2.

For example in the Lower Orange, the DWS estimated that the groundwater volume available with a 5m drawdown is 397 million m^3 per annum, which increases five times to approximately 2,000 million m^3 per annum, when the potential artificial recharge storage volume is used.

The artificial recharge strategy is being rolled out and tested in several settings for varying purposes and needs.

LOCAL GOVERNMENT - TURNING UNDERGROUND

Prince Albert

This town uses groundwater supplies for most of the year, and surface water augments the supply during winter when it is available. Feasibility studies, including test injection, have been completed to show how excess winter surface water can be injected into the aquifer to ensure it is full prior to the onset of summer.

Sedgefield

A desktop investigation has been completed into the possibility of using managed aquifer recharge as an indirect means of polishing water for potable re-use in Sedgefield. Treated effluent would be allowed to infiltrate into the sand aquifer, to be harvested downgradient for potable re-use. (Downgradient is the direction that groundwater flows; similar to 'downstream' for surface water.) Groundwater modelling shows the scheme would be viable, and a 3-phase implementation is recommended.

WATER-SENSITIVE URBAN DESIGN

Cities of the future need to reduce water pollution and re-integrate the water cycle back into town-planning. Current designs dominated by hard surfaces and channelled storm water rush water and pollution out of the city and into the nearest river or bay. 'Greening' the city with softer, living surfaces and slowing down water to allow infiltration, helps to recharge local groundwater and reduce pollution in rivers. Water sensitive cities encourage more recycling and re-use of water. And they are greener and more pleasant places to live! Perth and Philadelphia are examples of cities that have started using water sensitive urban design.

Addressing leakages and illegal off-takes

37%
OF WATER IN OUR URBAN PIPED WATER SYSTEMS LEAKS OUT OR IS USED ILLEGALLY

Research conducted by the Water Resource Partners (WRP) showed that the level of leakages and illegal off-takes (non-revenue water) from our urban reticulation systems averages 37%. This is fairly typical of leakage losses worldwide – especially from ageing infrastructure.

If we could reduce this loss to those of a world leader like Denmark (5% leakages), then we would be able to close the gap between supply and demand without expensive investment in new infrastructure. A proactive investment in our existing infrastructure, and programmes to reduce the leakages and illegal off-takes is urgently required along the full cycle – from treatment plant to tap.

Towards this, the DWS is training 15,000 new plumbers in a dual attempt to minimise losses and create jobs. In addition, South Africa needs to make use of leading leakage detection technology on pressurised systems, which can rapidly alert operators to leaks and breakages, and detect leaks in old, low-pressure reticulation systems.

Power in the pipes

Turn-around pressure-causing leaks to generating power

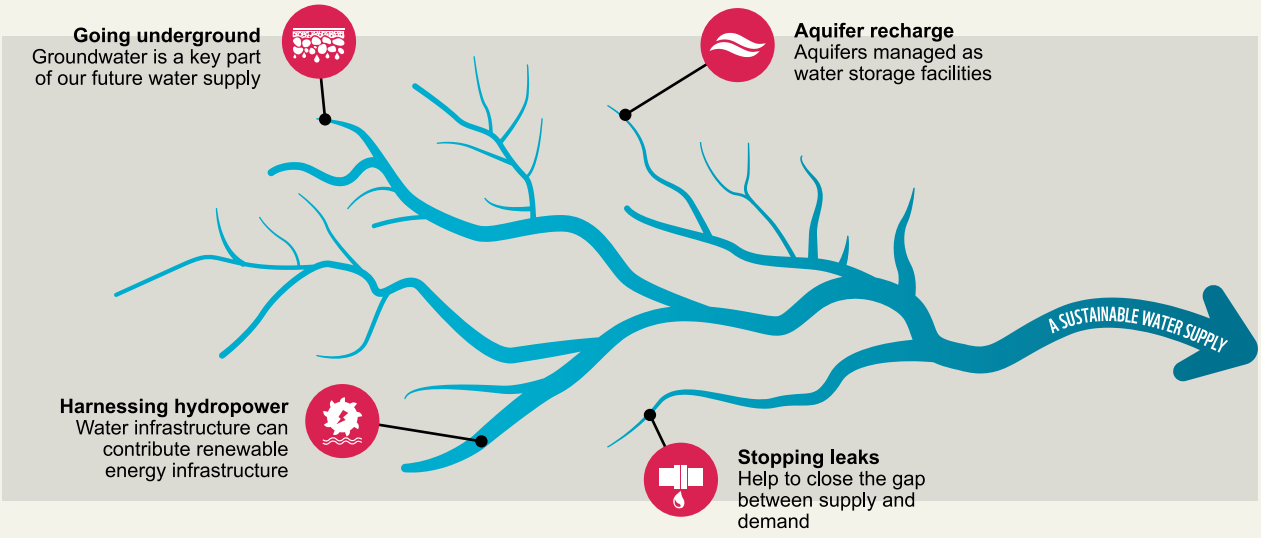
Some of our dams produce hydropower, but even small piped infrastructure with water under pressure can form part of our renewable energy infrastructure.

Micro-turbines are placed into existing pipes with water under pressure to generate a renewable energy source known as 'conduit hydropower'. It is an exciting development for the water sector that enables multiple users to generate hydro-electricity for on-site use and, in some cases to supply energy to isolated electricity demand clusters, as well as to the national electricity grid.

The largest present installation of this kind is from the Caledon-Bloemfontein potable water supply system that supplies the majority of the water demand in Bloemfontein. The water is supplied to the Brandkop Reservoir, and excess energy is dissipated through pressure control valves before being discharged into the reservoir. The system supplies 96kW/h of energy from a pressurised conduit, to power up its operational facilities, with a full capacity of 360 kW/h.

There is potential for widespread implementation of this power generation source. An added advantage is that the harnessing of water for power reduces the pressure and associated leakage losses in our pipes.

LOOKING AHEAD: LAYING THE FOUNDATIONS FOR SUSTAINABLE INFRASTRUCTURE



FURTHER INFORMATION

Weekly dam levels in South Africa: https://www.dwa.gov.za/hydrology/weekly/SumProvince.aspx

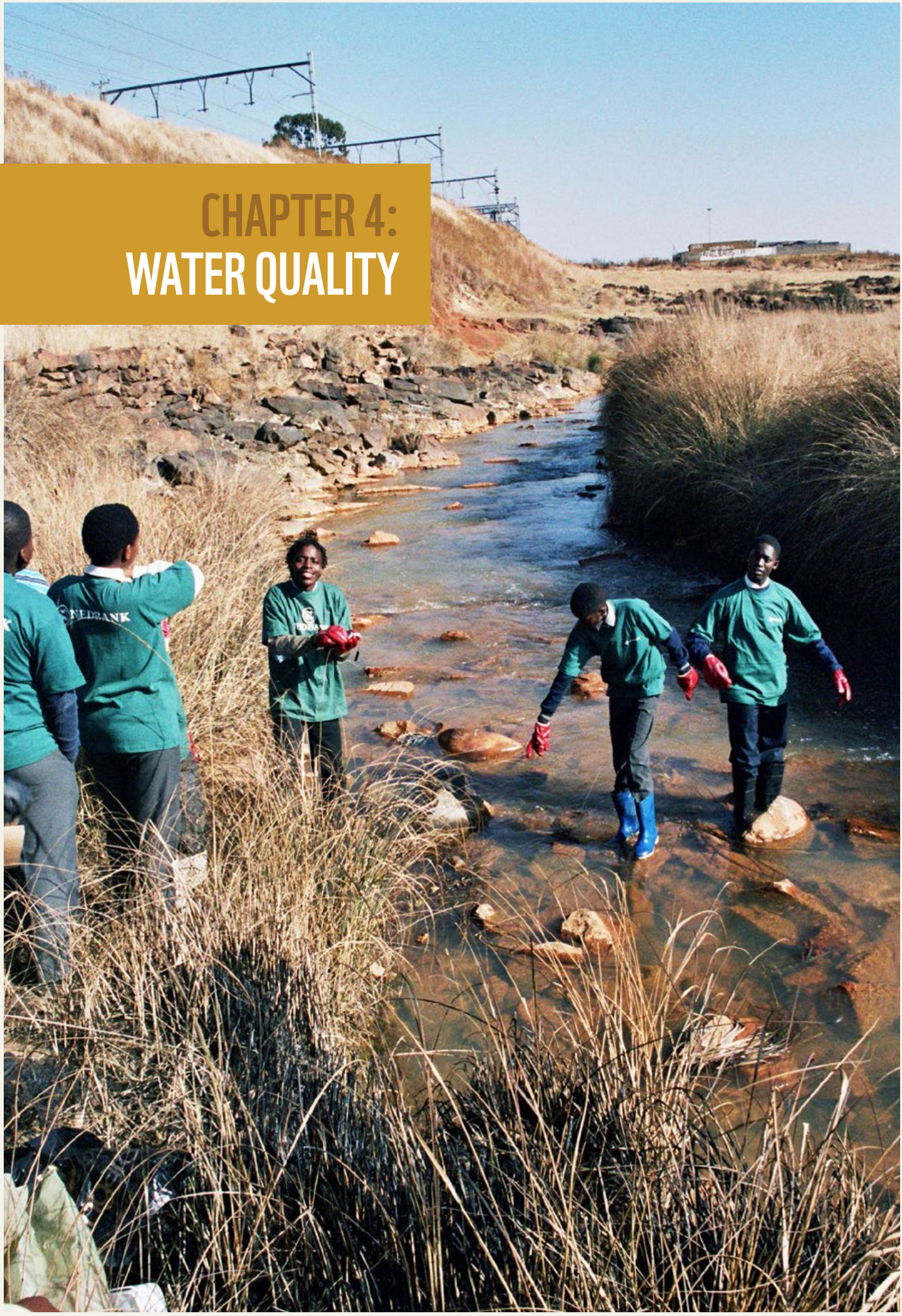
WRC – DWAF Artificial recharge strategy: https://www.dwa.gov.za/Documents/Other/Water%20Resources/ARStrategyforSAJun07SecA.pdf

Department of Water Affairs (DWA), 2010. Strategy and Guideline Development for National Groundwater Planning Requirements. Potential Artificial Recharge Schemes: Planning for Implementation, November 2010: http://www.artificialrecharge.co.za/booklet/AR_Booklet_13Jan2011.pdf

Conduit Hydropower: An Alternate Sustainable Renewable Energy Source, 2014: http://www.up.ac.za/media/shared/404/ZP_Files/Innovate%2009/Articles/conduit-hydropower_van-dijkweb.zp40154.pdf

WRC's Water Sensitive Urban Design site http://wsud.co.za/

CHAPTER 4:
WATER QUALITY



A SICK SYSTEM IN NEED OF GOOD HEALTH

Drinking, washing, food production, industry, electricity generation, all these actions require clean water, but many of them also contribute to the degradation of water quality

South Africa's natural water resources are being polluted by mining, industry, agriculture, development and human settlements. We need a dramatic turn-around to address pollution levels and prevent further pollution. While drought years come and go, pollution remains a constant threat and needs to be tackled if we are to have water fit for use now and into the future of a warmer world.

FACTS

Long-term data show that the water quality of most South African rivers and dams has significantly deteriorated over the past 20 years. In some areas water resource quality already poses serious health risks to humans and livestock. This increases the costs of treatment to make this water fit to use. The food production sector faces the major challenge of irrigating with often untreated water that may include pathogens like *E. coli*, which threatens human health and the export market.

...the water quality of most South African rivers and dams has significantly deteriorated over the past 20 years

The combination of a growing population, increased urbanisation, inadequate maintenance of freshwater and wastewater systems, and the long-term consequences of acid mine drainage, all point to a worsening situation.

The most prevalent contaminant sources affecting water quality throughout South Africa are:

1. Poorly treated sewage effluent from failing sewage treatment works;
2. Poor sanitation in informal settlements and rural areas;
3. Mining and ore processing activities, particularly acid mine drainage (AMD);
4. Industrial effluents containing pharmaceutical endocrine-disrupting chemicals in the manufacturing of products such as shampoo, pesticides, dyes and plastics; and
5. Agricultural runoff including fertilisers, sediment and pesticides.

Excess nutrients

South Africa's rivers in their natural state have very low levels of phosphate.

Excess nutrients, in the form of nitrogen and phosphates, are the most widespread water pollutants. High phosphate levels do not occur naturally and they always indicate human impacts, typically from fertilisers or sewage. Wastewater treatment works in South Africa were primarily designed to deal with the breakdown of nitrogen, but phosphates entering the system go largely untreated.

South Africa's rivers in their natural state have very low levels of phosphate. Our rivers can assimilate and buffer elevated levels of nitrogen to a certain degree, but phosphates cannot be assimilated in the same way.

Phosphates are a game changer, altering the manner in which a river system works. Through eutrophication, they can alter the composition and functioning of river systems. Algal blooms may also contain toxic cyanobacteria, which pose a risk to the health of humans and animals.

