THE FUTURE OF WATER SECURITY IN SOUTH AFRICA & SADC

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SCOPE OF PAPER

This paper explores water security in South Africa and SADC from the perspectives of public policy, the water supply chain, sustainability and strategic foresight to formulate a baseline and two alternative scenarios for water security to 2026. This is achieved by conducting an environmental scanning review of the major factors and trends shaping the trajectory of the development of water security in the region. These include; political and policy, economic and business, social and technological as well as ecological factors. Thereafter, having "framed" water security in a local, national, regional and global context, a scenario forecast was set forth and a facilitated dialogue held with experts on the topic and stakeholders from across the political, business and civil society sectors. A synthesis of analysis and insights gained are presented in the form of three alternative scenarios for water security, given key policy and business strategy choices. These scenarios are as follows.

The Future of Business Project in collaboraiton with the Oliver and Adelaide Tambo Foundation

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[1] This paper was initially prepared for use in the OR Thambo Foundation Dialogue Series on the National Development Plan – held in collaboration with the Gordon Institute of Busienss Science on 17 September 2015. Pannelists included; Water expert, Dr. Anthony Turton; Researcher, Steve Hedden of the Institute for Security Studies; water infrastructure engineer, Jacques Laubscher; risk analyst, Rivaj Parbhu of Control Risks; infrastructure investment expert, Andre' Kruger, of Barclays Africa Group Limited.

ALTERNATIVE SCENARIOS FOR WATER SECURITY BY 2026

BASELINE SCENARIO
"PERI-URBAN WATER CRISIS – NO.1 ELECTION ISSUE 2026"

It describes a business-as-usual scenario, where a lack of skills and effective policy implementation undermine an already ageing and weakened water infrastructure to lead to water shortages, especially in peri-urban settings. These failings are exasperated by rainfall dependence, the effects of fluctuations in climate and the exploitation of beleaguered water ecosystems.

A dialogue held by GIBS and the OR Tambo Foundation, between experts and stakeholders on the issue of water security, confirmed that if there would not be a large-scale implementation of national policy in an effective manner, water security will remain elusive. Furthermore, it confirmed that the responsibility does not lie singularly with the state, but also with all consumers and stakeholders – across sectors of manufacturing, mining, agriculture, business and households – to alter current usage patterns. The lack of forward thinking and constructive action in this scenario leads to a breakdown in relations, increased social tension and a mismatch between supply and demand that leads to a water crisis.

The futures scenarios, outlined by the GIBS Futures of Business Project, distinguish between three broad possible outcomes. The first, as discussed above, the baseline scenario, reflects the outcome should the current situation persist. The following two scenarios highlight the possibilities both within and outside the ambit of the government, to foster a new and positive outcome, in which the resource of water is managed in a way that delivers water in a manner aligned with the five factors required for "Future-Fitness" (Visser & Kaleodoscope Futures, 2015).

THE ALTERNATIVE SCENARIO A

"CAPABLE STATE MANTRA MARKS WATER TURNAROUND"

"CAPABLE STATE MANTRA MARKS WATER TURNAROUND" depicts a narrative where rapid enhancement of state capacity, coupled with an evolution to a water conservation culture by communities and the private sector, effectively relieves pressure on the water system. Investment, both domestic and international, is harnessed to ensure the longevity of the bulk transfer model of supply.

The first alternative scenario outlines a future where a "Capable State Mantra Marks Water Turnaround". In this future, the outlook is positive and the result of effective policy implementation is that water security becomes a fact of life for all South Africans. Furthermore, the role of all stakeholders is positive and centred around conservation. Rather than being a backbone of political disquiet, water becomes a feature of the success of the government in delivering human rights-focused and sustainable solutions. This scenario is focused simultaneously on human agency and the behavioural choices associated with conservation, as well as a concerted drive by government to create an enabling environment in which all participants can collaborate and deliver effective solutions, in line with government policy.