FIGURE 4.1: LAND USE IN THE OLIFANTS CATCHMENT

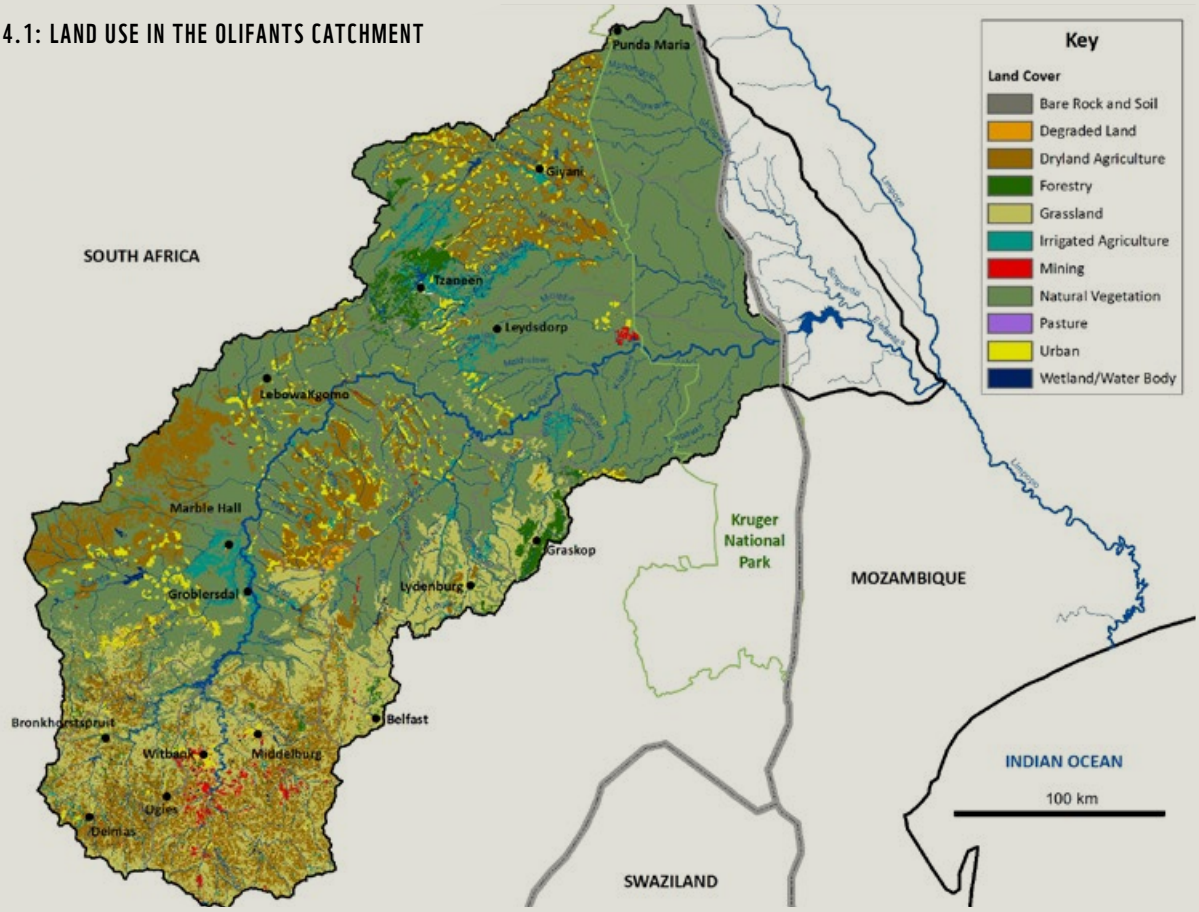
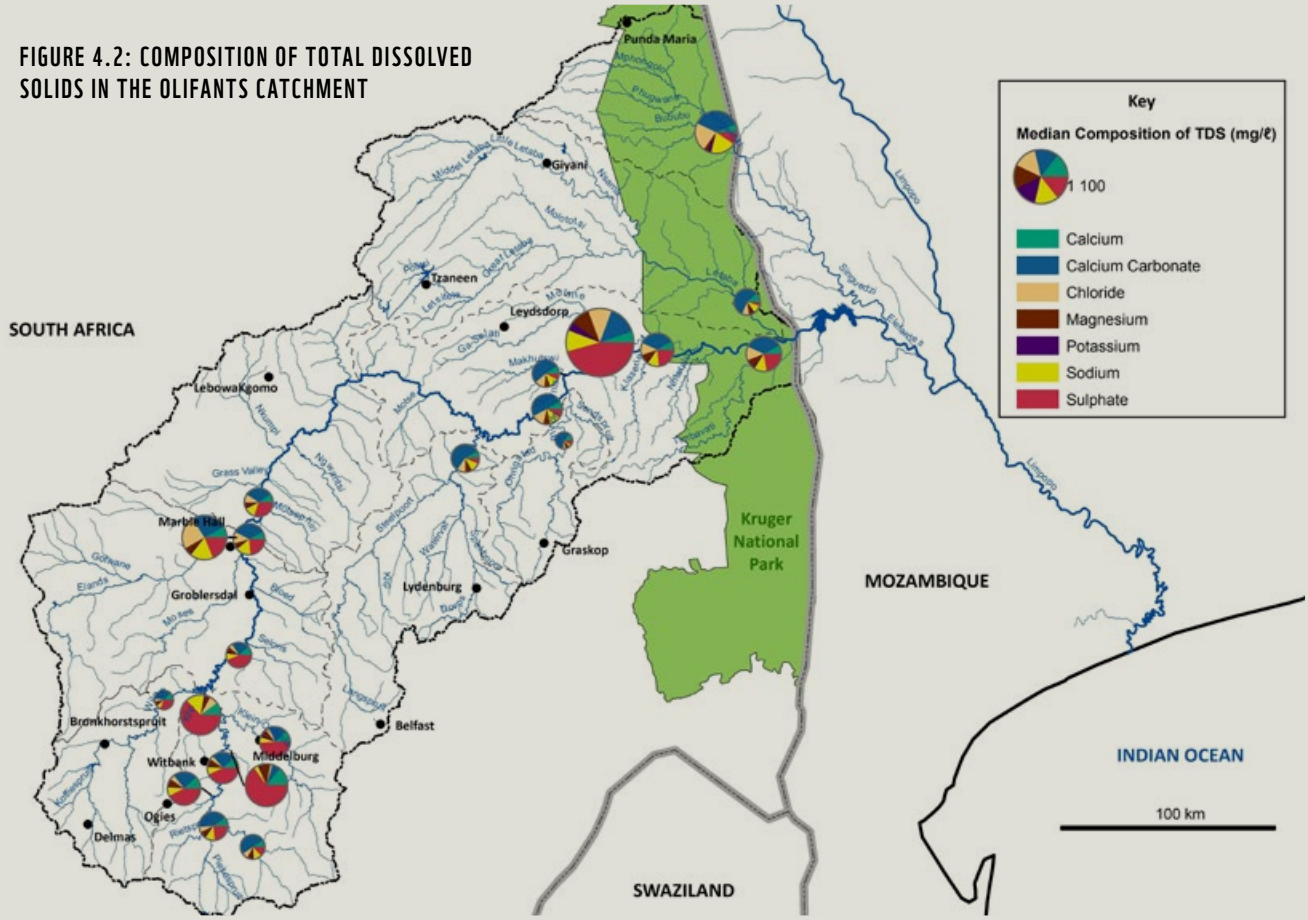


FIGURE 4.2: COMPOSITION OF TOTAL DISSOLVED SOLIDS IN THE OLIFANTS CATCHMENT



Source: Dabrowski (CSIR) 2015 (2)

Eutrophication: excessive enrichment of nutrients is a result of phosphates entering river systems, leading to exponential growth of algae and other aquatic plants. This pushes out other species and can result in fish die-offs as available oxygen is depleted when the algal bloom decomposes.

Highly polluted: the Olifants River

One of South Africa's key rivers, the Olifants River, which has its source in Mpumalanga Province and flows through Limpopo Province. Especially its upper catchment is highly polluted from mining, urbanisation and farming. Excessive nutrient levels in both the river and dams necessitate a holistic catchment approach, especially since reasonable water quality is required in Kruger Park, which lies in the lower catchment.

Towards this, a hydrological catchment model called SWAT was used by the Council for Scientific and Industrial Research (CSIR) to combine information on land use, climate, geographical and land management. The purpose was to identify the main source areas of nutrients, to quantify the nutrient levels per source and to determine how natural processes, as well as land and catchment management decisions, can influence the quantity of nutrients originating from these sources.

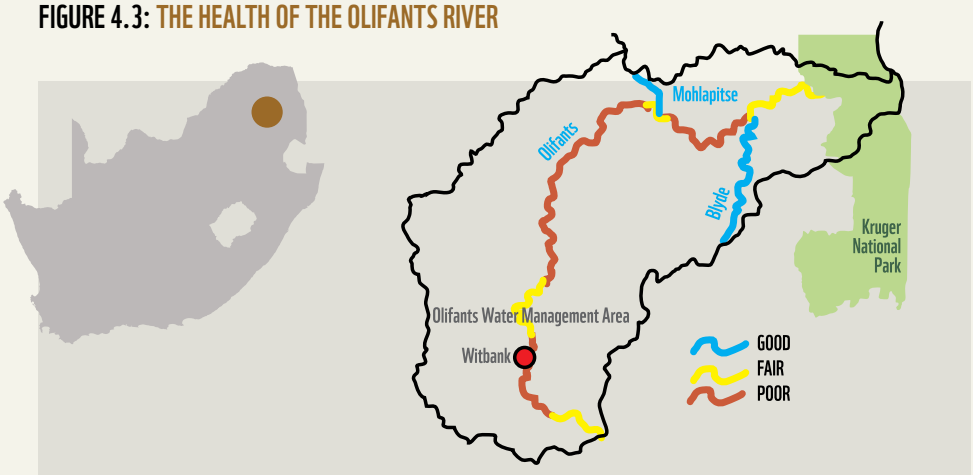
Sewage treatment works were found to be the largest contributors to nutrient pollution in the catchment. If current nutrient effluent guidelines were adhered to, it would significantly reduce the nutrient loading in large dams in the catchment.

DILUTION FACTOR

It is imperative to have a high volume of clean river water in order to dilute the inflow of poor water quality. For example, the volume of water required to dilute agrochemicals is greater than the amount of water needed by crops for irrigation. To put this into perspective, irrigated agriculture is South Africa's highest proportional water user at 62%.

Source: Dabrowski et al, 2008

FIGURE 4.3: THE HEALTH OF THE OLIFANTS RIVER



By focusing conservation and management efforts on the Blyde and Mohlapitse rivers, these tributaries of the Olifants River can provide crucial refuge for freshwater species, while also improving the health of the Olifants before it enters the iconic Kruger National Park.

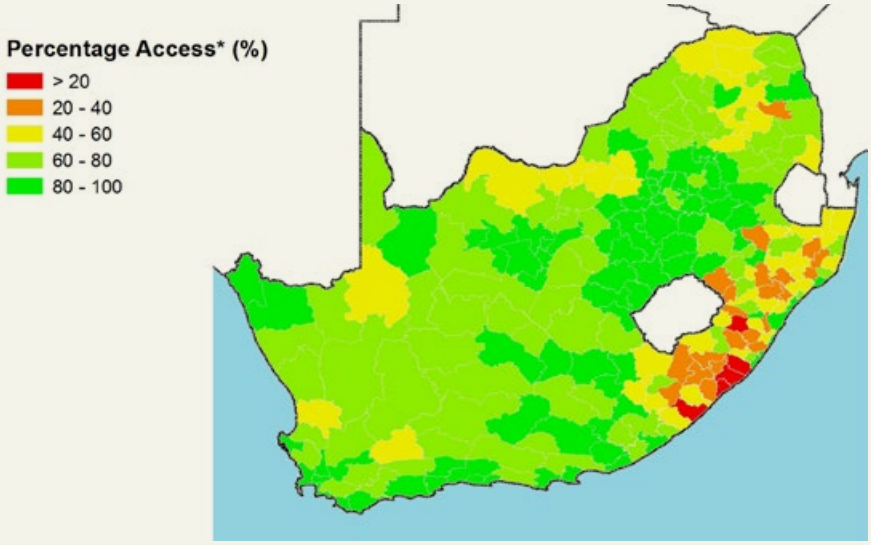
Water-related diseases

There are many different infectious water-related diseases, including gastroenteritis, amoebiasis, salmonellosis, dysentery, cholera, typhoid fever and hepatitis. Diarrhoea is a common symptom of these diseases which can become a major health hazard in regions without well-managed sanitation, where fecal material and non-treated sewage gets into the water supplies. Despite a general decline in deaths as a result of diarrhoea over the last half century, it remains one of the most important causes of illness and death in children.

Poor communities have the highest burden of inadequate water services and consequent disease. People in underserviced areas pay high prices to purchase clean, safe water and are often faced with unreliable supplies. Underserviced areas are also the areas with some of the highest health risks through fecal contamination and consequently the key areas in which diarrhoea is most prevalent.

Figure 4.4 shows that the bulk of underserviced communities are in the Eastern Cape, KwaZulu-Natal and Limpopo.

FIGURE 4.4: ACCESS TO PRIVATE WATER



Municipal Water Services Authorities

The provision of drinking water and sanitation services in South Africa is the responsibility of municipal Water Services Authorities. Many are battling to deliver these services in an environment of

- Rapid urbanisation;
- Ageing infrastructure;
- Insufficient refurbishment;
- Deteriorating operations and maintenance; and
- A lack of skilled personnel.

The problem is exacerbated by the fact that local government is faced with multiple challenges in service delivery, with water management and provision as one of their key areas of responsibility.

ACID MINE DRAINAGE

The effects of acid mine drainage (AMD) on water quality became public knowledge after a mine shaft started decanting contaminated groundwater near Krugersdorp in 2002. In South Africa AMD is associated primarily with gold and coal mines. AMD water is characteristically very acidic and high in metals and salts. The chemical reaction that causes AMD can continue for decades, even centuries, polluting groundwater and surface water long after mining has ceased.

The pollution through AMD is regarded as so persistent that the contaminated sites may never be completely restored without substantial purification efforts and treatments. The estimated AMD generated by the Witwatersrand Goldfield is comparable in volume to 10% of the potable water that Rand Water supplies to municipalities. As such, the sheer volume of AMD poses a phenomenal risk, if left untreated. However, it also presents an extra water source that could be harnessed if it is treated and cleaned with the appropriate technology.

914

THE NUMBER OF SUPPLY SYSTEMS REGISTERED IN 2009

1,009

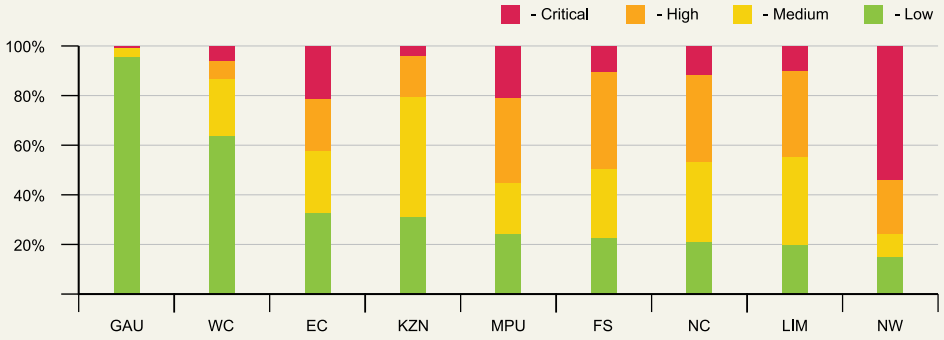
THE NUMBER REGISTERED IN 2013

Blue and Green Drop Certification Programmes

To assist local government with provisioning clean water and sanitation, in 2008 the then Department of Water Affairs began two certification programmes, called the Blue and Green Drop. Together, they provide a comparative benchmark and a transparent information system for the performance of Water Service Authorities in their provision of good quality drinking water and effective treatment of wastewater. The Blue Drop includes all freshwater sources – rain, rivers, wetlands and dams. The Green Drop includes the wastewater treatment systems.

From 2013 a risk rating tool was added to the process, in order to gauge the overall risk of a treatment system to failure and the consequent risk to citizens, the economy and the environment.

FIGURE 4.5: BLUE DROP RISK RATINGS CATEGORISED PER PROVINCE



BLUE DROP RISK RATINGS CATEGORISED PER PROVINCE

PROVINCE	NUMBER OF WATEWATER SYSTEMS WITH SCORES <30%	NUMBER OF 2013 GREEN DROP CERTIFICATES
Eastern Cape	34	1
Free State	46	1
Gauteng	0	8
KwaZulu-Natal	32	19
Limpopo	22	1
Mpumalanga	41	2
Northern Cape	33	1
North West	21	1
Western Cape	9	26
National total	**248**	**60**

444

THE NUMBER OF WASTEWATER TREATMENT SYSTEMS ASSESSED IN 2009

824

THE NUMBER ASSESSED IN 2013

Drakenstein Municipality: cleaner and more efficient

In the Western Cape, the Drakenstein Municipality has done exceptionally well by reducing water loss to 13% (the national average is 37%). It is currently engaged in a pilot project in Paarl and Wellington to further improve this level within Drakenstein's water supply and wastewater treatment plants.

Approximately 24 million litres or mega-litres (ML) flow through the Paarl wastewater plant per day, with a design capacity of 35ML per day. Ensuring this system is operating optimally, with good quality discharge and minimal energy consumption, is critical to the health of the natural environment especially the Berg River. This improves the health of the river, which means that all downstream water users benefit, including domestic, agricultural and industrial users.

Local and Danish engineers have reviewed the operations to improve the efficiency of biofilters in Paarl and Wellington wastewater treatment plants. The project identified that flow consistency has an impact on the efficiency of the biofilters, which harness bacteria that feed on solid organic material to clean the wastewater. When the water flow was inconsistent over the stone beds where the bacteria live, the bacteria died off, which in turn, led to a reduction in efficiency – even after the flow increased.

WORKING TOGETHER

The success of this project is in the public-private partnership between the forward-thinking managers and scientists within the Drakenstein Municipality, a contracted specialist South African water engineer and a leading Danish water and wastewater company, VCS. The project draws on local skills and Danish technology to enhance South Africa's water and wastewater sector.

THE FUTURE

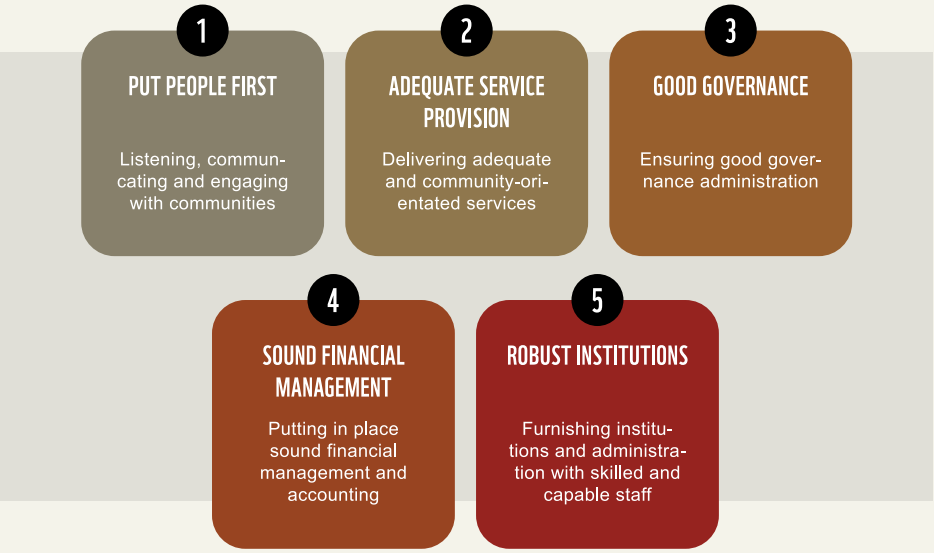
...municipalities play a key role in preventing pollution from sewage and settlements

The public and private sectors have a mutually supportive role to play in improving the health of our water systems and reducing the health risks for people and animals. Most of all industries and mining need to be better regulated to ensure the 'polluter pays' principle is upheld, and municipalities need to play a key role in preventing pollution from sewage and settlements (including dumping of rubbish).

Improving the functioning of Water Services Authorities in local government has become a focus area of the Department of Cooperative Governance and Traditional Affairs (CoGTA). Back to Basics (B2B) is a national government initiative that was launched in 2014 and that is driven by CoGTA. Its aim is to boost the performance of municipalities, including their provision of water services.

CoGTA will support the development and implementation of infrastructure and maintenance plans in municipalities, with at least 7% of operational budgets going to infrastructure maintenance, including infrastructure audits.

FIGURE 4.6: WHAT DOES "GETTING THE BASICS RIGHT" MEAN?



Capacity, transparency and performance

Several important initiatives, aimed at building capacity, transparency and performance across all 152 Water Services Authorities are starting to build momentum.

Municipal Benchmarking Initiative (MBI)

The MBI National Report showcases achievements and highlights key challenges, priorities and developments within the water sector

This initiative for Water Services by the South African Local Government Association (SALGA), covers all 152 Water Services Authorities. The MBI is a bottom-up focus on the performance measurement capabilities of municipalities, providing support to strengthen performance reporting systems and affirming their importance for effective service delivery. Information collected for each Water Services Authority is used to generate a draft MBI Scorecard, with outputs presented in the annual MBI National Report, which showcases achievements and highlights key challenges, priorities and developments within the water sector.

Innovation Partnership for Rural Development Programme

The Department of Science and Technology (DST) has initiated this programme to assist 24 District Municipalities in responding to their prioritised challenges. The Water Research Commission (WRC) is tasked with implementing six water-related projects from this programme. A water and environmental services company called Emanti is supporting the implementation of one part of this initiative, namely Building Capacity for Implementation of Water Safety Planning (WSP) and Wastewater Risk Abatement Planning (W_2RAP) in District Municipalities in the Eastern Cape and KwaZulu-Natal. Fifteen District Municipalities are participating in this project. This capacity-building initiative complements the ongoing Blue and Green Drop certification processes.

Systems for People to Access a Clean Environment (SPACE)

...community challenges and issues form the heart of the process.

For the last three years, the Western Cape Government has been running a project called 'Genius of SPACE Project – Systems for People to Access a Clean Environment' in Langrug, close to Franschhoek. The project is based on biomimicry principles and addresses the difficulty of delivering services in informal settlements and the impact this has on our water sources – with particular reference to stormwater and solid waste. The project takes a collective decision-making approach, investigating and co-creating sustainable solutions with the community and letting community challenges and issues form the heart of the process.

The project aims to find simple, innovative solutions that are not imposed, but instead are co-created with the community to develop the concept of community-owned infrastructure, based on the philosophy of sustainable urban drainage systems. The ownership benefits of the designs are emphasised to make long-term maintenance sustainable within the community.

21st century technology

most accessible gold resources in South Africa are either depleted or currently being mined

Gold mining techniques from the 20th century are in their twilight years in South Africa, as most accessible resources are either depleted or currently being mined. Twenty-first century technological advances and the increased gold price have made it feasible to extract leftover gold in mine tailings.

Re-mined tailings can then be used to refill old mine shafts. This offers a partial solution to the environmental risks associated with unmaintained tailings and toxic concentrations of metals entering the environment and nearby settlements via high winds and floods, for example. This process also reduces the contamination risk of wind-blown uranium spread from the tailings, but it does not solve the problem of acid mine drainage (AMD) decanting from underground mines.

While South Africa is battling to deal with its mining legacy, it needs to ensure that new mining does not create the same problems or other problems, particularly in the country's important water production areas.

No-go areas for mining

WWF-SA would like to see no-go areas for mining where there is a high risk of compromising South Africa's long-term water and food security. Where mining does take place, strong legislation needs to ensure that the mine companies – and not South Africa's tax payers – commit to financing long-term water treatment after mines have closed in order to prevent acid mine drainage. The current guidelines for financing mine decommissioning need to be strengthened to include an explicit quantum for long-term (decades-long) treatment of acid mine drainage.

More is not always better

Analysis of farm run-off allowed reduction of fertilisers by 25kg per hectare

As part of a WWF-supported exercise to understand on-farm water use and risk, a Western Cape fruit farm measured its incoming and outgoing water quality. The results for their drainage water showed a notable increase in nutrients compared to the water coming into the farm. They concluded that part of their applied fertiliser was literally 'running down the hill'. This is both financially wasteful and contributes to risks of eutrophication further downstream.

After careful evaluation, they decided to reduce their fertiliser application by 25kg/ha. This is a brave step that requires close monitoring of water quality and fruit production levels for optimal, sustainable farming. Monitoring farm-run off is therefore an important process in changing on-farm behaviour for the benefit of the landowner and the environment.

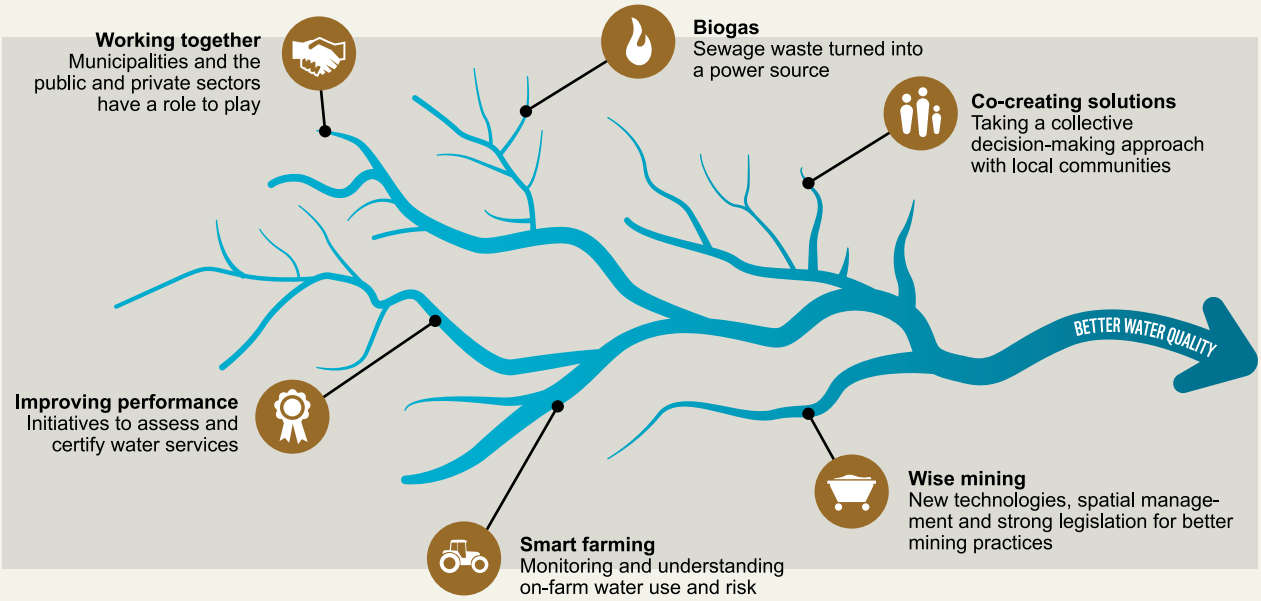
THE INTERNATIONAL BIOGAS TREND

In Europe there is a growing movement to use agricultural, food and sewage waste products in biogas reactors. In Sweden, for example, 250 buses in the Stockholm Public Transport system run on biogas. This is an excellent solution to deal with waste and effluent, which currently present a huge pollution risk.

Biogas plants can be built at many different scales. They can cater to small, localised needs in agriculture, dealing with the likes of dairy and piggery waste. At a large, centralised scale, they can be used by wastewater treatment works to supply their own energy needs or to provide power for regional and national needs.

One cubic metre of biogas can produce both 2.4kWh of electricity and 2.5kWh of heat. Other benefits include bio-fertilisers, bio-methane, savings on capital costs for waste cleaning systems and preventing methane emissions. Such biogas technology would serve both the agricultural and urban wastewater treatment sectors, reducing localised eutrophication and health risks, as well as contributing to alternative energy sources in a country that is in dire need of both.

LOOKING AHEAD: FACTORS CONTRIBUTING TO BETTER WATER QUALITY



FURTHER INFORMATION

Municipal Bench Marking Initiative – http://www.munibench.co.za/

Green Drop & Blue Drop Reports – https://www.dwa.gov.za/dir_ws/DWQR/

http://www.ewisa.co.za/misc/BLUE_GREENDROPREPORT/blue_drop_certification.htm

Water Quality guidelines http://www.who.int/water_sanitation_health/dwq/guidelines/en/

CHAPTER 5:
ACCESS TO BASIC WATER SERVICES

Paulina Malatji filling up a bucket at the communal tap next to her home in the village of Lerupurupung, Limpopo Province. She says the water from this tap has been reliable. The Lephalale municipality, situated 30 kilometres away, manages the water from this remote area.

HEALTHY WATER, FOR ALL, FOR EVER

Delivering safe, healthy water and decent sanitation to all South Africans has been one of the greatest challenges for the government during its democratic era.

There has been significant effort to redress the imbalance of previous discrimination in this sector, at the same time as serving a growing urban population. However, rural and township areas continue to pose significant challenges in bringing service delivery to disadvantaged, poor communities.

FACTS

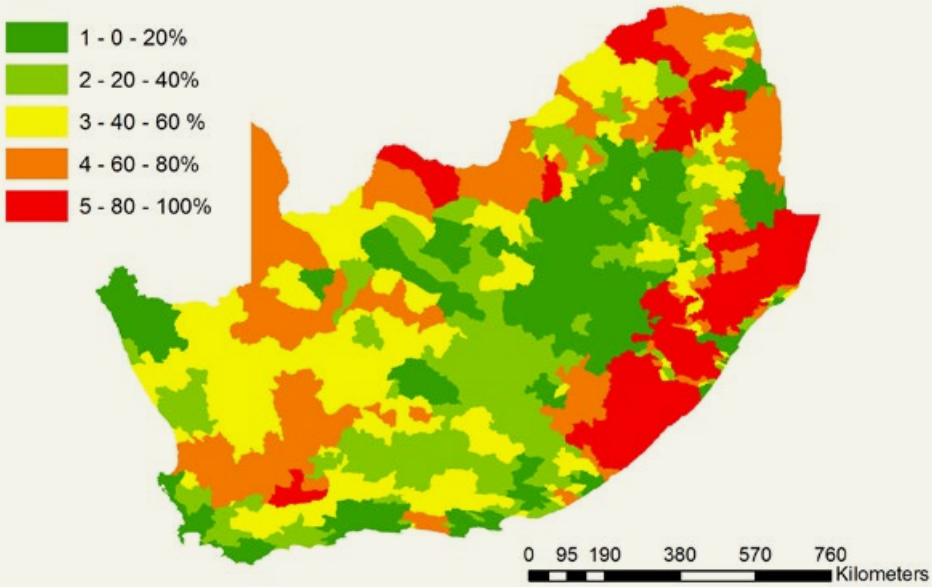
15.9 MILLION
SOUTH AFRICANS DID NOT HAVE ACCESS TO SAFE WATER SUPPLIES IN 1994

Historical imbalance

In 1994, at the time of South Africa's transition to a multiracial democracy, the distribution of water-related services to the country's 39 million inhabitants was skewed to serve the white minority. Around 15.9 million South Africans, many in rural areas, did not have access to safe water supplies, while only 59% had access to basic levels of water service – usually a communal tap.

In 1992, a standing committee on water and sanitation helped to develop a strategy to transform the water sector to one of greater social equity and ecological integrity. Ultimately, it has meant extending the water supply system to the whole population, while at the same time maintaining its supply to industry and agriculture as part of the cornerstone of South Africa's economic development.

FIGURE 5.1: PERCENTAGE OF HOUSEHOLDS WITHOUT ACCESS TO SAFE DRINKING WATER



During the battle to eradicate water supply backlogs, another challenge emerged in the reliability of water service delivery. This supply challenge has been compounded by the high level of water losses (non-revenue water). The total cost per annum of non-revenue water is estimated at R7.2 billion.

THE RIGHT TO WATER

The Constitution of the Republic of South Africa took effect on 4 February 1997. It lays the foundation for the right to access 'sufficient water' and provides for municipal delivery of water. It also establishes South Africans' right to 'an environment not harmful to health'.

As a water-scarce country, we urgently need to bring down the 37% of water losses

Overcoming water supply leakages

Preventing, monitoring and repairing water leaks in deep rural areas poses a significant challenge. Leakages are caused by anything from burst or blocked pipes to taps that are left running. As a water-scarce country, we urgently need to bring down the 37% of water losses that occur in most South African municipalities.

"Our major water delivery pipes have been leaking for years without the municipality repairing them. In one part of Meadowlands in Soweto this has created a 'wetland'."

– Soweto resident

CASE STUDY: LERUPURUPUNG PILOT PROJECT

One of countless examples in our rural areas is Lerupurupung – a village in rural Limpopo Province, situated 30km from the town of Lephalale, where the Lephalale Municipality manages the water for this remote area. Water is provided free of charge to Lerupurupung's approximately 5,000 people, many of whom are unemployed and some of whom work on farms in the district. Others are subsistence livestock farmers.

When there are leakages or problems with the water supply, it can take days – even weeks – to locate the problem and have it resolved. This problem is exacerbated by the fact that community members do not always know whom to contact to report leaks and broken taps.

To demonstrate what can be done to reduce leakages and improve the management of water through accurate technological monitoring, the WWF-Danish partnership is funding a pilot project in Lerupurupung using the Danish company Kamstrup's water meters to monitor water use and track irregularities. Kamstrup specialises in the design of water, electricity and heat energy meters.

The tried and tested water meters are simple, durable and highly effective, and the system can work equally well for small and large municipalities in urban and rural areas. This model will hopefully be extended to many other areas in South Africa.

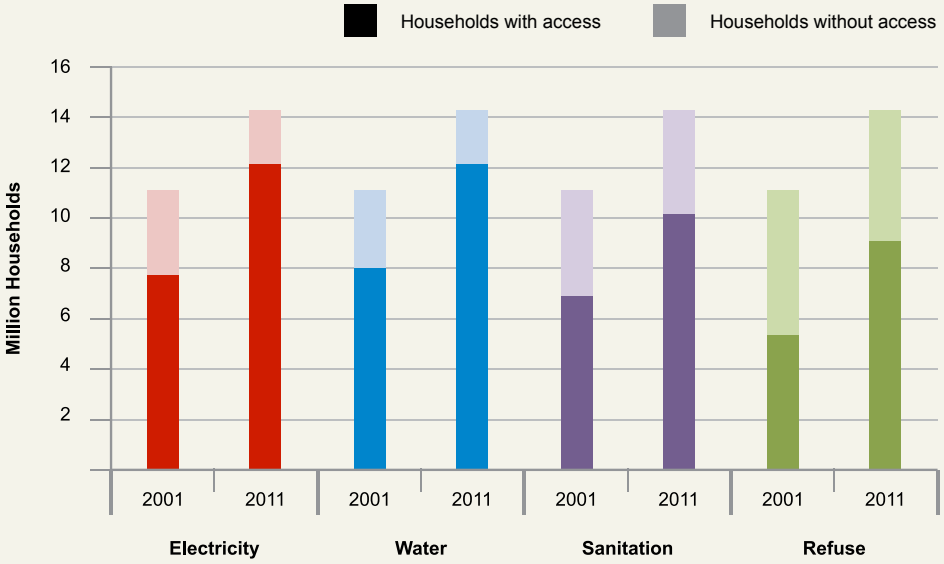
Bucket-toilet eradication programme

BETWEEN 2001 AND 2011, THE PERCENTAGE OF HOUSEHOLDS WITH PIPED WATER HAS INCREASED TO **46.3%**

From 2007–2010 more than 1,000 bucket-toilet systems in formalised areas were eradicated after R1.2 billion was allocated to a special bucket eradication programme. This was seen as a major milestone as communities' lives were significantly improved with better sanitation facilities and services.