THE ALTERNATIVE SCENARIO B

"BREAKTHROUGH CAPTURE AND STORAGE DISRUPTS WATER SYSTEM DEPENDENCE"

"BREAKTHROUGH CAPTURE AND STORAGE DISRUPTS WATER SYSTEM DEPENDENCE", describes a scenario where technological breakthroughs in capture and storage allow consumers to migrate to responsible water usage, with an emphasis on reuse, recycling and environmental sustainability. Dependence on local government for water security is reduced, while bulk supply remains relevant for industrial and agricultural purposes.

Key trends and factors identified in these scenarios, which will shape the future of water security, are; governance effectiveness, irresponsible private sector use, investment partnerships, culture of conservation, ecological vulnerability and variability as well as the use of technological alternatives.
The second alternative scenario is driven by innovation, in the context of communities and industries working outside of the constraints of the state, to find and implement their own locally relevant and innovative development. In this scenario, the idea of the state being a key provider of infrastructure and service is secondary to people and communities shifting their reliance away from the state, to seek independent and private sector-driven solutions.

It is evident that in both of these scenarios, the call of the National Development Plan (NDP) for enhanced participation and the engagement of civil society to work together in building a sustainable and growing economy is pivotal to the success of the country.

EXPERT AND STAKEHOLDER ASSESSMENT OF ALTERNATIVE SCENARIOS

The baseline scenario is clearly undesirable, with significant risks socially and in terms of business competitiveness. Current water use practices are leading towards an unsustainable future and threaten to deepen inequality and poverty in the country and region. In a country with inequality as stark as in South Africa, this situation cannot be allowed to develop. The baseline scenario regarding water use in South Africa and SADC (Southern African Development Community), is "Peri-urban water crisis – Number 1 election issue 2016". This scenario posits that due to a poor implementation of well-structured policies, the inability of the water system to cope with increasing demand on resources will lead to frustrated communities venting their grievances by destroying key water facilities, and in doing so further reinforcing a lack of implementation ability by the government.

The vulnerability of South Africa to water insecurity is related to the country's ecological and special landscape. Johannesburg, the economic epicentre of the country, for instance, is in a unique situation in that it is the largest city that has been built without a secure water source – such as a river or lake (Turton, 2015). Furthermore, South Africa is a water scarce country; however, the management of the resource is not aligned with this fact. For Turton (2015), South Africa does not have to wait for alternatives and best practice in terms of alternative management of water to be developed and tested. This is due to the fact that these technologies already exist and the country should be able to benefit from, and exploit best practice globally, to secure a sustainable future with regard to water. As noted by Turton, (2015) "Alternative storage is old hat, we've been doing it for a long time". The technology exists to manage water more effectively, with alternative storage systems – such as water storage in underground aquifers (which eliminates evaporation) in practice in Australia and Texas, for example (Turton, 2015). This is in line with the second alternative scenario, "Breakthrough Capture and Storage Disrupts Water System Dependence". Ingenuity has brought the country to the current point of economic development, and so it is possible to develop this further, using our current human capital. However, we need to "internalise externalities" with regard to water, a reversal of the approach to date, in order to ensure that it is priced in a manner that reflects its importance.

The 'Crash and burn scenario', 'Bumpy road scenario' and the 'Tall trees scenario', are three examples of earlier scenarios developed by Turton (2015), equivalent to those developed by the Futures of Business Project, which aim to tackle the problems associated with water in South Africa. These problems are diverse, complex and include a sewage problem, issues around storage, acid mine drainage and the possibility of monetising phosphate recovery.

South Africa's challenges are greater than just water, yet for Turton, solving the water crisis may hold the key to improving the state of the economy. This is based on the fact that as a fundamentally water-constrained economy, the success of the South African economy lies in recycling. All "we need to do is recycle our total national water resource 1.6 times by 2035 and we are going to have full employment and a prosperous economy" (Turton, 2015).