In addition to this, between the Censuses of 2001 and 2011 major milestones were achieved in the eradication of water and sanitation backlogs. In terms of basic water supply, South Africa halved the backlog in 2005, thus achieving the Millennium Development Goals (MDGs) 10 years ahead of the 2015 target date. In terms of sanitation, there has been a 40% improvement since 1994, which is also well within the timeframe of the MDGs.

FIGURE 5.2: THE NUMBER OF HOUSEHOLDS THAT HAVE GAINED ACCESS TO BASIC SERVICES



Source: National Treasury, 2014 (based on 2001 and 2011 Census Data)

Water on tap

Just less than half of all households in South Africa get their water from a tap inside their home. A further 27% have a tap on their property and 12% walk less than 200m to get water.

Just less than half of all households in South Africa get their water from a tap inside their home. A further 27% have a tap on their property and 12% walk less than 200m to get water. Approximately 6% of the population accesses piped water at a distance greater than the target for 'basic services', which is 200m. Around 9% of the population does not have access to piped water, with the highest incidence in rural areas and townships of the Eastern Cape, KwaZulu-Natal, Limpopo and Mpumalanga. Remote areas that do have basic services experience frequent breakdowns that often take a while to fix and people therefore live with unreliable water supplies and compromised sanitation systems.

Service-delivery protests

Service-delivery protests about inaccessibility to water and sanitation have been ongoing throughout South Africa as some areas remain un-serviced or serviced with infrastructure that is unreliable and faulty. The focus on infrastructure extension

25 LITRES
EACH SOUTH AFRICAN HAS A RIGHT TO THIS VOLUME OF SAFE WATER PER DAY

for basic water services has been prioritised over the maintenance of existing, functioning services. This emphasis has led to a situation where municipalities are failing to maintain existing and ageing infrastructure due to an absence of necessary skills and management focus and funding.

"We are unhappy with the pre-paid and smart meters. The workmanship is extremely bad in installing piping and meters. This leaves us with the leaks so access to water is difficult."

– Kwa-Thema township resident

When service provision by local government fails, entrepreneurs charging high prices for tankered water will often step in. The net result is that the poor often end up paying the most for services that they have a right to receive for free. Each South African has a right to 25 litres of safe water per day to meet their basic human needs.

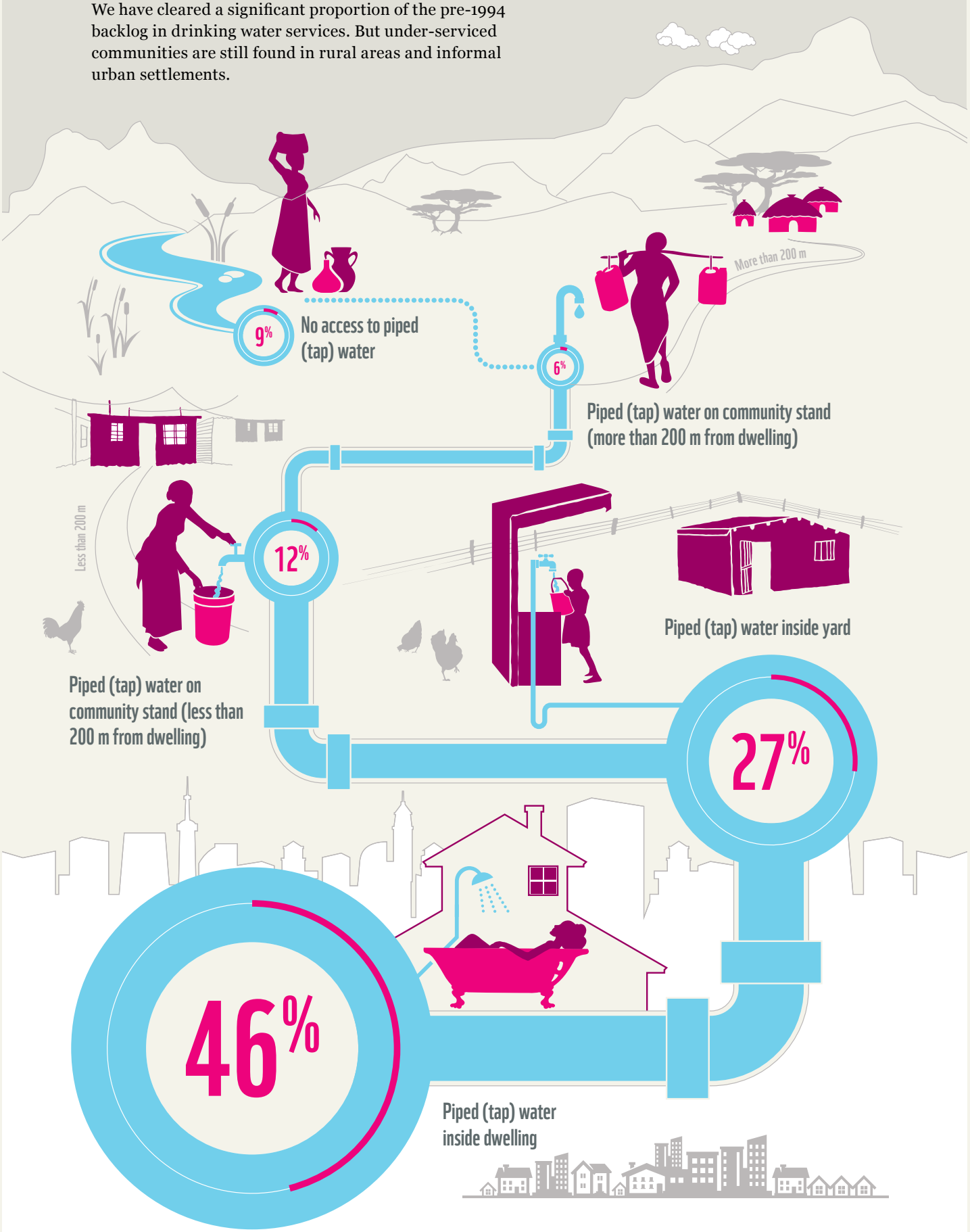
THE SPECTRUM OF WATER ACCESS

	Piped water inside dwelling		Piped water inside yard		Piped on community stand < 200m from dwelling		Piped on community stand > 200m from dwelling		No access to piped (tap) water	
PROVINCE	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
Western Cape	67,5	75,1	17,7	13,3	6,3	8,3	6,8	2,4	1,7	0,9
Eastern Cape	18,3	32,8	19,5	16,6	11,9	18,6	13,5	9,9	36,8	22,2
Northern Cape	34,3	45,8	37,7	32,3	10,9	12,8	11,1	6,6	6,0	2,6
Free State	22,8	44,8	47,7	44,3	13,7	6,2	11,4	2,6	4,4	2,2
KwaZulu-Natal	29,1	40,0	19,6	23,6	10,5	14,8	13,3	7,6	27,5	14,1
North West	18,7	29,3	35,5	40,0	16,0	14,3	16,4	8,0	13,4	8,4
Gauteng	46,4	62,1	36,4	27,3	7,0	6,0	7,3	2,8	2,9	1,8
Mpumalanga	19,8	35,7	36,7	36,0	12,8	9,2	16,4	6,6	14,3	12,6
Limpopo	9,7	18,4	29,2	33,9	16,1	20,5	23,1	13,2	21,9	14,0
South Africa	**32,3**	**46,3**	**29,0**	**27,1**	**10,7**	**11,7**	**12,4**	**6,2**	**15,6**	**8,8**

Source: Statistics South Africa Census 2011

ACCESS TO DRINKING WATER IN SOUTH AFRICA

We have cleared a significant proportion of the pre-1994 backlog in drinking water services. But under-serviced communities are still found in rural areas and informal urban settlements.



Source: Statistics South Africa, 2011 Census

THE FUTURE

Rethinking water systems

...we need to challenge the perception that one model can meet the needs of all users

Given the enormous diversity of the socio-economic and natural environment in South Africa, there is a need to challenge the perception that one model can meet the needs of all users.

Robust water and sanitation service delivery for all South Africans calls for new, decentralised approaches and stronger, accountable institutions. Appropriate technology embedded in good governance systems can achieve this.

Many of the technologies are not new but remain effective, such as the windpump – a longstanding feature of the South African landscape. However, a new and improved system for water services and infrastructure does require new technology and innovation to ensure the right systems are in place to complement new and effective skills and management processes.

More effective and efficient use of local resources will be critical to meeting the needs of un-serviced, remote rural communities. Rainwater harvesting, the sustainable management of springs and the sustainable use of boreholes are all critical local resources that, in combination, can meet the needs of rural households in addition to providing the initial small-scale infrastructure, such as harvesting gutters and tanks, boreholes and pumps. It is essential that local skills competence is supported to manage and maintain these systems. When they are well managed and looked after, these small-scale systems are sustainable in the long-term and create local jobs.

Water filters at point of use

Storage and treatment options have been proven to dramatically improve the quality of household water and reduce risks of diarrhoea

Local water use also requires small-scale treatment measures to ensure the water is safe to drink, especially for young, vulnerable children, the sick and HIV positive people. Household water filters can be used to treat local, raw water supplies. Simple, affordable water storage and treatment options at the household and community level have been proven to dramatically improve the quality of household water and reduce risks of diarrhoea in all ages. There are several possible systems that use either one of or a combination of solar, chemical and filtration treatment.

Each method has advantages and limitations that vary according to the context. The most suitable household water treatment method needs to be assessed for the diverse range of contexts in South Africa.

Research with Eastern Cape communities, for example, has shown that plastic containers with ceramic dome candle filters are the most practical and acceptable short-term treatment solution, until piped and treated water can be provided. Trial runs have shown that the design is sound, but particular focus needs to be given to appropriate training for handling and cleaning the buckets.

Local capacity for improving river health

Approximately 44% of South Africa's rivers are critically threatened by human-created problems that require human-centred solutions at a local scale. Along with the Municipal Benchmarking Initiative (described in Chapter 3), SETA courses for local government officials can significantly assist in up-skilling people in this sector. Courses have been designed to support workers in local municipalities, to assess resource challenges and to start formulating their own solutions towards cleaning and conserving the rivers in their region and ensuring access to clean, safe water. This form of skills development supports participants to fulfill their mandated responsibilities and is far more effective and meaningful than centrally delivered instructions.

RAINWATER HARVESTING

Rainwater harvesting systems specifically fitted for school roofs and gutter pipes can harvest 73,000ℓ of rain in a 90mm downpour over 48 hours from a roof with an area of 8 x 47m leading into a series of water tanks. In schools that subscribe to green principles, once the tanks reach their capacity, the excess water overflows into a swale mound that feeds water to trees, shrubs and ground covers planted along the swale mound above the school's vegetable garden. This combination of water access and food production in an educational environment provides future generations with a culture of rainwater harvesting, food production and environmental sustainability.

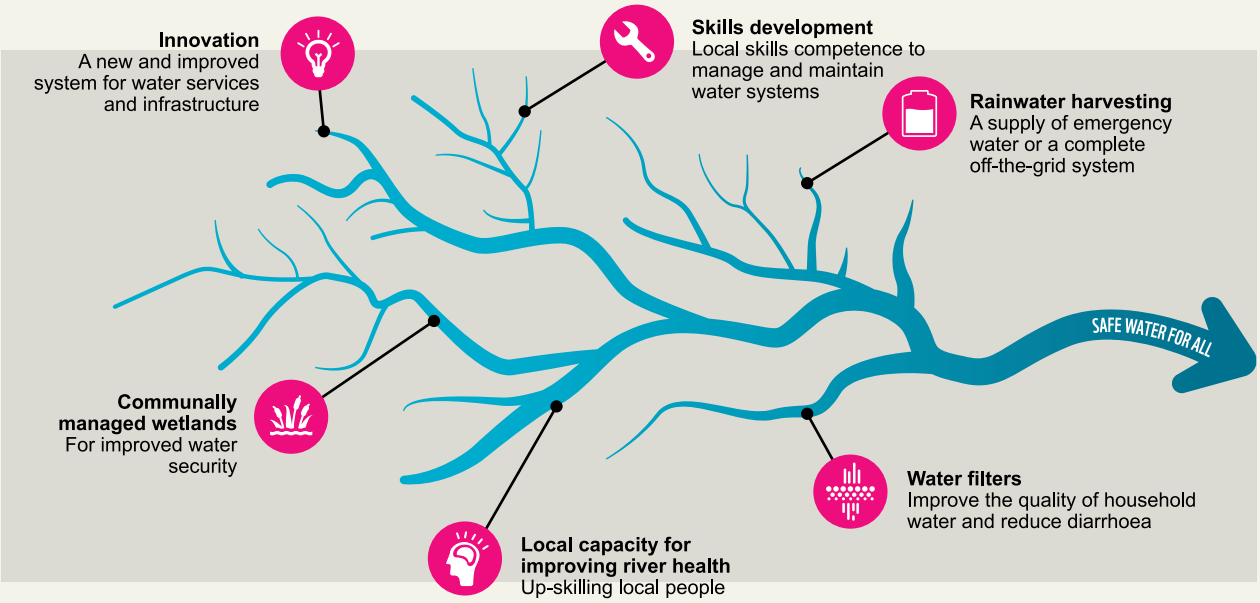
Communally managed wetlands for water security

For the past six years, the Ha-Makuya community in rural north-east Limpopo Province has worked closely with government and NGOs to manage their wetland better, so that they can use it for water and to support their livelihoods.

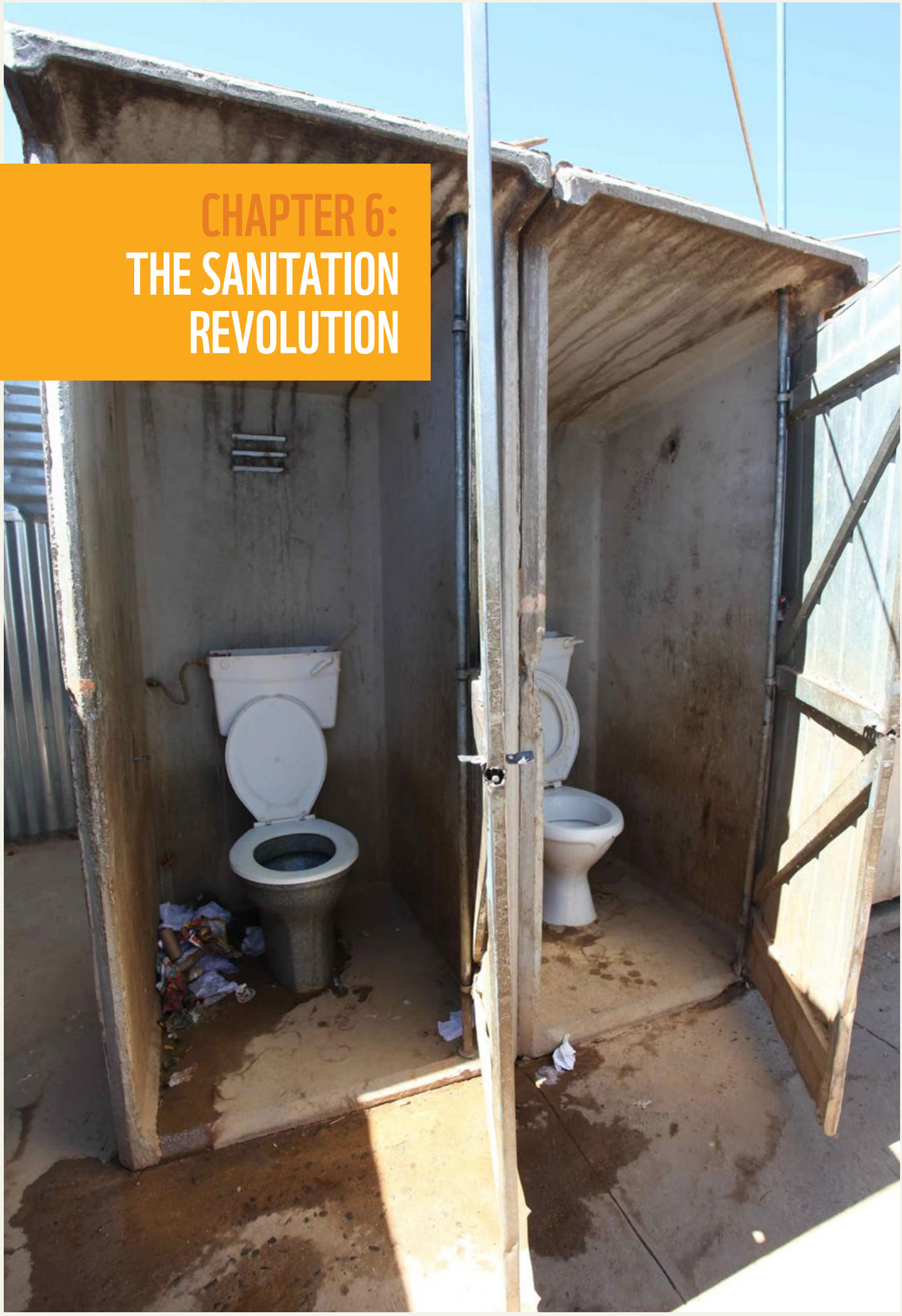
Community members use the wetland as a source of water for their domestic needs, as well as for watering their crops and livestock, but degradation of the wetland was threatening its capacity to continue providing these ecosystem services and community access to water.

A community-based project, in partnership with a development NGO, called AWARD, the Working for Wetlands Programme, WWF and WESSA, has developed a stronger custodial relationship between local villages, wetland users and the wetland. Ha-Makuya community members mapped and monitored wetland and catchment land uses and impacts and undertook their own 'wise-use' research. This represents a fundamental shift for such processes in the South African context, which are conventionally led by 'experts' who 'know'. The wetland is now used more wisely by community members who have deepened their understanding of wetland management, and have assumed the responsibility of securing their wetland and waters resources for their future.

LOOKING AHEAD: FACTORS CONTRIBUTING TO SAFE WATER FOR ALL



CHAPTER 6:
THE SANITATION REVOLUTION



CLOSING THE LAST GREAT DIVIDE

South Africa has been working to address the sanitation backlog since 1994, and although big strides have been made, almost 20% of South Africans are still without an improved sanitation service.

2.4 BILLION
PEOPLE WITHOUT ACCESS TO ADEQUATE SANITATION

Globally, there are 2.4 billion people without access to adequate sanitation. There are 45 countries in the world where less than half of the population has access to adequate sanitation and hygiene.

In South Africa, the sanitation backlog stood at 20.5 million (or 51% of all households) in 1994. The country has made significant progress since then and turned this around to achieve the Millennium Development Goals for sanitation in 2008, but there is still significant work to be done. For example, in 2015, 4.9% of South Africans had no toilet at all and 19.5% of South Africans are still without an improved sanitation service.

SANITATION FACILITY USED BY HOUSEHOLDS, BY PROVINCE, 2014 (IN THOUSANDS)

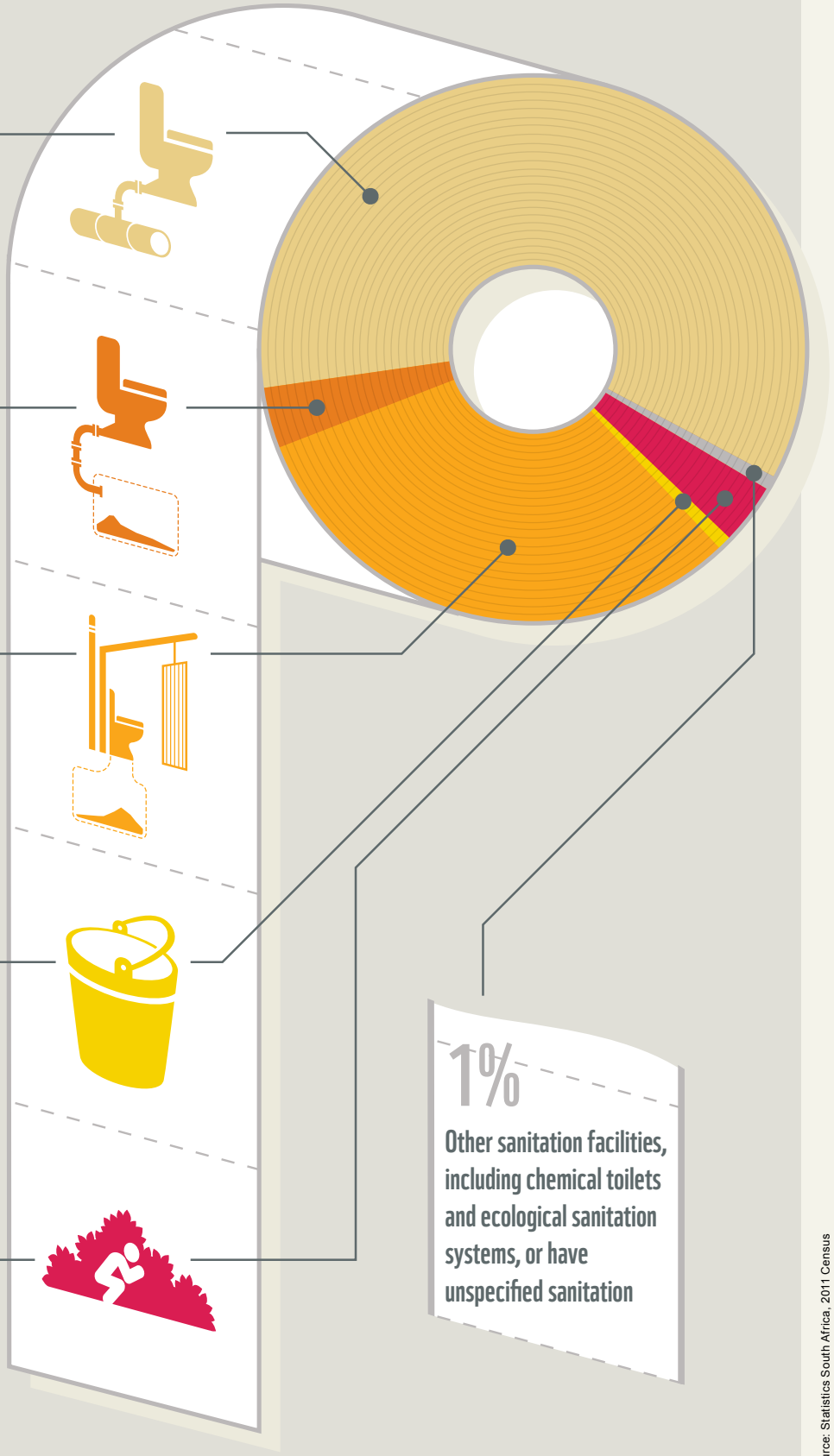
TYPE OF SANITATION FACILITY	WC	EC	NC	FS	KZN	NW	GAU	MPU	LIM	SA
Flush toilet connected to public sewerage system	1589	714	213	617	1157	514	3805	426	264	**9300**
Flush toilet connected to sepctic tank	33	20	13	17	172	58	103	55	60	**531**
Chemical toilet	8	*	*	*	28	*	31	*	2	**70**
Pit latrine/toilet with vantilation pipe	2	588	34	105	683	211	165	269	473	**2530**
Pit latrine/toilet without vantilation pipe	5	224	22	67	471	327	267	328	598	**2310**
Bucket toilet (collected by municipality)	37	12	9	42	3	3	51	*	4	**162**
Bucket toilet (emptied by household)	12	*	2	11	*	*	*	*	*	**34**
Ecological Sanitation System	*	*	*	*	*	2	*	*	*	**13**
None	28	132	17	17	124	55	31	81	74	**558**
Other	2	*	*	6	17	*	21	*	*	**49**
Unspecified		2	*	*	7	3	21	*	6	**44**
Total	**1720**	**1695**	**312**	**883**	**2663**	**1177**	**4501**	**1168**	**1483**	**15602**

Note: Due to rounding, numbers to not necessarily add up to totals.
Values based on three or less unweighted cases are considered too small to provide accurate estimates, and values are therefore replaced with asterisks.

Source: Statistics South Africa

ACCESS TO SANITATION IN SOUTH AFRICA

The majority of South Africans have access to dignified sanitation, however critical gaps remain. Many areas lack adequate water for flush toilets to be supplied to the remaining unserviced settlements. Well-managed pit latrines and ecological sanitation will be important in bringing sanitation to all.



60%
Flush toilet connected to a public sewerage system

3.5%
Flush toilet connected to a septic tank

31%
Pit latrine/toilet (with/without ventilation pipe)

1%
Bucket toilet (emptied by household/municipality)

3.5%
Open defecation

1%
Other sanitation facilities, including chemical toilets and ecological sanitation systems, or have unspecified sanitation

Source: Statistics South Africa, 2011 Census

FACTS

It has been estimated that R44.75 billion is needed to provide basic sanitation services to the un-served population and to refurbish and upgrade existing infrastructure. This amount excludes the investment costs for bulk infrastructure requirements for new services. The challenge is immense and includes a myriad of other complexities, including water scarcity, rapid urbanisation, the growth of both formal and informal areas, and the maintenance of existing infrastructure.

The range of toilets in South Africa

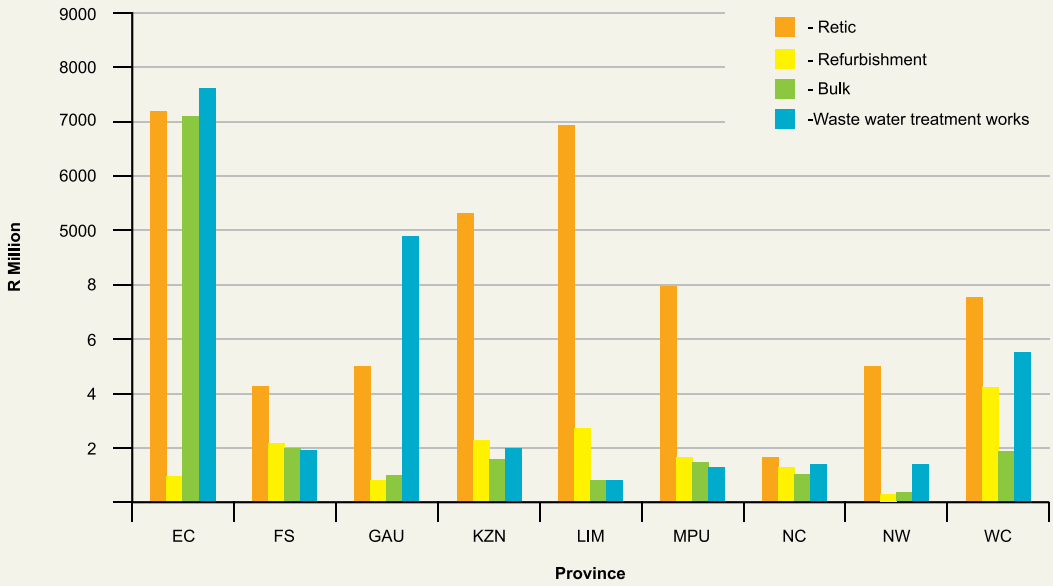
Flush toilets connected to a centralised sewerage system are regarded at the 'gold standard' of sanitation

South Africa has a range of toilets, although flush toilets connected to a centralised sewerage system are regarded at the 'gold standard' of sanitation:

- Flush toilets that link to the country's 2,000 waste water treatment plants;
- Toilets that flush into an on-site septic tank;
- Chemical toilets (emptied by a tanker);
- Pit latrines;
- Ecological or eco-toilets; and
- Bucket 'toilets', emptied either by local government or by the household.

In metros and larger towns, flush toilets are connected to a centralised sewerage system. The wastewater is transported by sewers linked to pump stations where it enters treatment works on the outskirts of the city. This form of sanitation is regarded as the 'gold standard' and is an aspiration for most citizens in South Africa. It is technically possible to connect more households to this network provided that wastewater treatment plants are upgraded and maintained to handle additional load.

FIGURE 6.1: TOTAL SANITATION NEEDS



Source: Department of Co-operative Governance & Traditional Affairs (2010)

78%
OF EXISTING WASTEWATER DESIGN CAPACITY IS CURRENTLY ACCOUNTED FOR

Wastewater services delivery is performed by 152 Water Services Authorities (WSAs) in South Africa via an infrastructure network of 824 wastewater collector and treatment systems. A total operational flow of 5,128.8 Ml/day is received at the 824 treatment facilities, which have a collective hydraulic design capacity of 6,509.7 Ml/day[1].

This means that 78% of the existing design capacity is currently accounted for, leaving a theoretical surplus of 22% as available capacity for future demand, although many individual plants have no surplus and run at full capacity.

As discussed in a previous chapter, South Africa has a Green Drop Audit that assesses the performance of wastewater treatment plants against a benchmark.

GREEN DROP COMPARATIVE ANALYSIS

PERFORMANCE CATEGORY	2009	2010/11	2012/13	TREND
Number of municipalities assessed	98	156 (100%)	152 (100%)	→
Number of wastewater systems assessed	444	821	824	↑
Average Green Drop score	37%	45%	46.4%	↑
Number of Green Drop score ≥ 50%	216 (49%)	361 (44%)	415 (50.4%)	↑
Number of Green Drop score < 50%	228 (51%)	460 (56%)	409 (49.6%)	↑
Number of Green Drop awards	33	40	60	↑
Average Site Inspection score	N/A	51.4%	57.0%	↑
National Green Drop score	N/A	71%	73.8%	↑

↑ - improvement ↓ - digress → - no change

Source: DWS, Green Drop Report (2013)

VIP Latrines

The rapid up-scaling of VIP latrines led to around 3 million units being installed in South Africa

The greatest challenge exists outside of the sewered boundaries of our towns where infrastructure is often lacking. The costs associated with providing universal access to conventional waterborne sanitation is beyond the reach of most developing countries, prohibitive in sparse settlements.

One approach for providing sanitation in areas outside the sewered network in South Africa has been to implement Ventilated Improved Pit (VIP) latrines. VIPs are recognised in South Africa as the basic minimum sanitation intervention. The main advantages of this technology are that it can – if used and maintained properly – provide a barrier between people and faecal waste, it does not require water for functioning and it can be installed faster than conventional waterborne sanitation because it does not require the laying of complex sewers and the construction of treatment works.

The rapid up-scaling of VIP latrines led to around 3 million units being installed in South Africa. However, the lack of maintenance capacity along with the absence of clear guidelines on how to deal with full latrines has proved to be a major hurdle.

[1] South Africa's population grew by 25% between 2000 and 2013.

CHALLENGES OF VIP LATRINES FOR SOUTH AFRICAN MUNICIPALITIES

- Flawed knowledge of how the pits functioned;
- Dumping of all sorts of waste (including rags and plastic bags) into the latrines meant they were filling faster than they were designed to handle;
- Incomplete digestion of faecal sludge;
- Accumulating faecal sludge meant that the systems were difficult to empty; and
- Disposal of the sludge is difficult to do safely.

With pits filling up and not being maintained properly by either the municipality or the household, people who had already been supplied with VIP latrines rejoined the backlog queue.

Bridging the gap

One of the challenges for the sanitation sector in South Africa is finding technologies that can bridge the gap between VIP latrines and full waterborne sanitation. We don't have enough additional water all year round to supply everyone with waterborne sanitation.

TWO ALTERNATIVE TOILETS

The Low Flush Toilet

The on-site Low Flush system is one example of a system capable of bridging the gap between VIP latrines and waterborne sanitation. The innovative Low Flush toilet bowl design works on low flush volumes, using between one and two litres a flush – as opposed to the conventional nine litres per flush – and it is capable of using greywater during times of water stress.

The Pour Flush Toilet

Another example is the Pour Flush toilet, which is designed to be flushed using poured water. The main advantage of this toilet is that it does not require a constant pressurised water supply to function. The toilet can also be upgraded with a cistern that uses around three litres to flush, highlighting its adaptability. Pilots have been successfully installed in various parts of South Africa.