According to Kruger, South Africa has a strong regulatory environment that is underutilised. Therefore, the water crisis is essentially a crisis of implementation and political will. Furthermore, the ideological position adopted by the state regarding the role of the government in terms of service provision, relative to the private sector – particularly in a developing economy – is key. The immense potential for Public-Private Partnerships (PPPs) has to date not been harnessed and capacity developed thereby in South Africa, yet there are numerous case studies that highlight the efficacy of this approach. This includes PPPs at various points along the water value chain, from desalination to water treatment. South Africa, at various points in recent history, has been noted as a leader in water management, yet Kruger (2015) believed "we have actually lost that position a few years ago". South Africa needs to regain its competitive edge and seek context-appropriate solutions to the challenges in the water sector. There appears to be a shift across the continent with an increasing number of countries adopting the PPP model with regard to water provision. These countries include Kenya, Mozambique and Rwanda that recently awarded a 30-year contract to an international operator in the water sector. Private sector participation may take various forms – ranging from management contracts to leases, and can be tailored to balance the state's responsibility to ensure cost-effective

service provision with the private sector's expertise. Related opportunities for all stakeholders to work together exist in terms of agriculture and mining. The recent development of a centre of expertise attests to this. PPPs can be effective as they allow for the focus on cost effective tariffs, as well as the consideration of effective billing and collection – which is important in terms of promoting the value of water as a scarce commodity.

The importance of adopting the correct pricing mechanism for water, to internalise the externalities, and to ensure that the commodity is valued in a manner aligned with its level of scarcity is key. South Africa consumes water at a higher rate per capita than many other countries, including those that do not suffer from the same water scarcity as South Africa. In the context of South Africa's socio-economic structure, however, we "need to consider inequality, as obviously not everyone consumes an above average [amount]" (Hadden, 2015). There are certain users who consume significant amounts of water relative to others – a disparity that is replicated across industries and sectors.

Water is not viewed as a commercial commodity; however, people are willing to pay significant amounts for water – for example bottled water – because of the convenience and good quality of the product. "When we look at providing water, we should not only focus on having the physical liquid available, but also the value and the service that goes with it" (Laubscher, 2015).

Hadden (2015) highlighted that water demand will outstrip supply in the foreseeable future – and indeed increase in the next 20 years – which aligns with the current baseline scenario. However, the actual point at which this is likely to occur is unknown as current measures of demand are uncertain and inaccurate – a problem that is not uniquely South African. The dearth of reliable, granular and accessible statistics regarding water demand and supply is a key challenge to successful planning and management of the resource.

In an assessment of whether management of long-term demand, through the National Water Resource Strategy, would be able to meet growing demand, the issue of lacking data arose as a critical impediment. Findings state that increased incomes, urbanisation, municipal demand and an increase in the percentage of land under cultivation, inter alia, will all lead to the increased demand on water. This is to be expected in a developing economy such as South Africa. The challenge will be to balance growth with the efficient provision of essential services, and in the case of South Africa – to ensure historical redress through this process.

RESEARCH INDICATES THAT THE CURRENT MODEL AND PROVISION FOR FUTURE DEMAND IS INADEQUATE AND THAT THE BASELINE SCENARIO IS, IN FACT, LIKELY.

The current supply-side measures appear to be inadequate to reach the goals established in the National Water Resource Strategy. The complexity of the issues surrounding water management make planning for and solving the challenges that lie ahead particularly complex. For Hadden (2015), both the quality and quantity of the water provided are key issues to be considered and managed. Furthermore, it was noted that approximately 36% of municipal water is lost, stolen or unaccounted for. This again highlights the challenges surrounding correct data, as exact figures and the causes for unaccounted for water are unknown. Without establishing whether the loss of water is caused by theft or leaks, it is impossible to implement an effective and targeted solution. Ultimately, in all scenarios considered by Hadden (2015), "demand exceeds supply and water is overexploited until 2035". This is a rallying call for decisive action, to seek alternatives to the current programmes and policies that are ineffective in meeting the needs of the future – a critical component of sustainability.

Following Hadden's emphasis of the importance of data, Laubscher (2015) engaged with the baseline scenario in a very pragmatic and rational manner. Without full comprehension of what the water crisis represents and means, it is impossible to address the challenges posed. Laubscher thus engaged with the question of "What does the water crisis mean?". This is particularly important in the context of South Africa's current challenges around the energy crisis and load-shedding, which led to a common understanding around the notion of a 'crisis' in the provision of an essential service. However, the nature of the services or commodities in question has very different implications for the country. For Laubscher, Eskom's power crisis has national impact, but water is "compartmentalised into specific schemes" (2015) and can therefore be expected to result in localised and isolated crisis points.