Next generation toilet technologies

The South African Sanitation Technology Demonstration Programme (SASTEP) – a partnership between the Water Research Commission, the Department of Science and Technology, and the Bill and Melinda Gates Foundation – provided a glimpse of what the future might look like by commissioning researchers to "Reinvent the Toilet".

Demonstration-ready models are being evaluated in South Africa, specifically in municipalities that have service delivery challenges. These next-generation toilet technologies are modular units with a hygienic interface and new treatment processes. Examples of these processes include hydrothermal carbonisation, combustion and electrochemical treatment.

CREATING JOBS THROUGH SANITATION MAINTENANCE

A pilot project that was run in the Eastern Cape between 2009 and 2013 provided sanitation maintenance services to approximately 400 schools in the Butterworth district. Half a dozen franchisee micro-businesses were created to deliver this, and 36 previously unemployed people were taught workplace skills. The pilot project provided a workable model that was recognised by the Department of Education as being suitable to roll out to the more than 4,000 rural schools across the Eastern Cape with a similar type of infrastructure. Based on the proven success of the pilot, the Department of Education has proceeded in implementing a Phase 1 rollout to the East London, Butterworth, Dutywa and Cofimvaba Districts to service 1,200 schools. Many opportunities lie in applying this Impilo Yabantu approach to other operational and maintenance activities within the water and sanitation services delivery chain throughout South Africa.

The urine-diversion toilet

The urine-diversion toilet, also known as the 'Drybox' is another innovation that rethinks sanitation. This is a superior type of dry toilet that overcomes the problems sometimes encountered with implementing VIP toilets. The main advantage of the Drybox is that it doesn't need a pit, hence the toilet may be installed inside the house.

Urine is diverted at source by a specially designed pedestal and the relatively small volumes are simply led into a shallow soakpit. Alternatively, urine can be directed into a container and re-used for agricultural fertiliser, as it is rich in plant nutrients, such as nitrogen, phosphorus and potassium.

Faeces are deposited in a shallow vault and covered with a sprinkling of ash or dry soil, which absorbs most of the moisture. Faeces are subjected to a dehydration process inside the vault, which hastens pathogen die-off.

Treat waste at source

The new-generation sanitation treatment processes allow human waste to be treated at source, eliminating the need for sewers or, in the case of latrines, having to find ways to effectively manage faecal sludge.

THE FUTURE

Shared knowledge

South Africa requires a re-think of how to address universal sanitation delivery, not only in this country, but also in the rest of the continent. Many African countries are striving to achieve their development targets for sanitation and South Africa could provide many shared lessons.

South Africa could provide many shared lessons on sanitation for the rest of Africa

Most of Africa's sanitation targets are infrastructural with little emphasis placed on sustainability or soft issues like household or community acceptance of the technology. Moreover, evidence has shown that the management of faecal sludge is extremely challenging due to its various physical and chemical characteristics. Pit latrine processes are dependent on a number of factors making the management of this toilet technology highly complex from a planning perspective.

Sanitation Research Fund for Africa

The Sanitation Research Fund for Africa (SRFA) recognises the enormous challenge that effective management of faecal sludge presents. The SRFA therefore seeks to develop localised capacity and solutions to deal with the challenge. Some of the technologies piloted by the SRFA include a decentralised faecal sludge treatment plant to reduce transport costs for pit-emptying entrepreneurs, an easily transportable solar pasteuriser and co-digestion of faecal sludge with other organic wastes.

High-tech options

...biogas could be one way to rethink the sanitation and energy issues faced by many countries

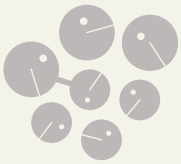
Using sewage sludge to generate biogas could be one way to rethink the sanitation and energy issues faced by many countries, simply by making the connection between the two. Large-scale anaerobic biogas digesters are reactors used for the conversion of the organic component of large volumes of sludge and slurry into biogas by anaerobic digestion. The biogas is recovered and used either directly for heating the reactors or transformed into combined power and heat, and fed into the grid.

Both small- and large-scale anaerobic digestion is a well-established commercial technology. The technology has been increasingly used for municipal wastewater treatment in Asia (India in particular) and Latin America.

THE BIOGAS LANDCAPE IN CHINA

CHINA
IS THE NUMBER ONE BIOGAS PRODUCER IN THE WORLD

18 MILLION
FARM HOUSEHOLDS USE BIOGAS



3,500
MEDIUM-TO-LARGE SCALE DIGESTER UNITS

Biogas has the potential to become an efficient and economical source of renewable energy.

Scaling up low-water sanitation in South Africa

...social franchising partnerships for the maintenance of infrastructure could alleviate and address many challenges in the management of water services.

The technology is clearly out there for South Africa and the world to rethink sanitation systems.

In South Africa, one of the most important questions that needs to be addressed for a sustainable future is how to scale up low-water sanitation (where water is scarce). The Council for Scientific and Industrial Research (CSIR) and the Water Research Commission have established that social franchising partnerships for the maintenance of infrastructure could alleviate and address many challenges in the management of water services.

As the recent 2015 drought has shown, there is an urgent need for new and disruptive technologies that can combine South Africa's sanitation needs with social, environmental and financial sustainability. The technologies are available and there could not be a better time to make use of them.

FURTHER INFORMATION

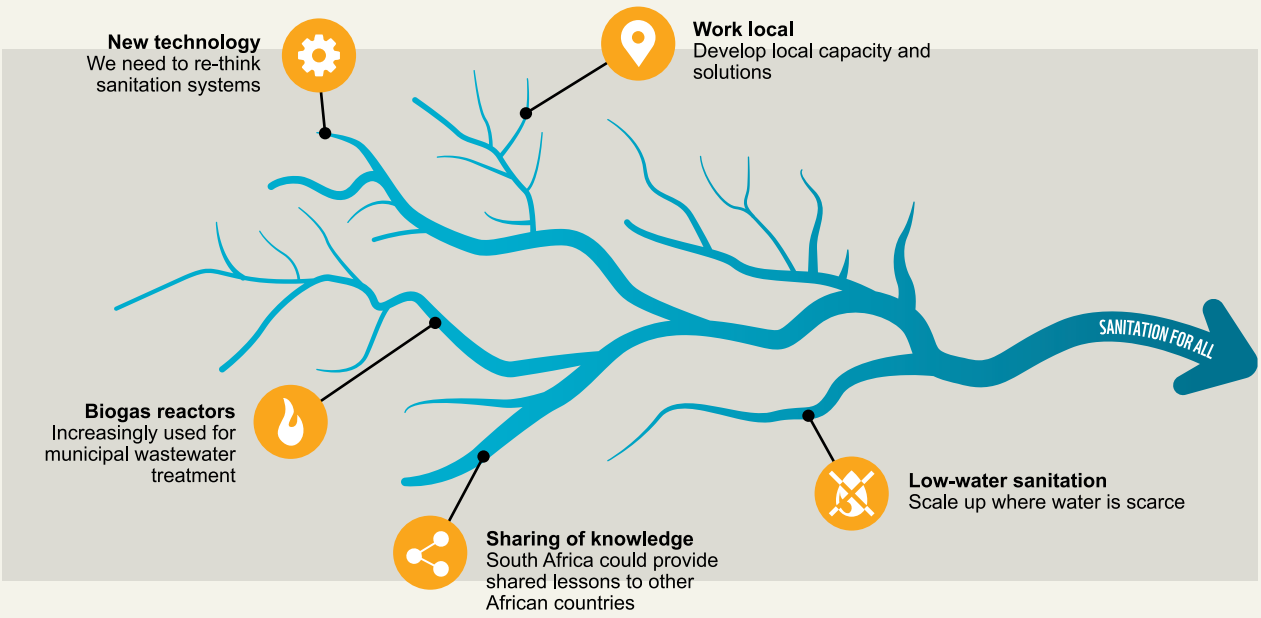
Water and Sanitation and Hygiene: http://www.unicef.org/wash/

History of sanitation and social change in India: http://www.sulabhtoiletmuseum.org/

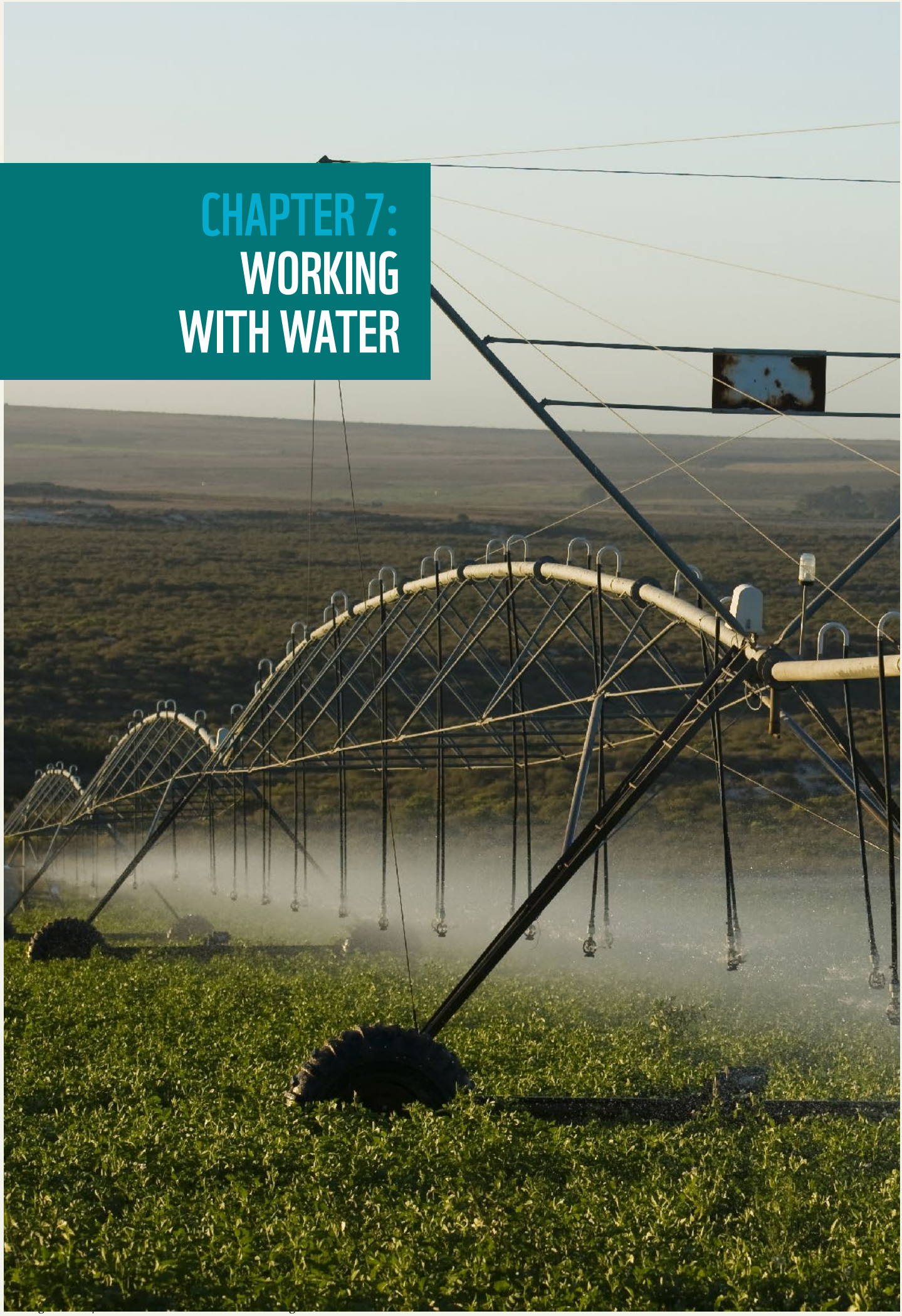
Pour flush toilets: https://www.youtube.com/watch?v=IUIYzoyZ__c

Sustainable Sanitation Alliance: http://www.susana.org/en/

LOOKING AHEAD: FACTORS CONTRIBUTING TO SANITATION FOR ALL



CHAPTER 7: WORKING WITH WATER

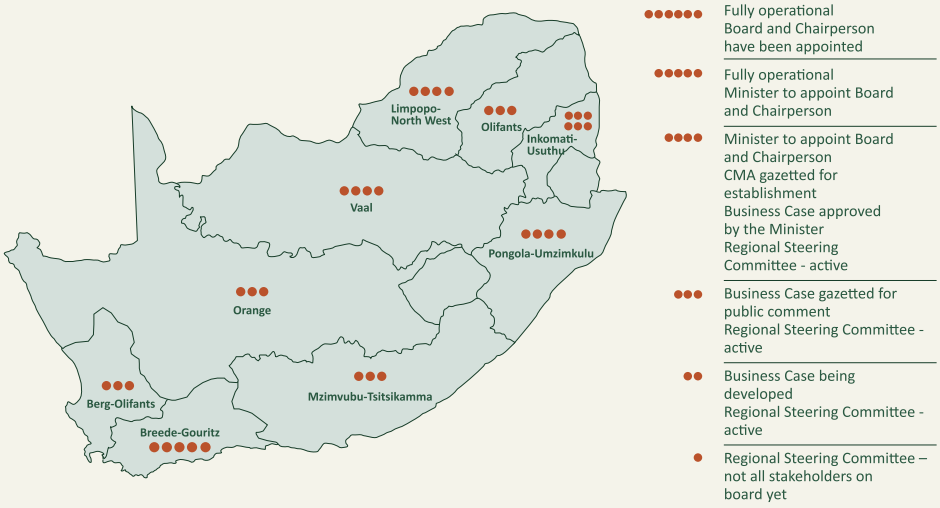


WATER IS EVERYBODY'S BUSINESS

Public institutions form the backbone of our water sector, from catchment management agencies who look after the resource base, to municipal water service providers who make sure that we receive water in our taps and that our wastewater is treated. However, every business and household uses and impacts water, and therefore water is everybody's business.

Currently, in the public sector, 13 water boards, two CMAs, the Water Research Commission, 167 Water User Associations and the TransCaledon Tunnel Authority report to the Minister of Water and Sanitation. These public institutions are supported and serviced by a myriad of engineering, chemical and scientific companies and organisations.

FIGURE 7.1: UPDATE ON PROGRESS TO ESTABLISH NINE CATCHMENT MANAGEMENT AGENCIES



Source: Department of Water & Sanitation (February 2015)

FACTS

Functioning Catchment Management Agencies are critical

Functioning Catchment Management Agencies (CMAs) are critical for the management of scarce water resources in South Africa, as Integrated Water Resources Management is best carried out at a local, catchment scale. CMAs are envisaged as the operational arm to implement water policy and legislation in South Africa. There are currently two operational CMAs in South Africa, with the remainder at varying levels of establishment. Although there has been significant frustration regarding the slow development of CMAs across South Africa, the staggering of CMA establishment has created the opportunity to fine-tune the

Catchment Management Agencies are envisaged as the operational arm to implement water policy and legislation in South Africa

system. The Breede-Overberg and Incomati CMAs have acted as 'pathfinder' CMAs, helping the Department of Water and Sanitation (DWS) to pilot and refine the novel institutional structure. This has helped the CMAs and the DWS to understand and mitigate the challenges of institutional realignment and development. Institutional development processes require time and iteration, to ensure the optimal institutional solution to manage our scare water resources in South Africa effectively.

Legal rights

Access to water in society and the economy is determined by legal rights and the price of water.

International Law

The United Nations Human Rights Council adopted a resolution on 30 September 2010 affirming that water and sanitation are human rights.

Constitution of South Africa

2010
UN AFFIRMED WATER & SANITATION AS HUMAN RIGHTS

South Africa enshrines the basic right to sufficient water in its Constitution, stating that "Everyone has the right to have access to (...) sufficient food and water ..." - Section 27(1) (b).

South Africa's Water Services Act, Act 108 (1997)

This Act contains a section on the right of access to basic water and sanitation. It states that:

- Everyone has a right of access to basic water supply and basic sanitation;
- Every water services institution must take reasonable measures to realise these rights; and
- Every water services authority must, in its water services development plan, provide for measures to realise these rights ...

The National Water Act, Act 36 (1998)

The National Water Act provides a framework to protect water resources against over-exploitation and to ensure that there is water for social and economic development and water for the future. It also recognises that water belongs to the whole nation for the benefit of all people.

This Act outlines the permissible use of water. It says a person can:

- Take water for reasonable domestic use in their household, directly from any water resource to which that person has lawful access;
- Take water for use on land owned or occupied by that person, for reasonable domestic use; small gardening (not for commercial purposes); and the watering of animals (excluding feedlots) which graze on that land (within the grazing capacity of that land) from any water resource which is situated on or forms a boundary of that land, if the use is not excessive in relation to the capacity of the water resource and the needs of other users;
- Store and use run off water from a roof; and
- In an emergency situation, take water from any water resource for human consumption or fire fighting.

Compulsory National Standards and Measures to Conserve Water (June 2001)

Regulation 2 states that the minimum standard for basic sanitation services is:

- The provision of appropriate health and hygiene education; and
- A toilet which is safe, reliable, environmentally sound, easy to keep clean, provides privacy and protection against the weather, is well ventilated, keeps smells to a minimum and prevents the entry of flies and other disease-carrying pests.

Regulation 3 states that the minimum standard for basic water supply services is:

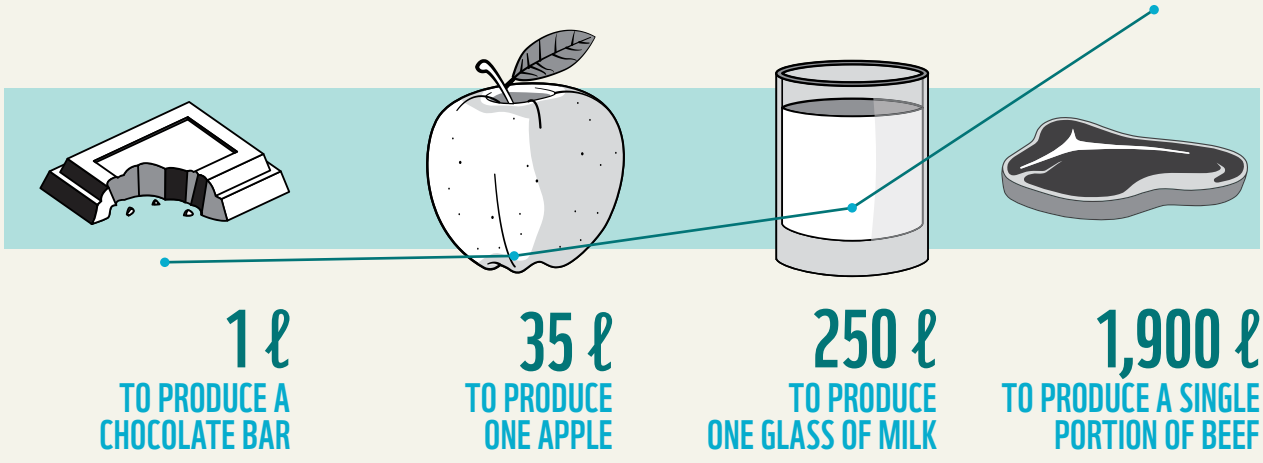
- The provision of appropriate education in respect of effective water use; and
- A minimum quantity of potable water of 25 litres per person per day or 6 kilolitres per household per month:
    - At a minimum flow rate of not less than 10 litres per minutes;
    - Within 200 metres of a household; and
    - With effectiveness such that no consumer is without a supply for more than seven full days in any year.

Water, water everywhere...

Everything we use, eat or throw away has a water footprint.

Water flows through every part of our economy and is essential for all our work and livelihoods. Because it is necessary everywhere, it is often invisible. And yet without it, the daily operations of our lives, businesses, farms, towns and schools would quickly grind to a halt.

Everything we use, eat or throw away has a water footprint. We don't see this water, but it has been consumed in making everything we use and in the operating of our lives.



THE SOUTH AFRICAN WATER SECTOR

National Department of Water and Sanitation (DWS)

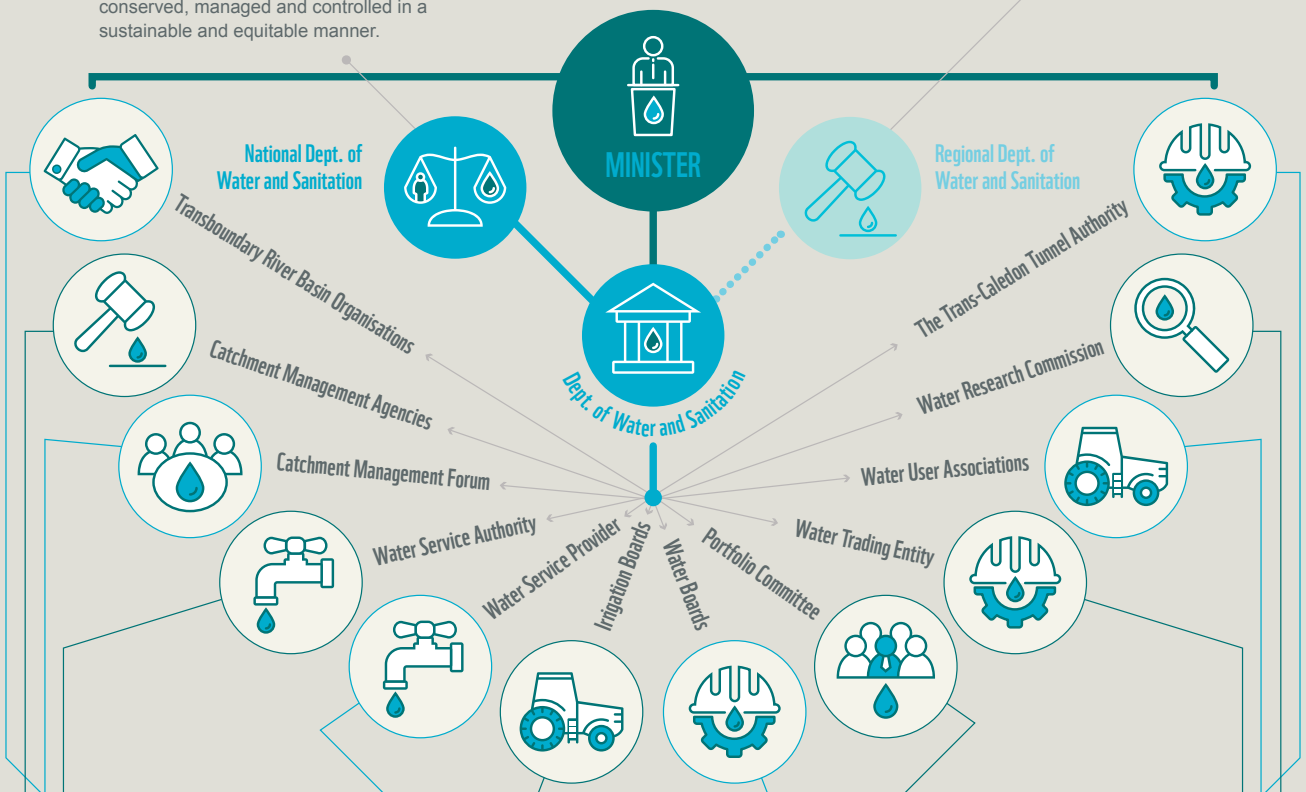
Acting through the Minister, has the power to regulate the use, flow and control of all water; must ensure that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner.

Minister

Custodian, policy-maker and regulator for the water sector; responsible for ensuring that water is allocated equitably and used beneficially, while promoting environmental values.

Regional Department of Water and Sanitation (DWS)

In the absence of CMAs, performs their function in the future; provides technical support to CMAs.



Transboundary River Basin Organisations

To give effect to our International Obligations under the National Water Act; South Africa is signatory to various international agreements governing transboundary resources.

Catchment Management Agencies (CMAs)

Investigate and advise on the protection, use, development, conservation, management and control of water resources in its water management area; co-ordinating activities of water users and water management institutions.

Catchment Management Forum (CMFs)

Provides the opportunity for issues to be discussed and for the CMA to provide feedback to its members.

Water Service Authority

Any municipality responsible for ensuring access to water supply and sanitation services; progressively ensure efficient, affordable, economical and sustainable access for consumers.

Water ServiceProvider

Physically provides water and sanitation services to consumers under contract to the water services authority. This function can be performed by the municipality itself or any other public or private body.

Irrigation Boards

Existing Irrigation Boards, Subterranean Water Control Boards and Water Boards established for stock watering purposes, as per the Water Act of 1956, are recognised until they are re-structured as WUAs.

Water Boards

Provides water services to other water institutions within its service area. Key activities include management; training; supplying untreated or non-potable water and water for industrial use; accepting industrial effluent.

Portfolio Committee

Consider Bills; deal with departmental budget votes; oversee the work of the department; enquire and make recommendations.

The Trans-Caledon Tunnel Authority (TCTA)

Engaged in project financing and implementation, also a specialised liability management entity. It finances and implements bulk raw water infrastructure in a cost-effective manner.

Water Research Commission (WRC)

Co-ordinate, promote, encourage or cause to be undertaken, as determined by the Minister, research about water.

Water User Associations (WUAs)

Exercise its delegated management powers, including protecting water resources; preventing unlawful water use and unlawful acts likely to reduce the quality of water; regulating the flow of any watercourse.

The Water Trading Entity (WTE)

The development, operation and maintenance of specific water resource infrastructure and managing water resources in specific management areas.

Water footprint: the amount of water that went into making a product or service, including water from the soil (known as brown water), water from rivers and aquifers (blue water) and water impacted by waste products (grey water). It is also known as virtual water or embedded water.

Putting a price on water

While we have a legal right to access water for basic human needs, businesses and individuals pay for water when it exceeds the basic allocation.

RAW BULK WATER CHARGES TO DIFFERENT SECTORS IN CATCHMENT AREAS IN SOUTH AFRICA, 2012

	COST PER C/M³		
CATCHMENT AREA	DOMESTIC & INDUSTRY	AGRICULTURE	FORESTRY
Berg	10.35	2.17	1.03
Breede	4.88	1.39	0.48
Crocodile West & Marico	13.75	2.33	0.81
Fish to Tskisi	21.45	1.9	0.7
Gouritz	22.23	1.48	0.79
Inkomati	24.51	1.13	0.87
Limpopo	4.89	3.08	0.98
Lower Orange	3.79	0.73	ND
Lower Vaal	39.6	0.56	ND
Luvuvuhu & Letaba	7.97	0.01	1.09
Middle Vaal	44.25	1.89	ND
Mvoti to Mzimkulu	7.86	2.23	1.3
Umzimvubu to Keiskamma	21.37	3.27	1.25
Olifants	4.93	1.62	0.91
Olifants Doorn	8.47	1.01	0.79
Thukela	6.72	2.11	0.51
Upper Orange	5.48	0.65	ND
Upper Vaal	48.03	2.68	1.06
Usutu to Mhlatuze	22.12	2.77	0.49
Mean average	**16.98**	**1.74**	**0.69**

Source: DWS National Integrated Water Information System

25 LITRES
PER PERSON PER DAY IS FREE BASIC WATER

In 2001, South Africa introduced a policy of free basic services, including water, electricity and solid waste collection. As part of that policy, every household should receive the first 6,000 litres of water per month for free, based on a calculation of a minimum of 25 litres per person per day for a household of eight.

However, municipalities can decide if free basic water is made available only to the poor, and how the poor will be defined and identified. Out of 169 Water Service Providers (municipalities), 29 provide free basic water to all their residents, 136 provide it to some residents and four very small municipalities provide it to none of their residents.

...the volume of free water has often proven inadequate for low-income households

You are required to pay for water that is used over and above the free supply; consumption in excess of 6,000l (6kl) per month being charged on a basis of rising block tariffs. In theory, therefore, all households receive a free lifeline supply of water, subsidised by rising block tariffs that penalise wealthier households and act as a disincentive to over-consumption.

In practice, however, the volume of free water has often proven inadequate for low-income households, forcing them into the second or third blocks of consumption, often creating higher water bills than what these households were charged prior to the introduction of "free" water.

The biggest water-users are farmers and they receive water from irrigation boards, water boards or bulk water providers. They use 'raw water' which has not been treated to the levels required for drinking water. Currently, these large-scale users pay vastly different amounts for water across the country. Drier areas do not necessarily pay the most for water, despite the fact that the cost of infrastructure to reach those areas can make it more expensive.

Basic Water Supply Facility: The infrastructure necessary to supply 25 litres of potable water per person per day within 200 metres of a household and with a minimum flow of 10 litres per minute (in the case of communal water points) or 6,000 litres of potable water supplied per formal connection per month (in the case of yard or house connections).

The Private Sector

The private sector recognises water risk as a material concern for business viability, and several initiatives have grown internationally in the past decade to deal with that risk. Global corporate companies who are already signatories of the United Nations Global Compact can sign the CEO Water Mandate.

UN GLOBAL COMPACT

The United Nations Global Compact is the world's largest corporate sustainability initiative. The CEO Water Mandate assists companies in developing, implementing and disclosing water sustainability policies and practices.

CEO Water Mandate signatory companies commit to annually disclosing their water plans and results in the form of Direct Operations, Supply Chain and Watershed Management, Collective Action, Public Policy, Community Engagement, and Transparency.

83%

OF SOUTH AFRICAN WDP COMPANIES SAID THEY ARE EXPOSED TO WATER RISK

WATER DISCLOSURE PROJECT

In South Africa some of the corporate companies listed on the JSE have responded to the Water Disclosure Project, which is part of the global Carbon Disclosure Project (CDP).

Respondents to the CDP's Water Disclosure Project list how they are improving water efficiency in their operations and reducing their water impacts. This year South Africa had the highest number of respondents in the world reporting water risks. About 83% of respondents reported that their direct operations are exposed to water-related risks, the highest of any sample in the world, with more than half of these risks expected to manifest within the next three years.

THE FUTURE

Water risk highlights the need to do 'business unusual'

Water is a resource under increased stress, and according to the World Economic Forum, it is now ranked as the number one impact risk to business continuity and growth. As a result of South Africa's 2015/16 drought, the private sector is more interested in understanding its water risk and in working with others to mitigate shared risks.

WWF's Water Risk Filter, the first tool to quantify water-related risks for all industries in all countries, helps farmers and businesses understand how their water risk varies across the South African landscape and gives them guidance on best practice and how to implement it.

Water is a constant traveller. Water stewardship requires you to look at where water comes from, how you use it and where it goes to.

Working together

A water-secure future will require strong cooperation between the public and private sectors to address our significant, accelerating water challenges. Matters of water governance, scarcity and pollution are becoming more pressing realities for agriculture, industry and other sectors, and functioning within these growing risks requires responsible water management practices.

Good water stewardship

Water stewardship requires you to look at where water comes from, how you use it and where it goes to.