There are four primary reasons for a water crisis: firstly, there may be a resource limitation – such as a limited dam capacity or limited rainfall leading to a drought. This can be managed to some extent, but is difficult to control. Infrastructure projects such as building larger dams have long lead times, are capital intensive and funding is often difficult to attain.

Secondly, there may be infrastructure limitations leading to a water crisis. Although in certain cases, the infrastructure is adequate and technically functional, shifts in demand, either due to unforeseen social and economic requirements or urbanisation and as a result, the infrastructure "is too small, [and] cannot provide for the demand for which it was supposed to be built" (Laubscher, 2015).

Laubscher (2015) provided an example of being tasked with the job "Fix the problem" of inadequate infrastructure in a rural community. "We fixed the problem to a certain extent, but the problem that we had at that point in time, was a short-term fix" (Laubscher, 2015). Once a high-technology infrastructure system was installed, designed to cater for the size of the community in that particular area, there was a migration of people "from areas where there was no infrastructure to the area where we had provided infrastructure" (Laubscher, 2015). As a result, the new infrastructure was almost immediately placed under severe strain and no longer sufficient to cater for the increased demand levels. In this way, the importance of adequate infrastructure according to the level of demand is key.

SHOULD THE INGENUITY OF THE LOCAL COMMUNITIES BE HARNESSED, AS IN THE SECOND ALTERNATIVE SCENARIO, THIS MIGRATION AND STRAIN ON INFRASTRUCTURE COULD BE AVOIDED.

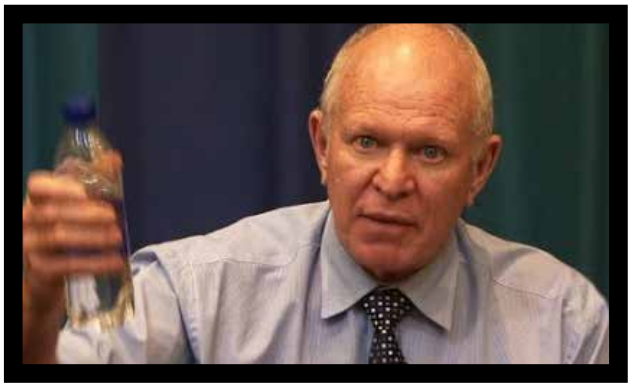
The third issue is breakdowns and the limited lifespan of facilities. This issue can be managed through effective preventative maintenance, which could address some of the country's broader economic challenges – such as job creation, as noted by Turton.

The fourth issue deals with the impacts of load-shedding and theft. It is evident that each of the above factors that will contribute to a water crisis are present in South Africa. Furthermore, each of these factors or challenges requires a different approach to managing the problem. Finally, in attempting to attain the goal of either of the alternative scenarios, these four factors will have to be addressed in a very specific manner as well.

In attempting to determine what will lead to these factors being addressed by the various stakeholders in society, it is evident that if either of the alternative scenarios is to become a reality – or are to be actively driven – the role of all stakeholders is critical to achieving this. A water crisis has major implications for businesses and can have a critical and adverse impact on their operations. Lacking systems are the major issue in the water sector, resulting in social and business risks and challenges, and have to be approached as a major risk to be mitigated.

For Parbhu (2015), business needs to take water scarcity very seriously "because of the operational effect it will have". This is particularly true when the challenge of water scarcity is coupled with high electricity and labour costs. Parbhu indicated that the impending water crisis and challenges around the levels of demand and access would lead to a shift in policy. From a regulatory standpoint, "government will start to realise the impact that water makes from a social point of view … and will then start to regulate the way that … we use water". This will have severe repercussions, not only for business, but for all stakeholders, and ultimately impact the growth and development trajectory of the economy.