The concept of good water stewardship serves to unite a wide set of stakeholders to:

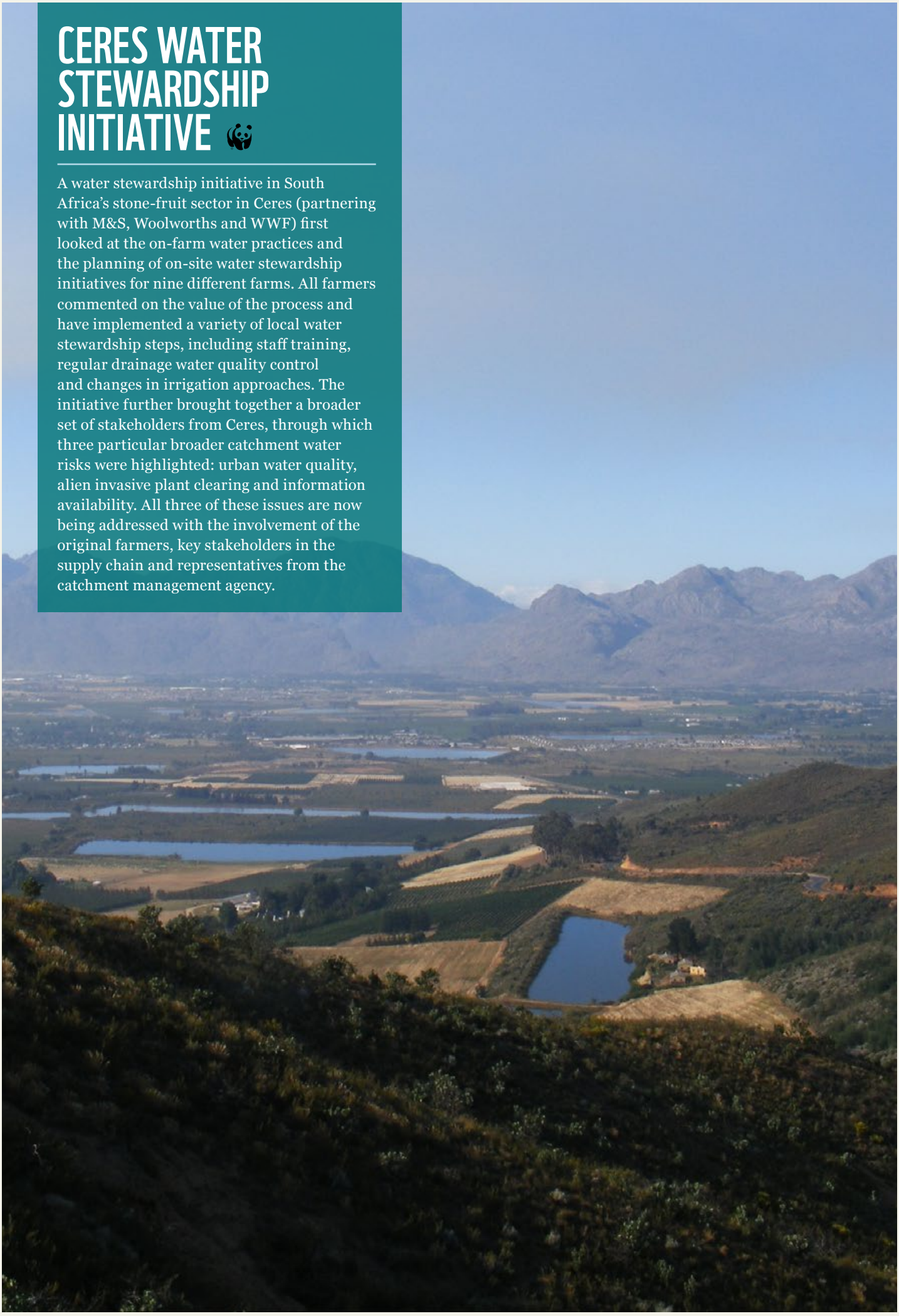
- Use water responsibly in-house, as well as throughout the wider catchment; and
- Use and share water fairly, sustainably and in a manner that is economically beneficial.

Due to the transient nature of water and the fact that it flows through large areas of land, its stewardship requires local and catchment-scale levels of interaction.

Water stewardship is gaining increasing interest and attention in South Africa, and a wide variety of sectors (fruit, forestry, hops) and catchments (Breede, Gouritz, uMgeni) are currently engaging around water stewardship.

CERES WATER STEWARDSHIP INITIATIVE

A water stewardship initiative in South Africa's stone-fruit sector in Ceres (partnering with M&S, Woolworths and WWF) first looked at the on-farm water practices and the planning of on-site water stewardship initiatives for nine different farms. All farmers commented on the value of the process and have implemented a variety of local water stewardship steps, including staff training, regular drainage water quality control and changes in irrigation approaches. The initiative further brought together a broader set of stakeholders from Ceres, through which three particular broader catchment water risks were highlighted: urban water quality, alien invasive plant clearing and information availability. All three of these issues are now being addressed with the involvement of the original farmers, key stakeholders in the supply chain and representatives from the catchment management agency.



WATER STEWARDSHIP FOR BUSINESS

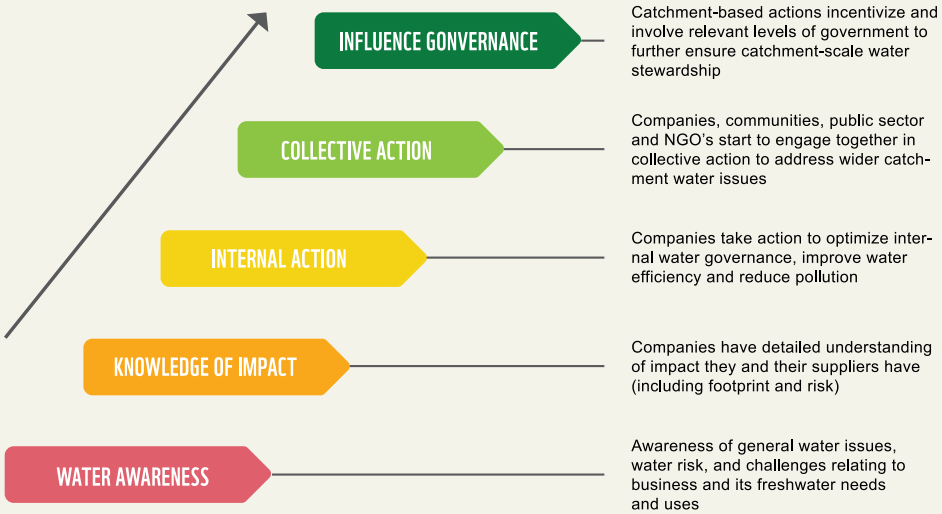
Water stewardship for business is a progression of increased improvement of water use and a reduction in the water-related impacts of internal and value chain operations. More importantly, it is a commitment to the sustainable management of shared water resources in the public interest through collective action with other businesses, governments, NGOs and communities.

-WWF

Alliance for Water Stewardship

The Alliance for Water Stewardship (AWS) is a non-profit organisation founded as a response to the urgency and scale of water challenges today. The AWS operates a global water stewardship standard, launched in 2014. The focus is to promote water stewardship through a globally-consistent set of principles and criteria. This standard is new and unique, especially because it includes social water issues, and promotes collective action and transparency. It provides a clear step-by-step roadmap with questions you can ask about your water risks and your water use – both within your operation and within your operating catchment. The standard is available for anyone to use and a formal verification process is under development.

FIGURE 7.2: THE FIVE WATER STEWARDSHIP STEPS



Collective action for our water future

As water is a common resource – it is not owned by individuals or organisations – it can be difficult to organise people and groups to voluntarily look after it better. Encouragingly, we are seeing many examples of communities, NGOs and government coming together in collective water action initiatives that are making a difference in their catchments.

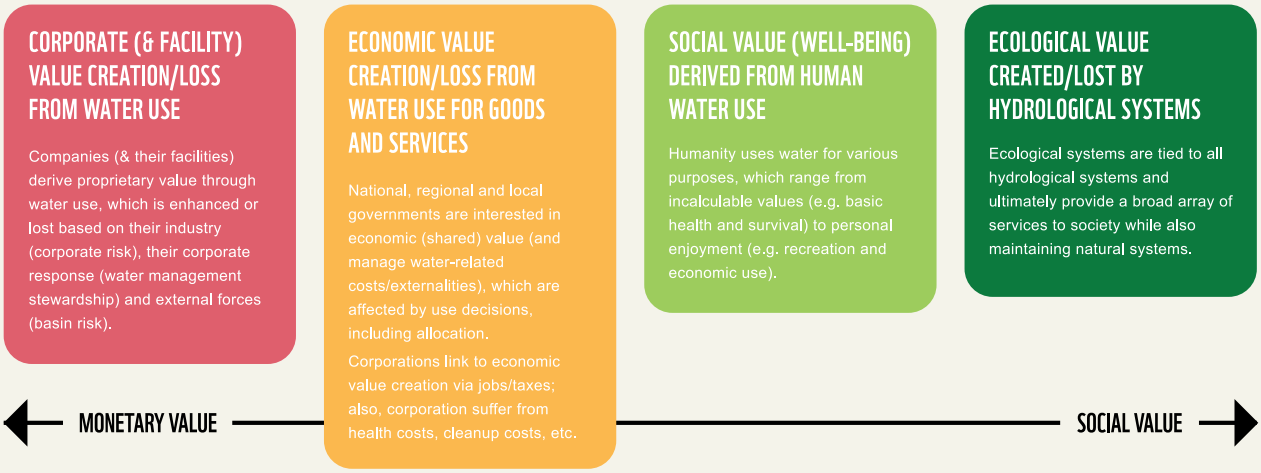
RIVER RESTORATION AND THE DEPARTMENT OF AGRICULTURE

"Over the last 20 years, many Western Cape lowland rivers have demonstrated the high cost of years of neglect. The recent invasion of woody alien vegetation, the bulldozing of river beds by farmers, the loss of deep rooted indigenous river plants, and the condensing of flood flows into narrow deep channels, have all contributed to the ongoing disastrous instability of the rivers. A major secondary issue is the abnormal movement of sediment as a result of bank erosion which escalates the instability of the rivers.

"The Western Cape Department of Agriculture is assisting communities in restoring their rivers by combating alien vegetation, constructing flow structures to slow down flow velocities during floods, and re-establishing indigenous vegetation in rivers. Although it won't be possible to restore the rivers to their pristine condition, it is essential that the movement of sediment be reduced to what it would have had been in its natural state. The removal of alien vegetation, the provision of more space for rivers, widening and vegetating river channels as far as possible, and the cessation of the regular disturbance of river beds with bulldozers, are the most sustainable ways to achieve the river restoration aim."

- Hans King, Deputy Chief Engineer,
Soil Conservation & Sustainable Resource Management,
Western Cape Department of Agriculture

FIGURE 7.3: THE VALUE OF WATER TO A COMPANY, THE ECONOMY, SOCIETY AND NATURE



Cleaning up the Jukskei river

The dire state of the Jukskei River, an iconic water course in Gauteng, brought together the community of key stakeholders to form the WET Africa Jukskei River Restoration initiative.

WET Africa is a South African-based Social Enterprise Company dedicated to the restoration of our natural resources by cleaning up our rivers and environment of pollution and waste, and creating visible community transformation.

The restoration of the water quality of the Jukskei River is vital to the creation of a healthy environment and healthy communities living adjacent to the river. The success of this initiative saw 48km of the Jukskei River restored, with 12,000 tons of solid waste removed from the watercourse beds, banks and riparian zone. The E.coli count in the river was reduced from 22,000,000/100ml to 240,000/100ml and community monitoring systems were established.

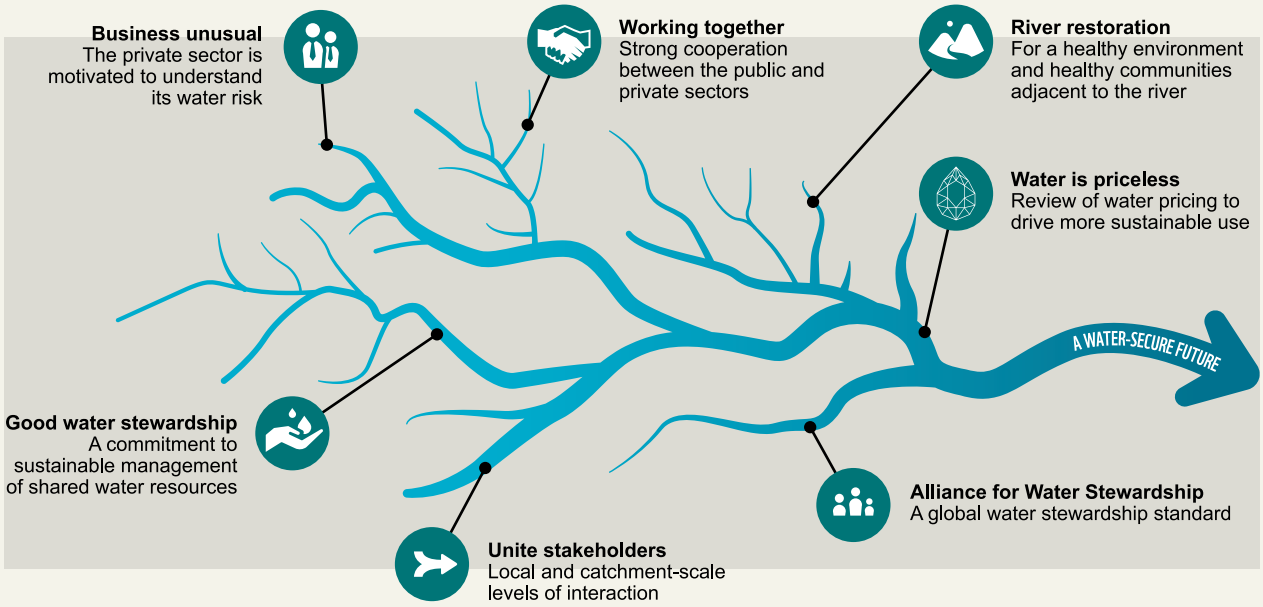
Value far exceeds cost

...all South Africans need to come together to ensure that this priceless natural asset is managed far more consciously

The value of water far exceeds its current cost to users. Following on this, the Department of Water and Sanitation is proposing a review of water pricing and this should help to drive more efficient, sustainable use of water, particularly by bulk consumers.

Ultimately, the value of water is priceless and all South Africans need to come together to ensure that this priceless natural asset is managed far more consciously, carefully and effectively. As the time-old saying goes, 'Water is life'; it is the lifeblood of us all.

LOOKING AHEAD: FACTORS CONTRIBUTING TO A SECURE WATER FUTURE



FURTHER INFORMATION

More about water stewardship in South Africa: http://www.wwf.org.za/what_we_do/freshwater/water_stewardship_programme/

The tool to support water stewardship for farmers in South Africa: https://aws.wwfsa.org.za/aws/home/%20%20-www.allianceforwaterstewardship.org

The global CEO water mandate for corporates and supporting tools to help them communicate, engage and develop a water strategy: http://ceowatermandate.org/toolbox/begin-your-stewardship-practice/

Responses from JSE companies on their water risk and actions: http://www.nbi.org.za/assets/downloads/climate/CDP_South%20Africa_Executive_Summary_2015.pdf

How much water is in what we consume: http://waterfootprint.org/en/water-footprint/what-is-water-footprint/

ABBREVIATIONS

CEBA	Community Ecosystems Based Adaptation
CMAs	Catchment Management Agencies
CMFs	Catchment Management Forums
CSI	Corporate Social Investment
CSIR	Council for Scientific and Industrial Research
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DFIs	Development Finance Institutions
DUCT	Duzi-Umngeni Conservation Trust
DWS	Department of Water and Sanitation
EKZNWildlife	Ezemvelo KwaZulu-Natal Wildlife
EPWP	Expanded Public Works Programme
ESG	Environmental Social and Governance
FIBC	Future Infrastructure Build Charge (in 2015 Water Pricing Strategy)
FSC	Forestry Stewardship Council
GDP	Gross Domestic Product
GEEF	Green Energy Efficiency Fund
GHG	Greenhouse Gas
IDC	Industrial Development Corporation
IFC	International Finance Corporation
IMMS	Integrated Information Management and Modelling System
IPPs	Independent Power Producers
IWRM	Integrated Water Resource Management
KZN	KwaZulu-Natal
LUI	Land User Incentive Programme
MIGs	Municipal Infrastructure Grants
MMTS	Mooi-uMngeni Transfer Scheme
MTEF	Medium Term Expenditure Framework
MWIG	Municipal Water Infrastructure Grant
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NWA	National Water Act (Act No. 36 of 1988)
NWRS	National Water Resources Strategy
PIC	Public Investment Corporation
PUCMA	Proto Pongola Umzimkulu Catchment Management Agency
RBIG	Regional Bulk Infrastructure Grant
RWIG	Regional Water Infrastructure Grant
ROA	Return on Assets
TCTA	Trans Caledon Tunnel Authority
SRI	Socially Responsible Investment
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
UEIP	uMngeni Ecological Infrastructure Partnership
USDGs	Urban Settlement Development Grants
WCT	Wildlands Conservation Trust
WRC	Water Research Commission
WRM	Water Resource Management Charge
WUA	Water User Associations
WWF-SA	World Wide Fund for Nature South Africa

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South Africa's fresh water by numbers

66%

of all water consumption in South Africa is by farmers who are the biggest direct users of water

8%

of South Africa's land area produces half of our fresh water

2 076

kilolitres of water gained per hectare cleared of invasive alien vegetation

37%

water loss occurs in most South African municipalities

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