Awareness of the critical role played by water is increasing in the business community, with a growing and diverse number of actors paying attention to the role of water. As noted by Parbhu (2015), water had been identified by the World Economic Forum as a "Top Four priority" or challenge in terms of doing business. Accordingly, appropriate planning is important for stakeholders to map out their role in addressing and mitigating the challenges. Furthermore, it is important that business and industry – particularly heavy users of water and those who pollute water to pay attention to their social reputation. This is a key area of business risk that could arise from poor engagement with a resource that is as critical as water. An issue raised by Parbhu (2015) is that a scarcity of water raises social tension, as it is a basic element that is required for people to survive. Parbhu (2015) stated "business in South Africa needs to start to consider these issues very seriously". All stakeholders have to act more responsibly in relation to their water use and consumption.

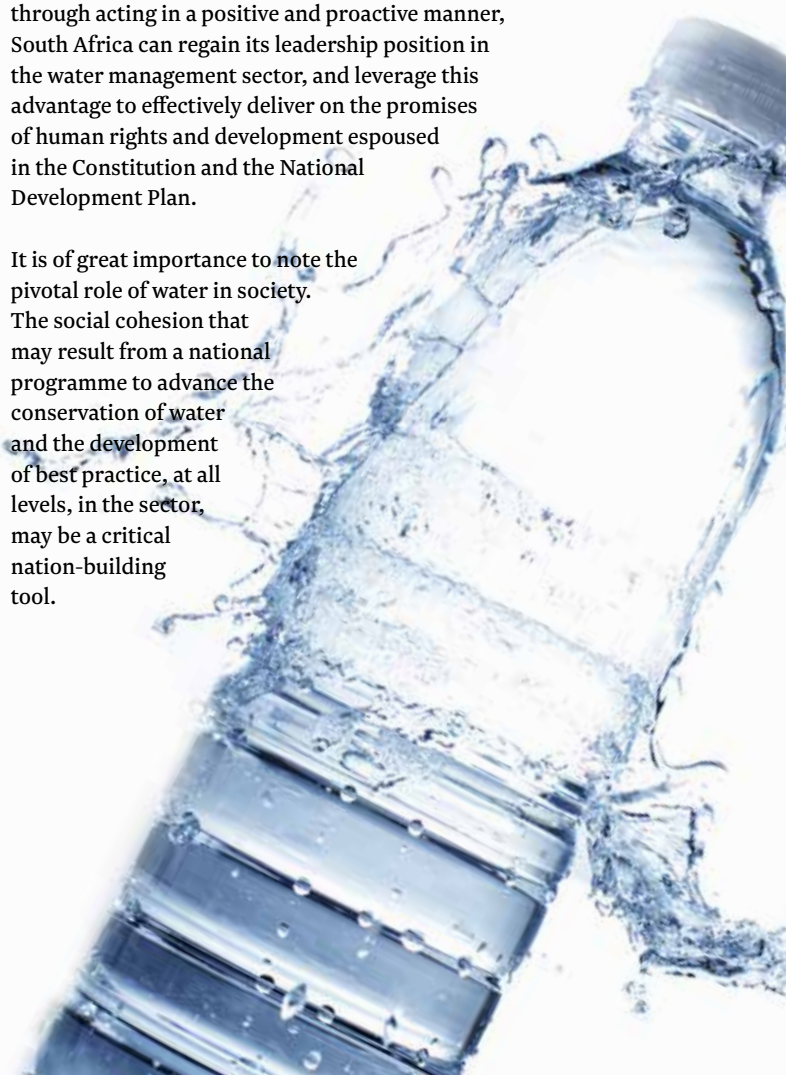


Dr Anthony Turton

KEY INSIGHTS

Consensus arose around the issues of the importance of avoiding the baseline scenario, and towards maximising the ingenuity of the population, engaging in a consciousness-raising exercise around the value of water as a scarce commodity. There is the need for government and the private sector to work together to ensure an alternative future scenario that builds upon a 'Capable State' or 'Disruptive Technology' in a 'Tall Trees' outcome, where the best outcome for all stakeholders is achieved. In this way, social and political tensions, which are disruptive for the economy and the environment are avoided, and stakeholders can work together, building social capital and advancing the future of the economy and nation in a constructive manner. Furthermore, through acting in a positive and proactive manner, South Africa can regain its leadership position in the water management sector, and leverage this advantage to effectively deliver on the promises of human rights and development espoused in the Constitution and the National Development Plan.

It is of great importance to note the pivotal role of water in society. The social cohesion that may result from a national programme to advance the conservation of water and the development of best practice, at all levels, in the sector, may be a critical nation-building tool.

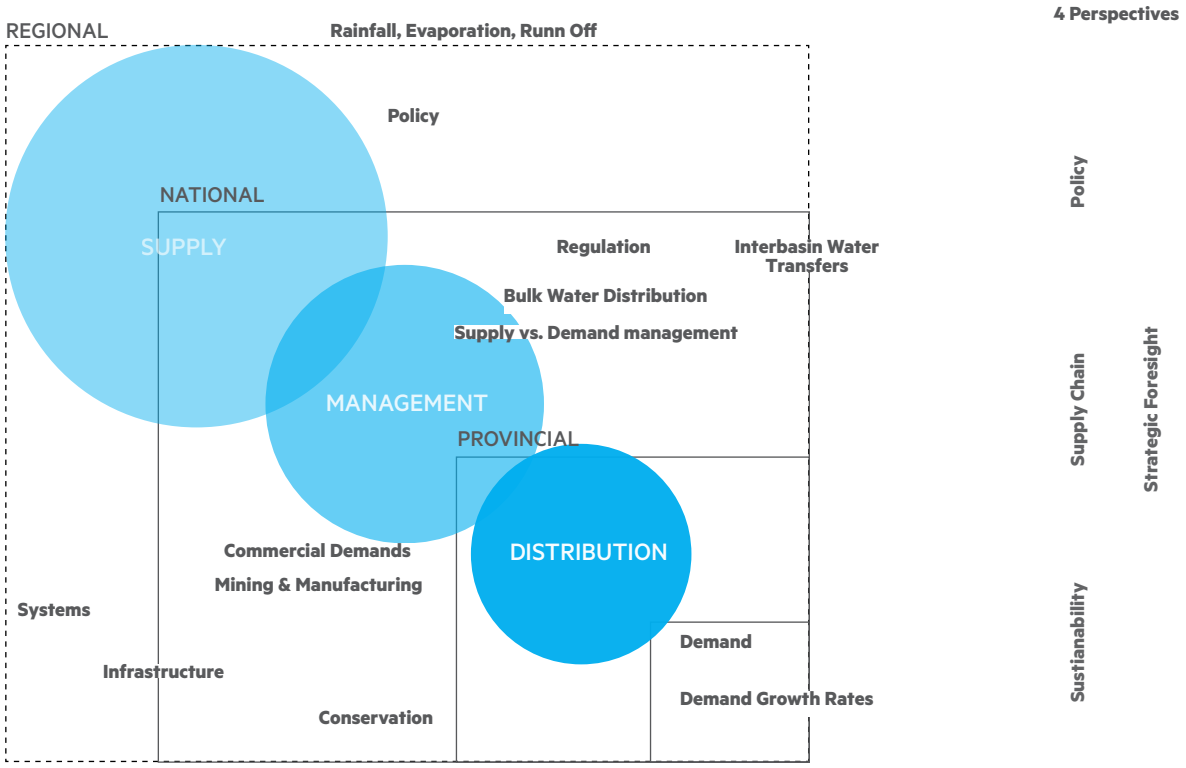


"FRAMING" WATER SECURITY IN SOUTH AFRICA AND SADC

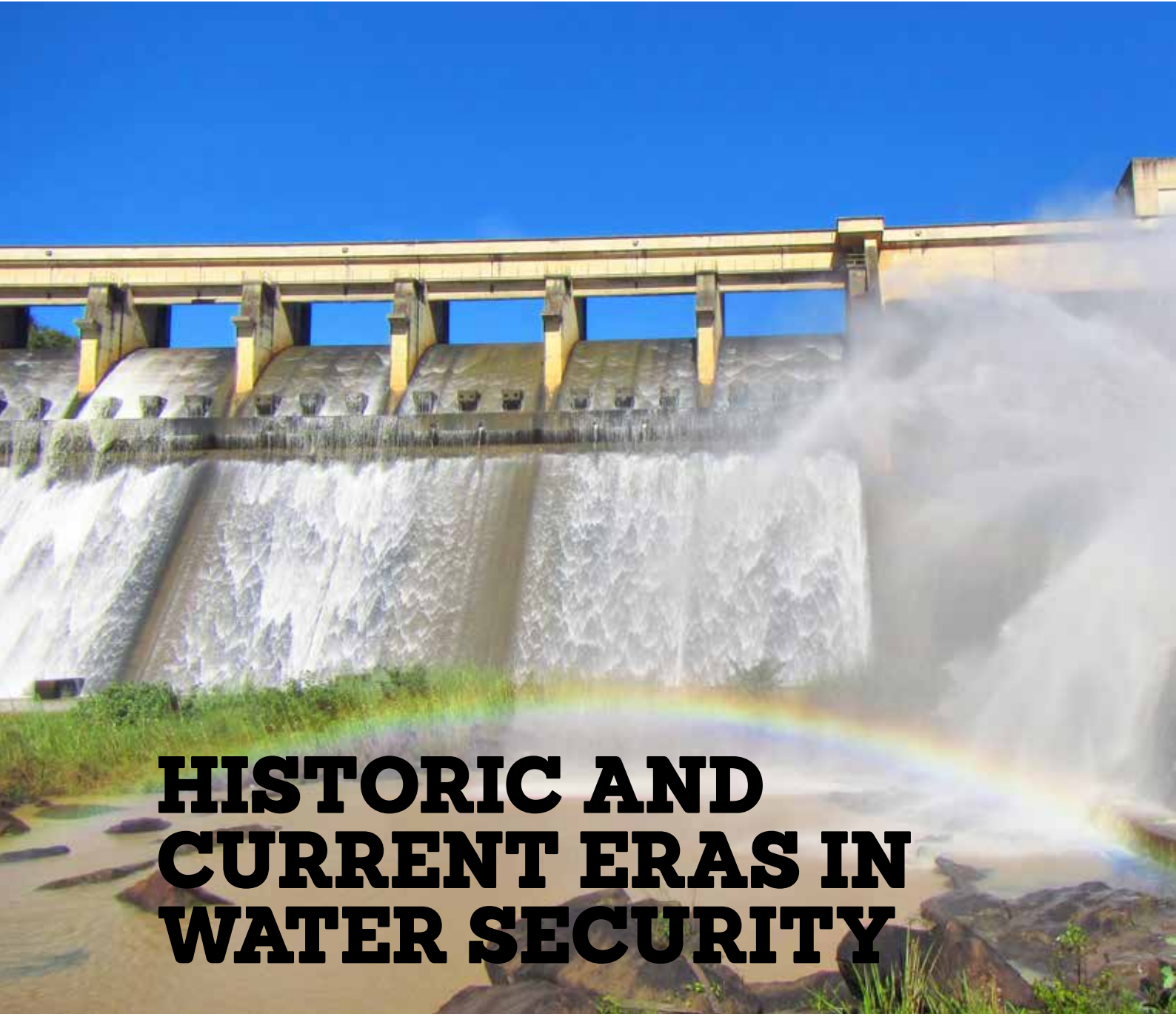
A key step in assessing the future of water security is the adequate "framing" of the issue. Hines[2] described framing as the "...first step that enables organisations to define the scope and focus of problems requiring strategic foresight". We framed the issue of water security as a multi-dimensional issue that has at its core the process from supply, through management and distribution to the consumption of water. This, of course, is not a linear process, but is cyclical and forms part of the larger systemic and cyclical ecological context within which water security exists. For the purposes of the analysis, the framing is cognisant of the regional, national and provincial as well as local contextual tiers wherein water security must be conceptualised to accommodate the complex layers of interdependent variables affecting the issue.

These tiers range from the policy and regulatory environment to the infrastructure, water systems, attempts at conservation and ultimately, the demand for water. Four different perspectives were employed to approach the issue holistically yet concretely, to assess the issue of public policy, supply chain, sustainability and finally strategic foresight, each delivering a unique and interdependent assessment of the status quo and likely future of water security in SA and SADC.

FRAMING: WATER SECURITY
THE FUTURE OF WATER SECURITY IN SOUTH AFRICA AND SADC



[2] Hines, H. A. (Auf, 2012) Framework for Thinking about the Future. andyhinessight.com. Accessed at: http://www.andyhinesight.com/books/thinking-about-the-future/



HISTORIC AND CURRENT ERAS IN WATER SECURITY

Of South Africa's approximately 200 dams, fewer than 10 date from the late 1800s. These were a legacy of the colonial period and are located largely in the Cape region to the south. From 1900 to 1950, 19% of dams were constructed along rivers across the country, spurred by the mining boom and subsequent urban and agricultural settlements. 65% of South African dams were constructed between the 1950s and the year 2000, mostly under the Afrikaaner Nationalists who sought to secure water supply along the lines of narrow racial interests and a network of state-subsidised industries enabled through state owned enterprises, Iscor, Eskom, etc. The advent of democratic transition marked a sea change in water policy, leading to the rapid increase from 65% access in 1994, to inclusive water distribution to the population rising to over 95% today, this while as little as 10% of catchment infrastructure was constructed in the period. While the South African government in so doing met an important United Nations Millennium Development Goal, reducing to well below half the number of people who do not have access to basic water supply, rapid distribution has brought about challenges in terms of supply and quality. Identifiable eras in Water Security in SA may be identified as:

Pre 1900 –	Parched Settlement
1900-1949 –	Industrial Infrastructure Investment (19%)
1950-2000 –	Narrow Apartheid Architecture (65%)
1994-Present –	Constrained Demographic Demands (10%).

These eras have significance in terms of the legacy systems and policy shifts that shape water security in South Africa. One may thus observe that neither investment in infrastructure has kept pace with the changing political and related social demands on water resources, nor have technologies and conservation been adequately employed.

THE STATE OF WATER SECURITY IN SA AND SADC

WATER IN THE GLOBAL CONTEXT

According to the World Water Council (WWC), a global organisation based in Stockholm, Sweden that promotes water awareness, the world experiences a water crisis as a result of poor water management and not because of its scarcity. The consequences of poor water management are that people are suffering and the environment is constantly being degraded. Poor water management, in many cases, has resulted directly from use of water for economic development predominantly in industry and agriculture. Economic activities that require significant water consumption negatively impact the environment and, in turn, place animals and the ecosystem at risk, resulting in water pollution and water shortages. According to data obtained by the National Aeronautics and Space Administration's Gravity Recovery and Climate Experiment satellite mission, which monitors the groundwater supplies and depletion rates, ground water supplies are rapidly being depleted in many parts of the world with countries such as India, China and the Middle East ranking high in the list of offenders.

The following examples of where poor water management poses water security risks due to economic activities in various parts of the world include;
Hydraulic fracturing or fracking for shale gas for energy provision, recently used in the United States – a technique being considered in South Africa
Power utilities consuming vast quantities of water in their generation processes – as is also the case with South Africa's coal dependence
Water resource sharing between nations – the WWC positing that more than 260 river basins are shared by two or more countries, which has the potential of triggering transboundary tensions emanating from poor or unfair water management
Poor collaboration between public and private sectors in water projects, resulting in tensions, which in turn deprive local communities of adequate water supply.

According to the United Nations Secretary-General, Ban Ki-moon, "one in three people live in a country with moderate or high water stress and, by 2030, nearly half the global population could face water scarcity, with demand exceeding supply by 40%".

GLOBAL ACCESS TO WATER AND SANITATION

A United Nations handbook: Releasing the Human Rights to Water and Sanitation, states:
"International human rights laws require states to work towards achieving universal access to water and sanitation, led by human rights principles and their defined standards, while giving precedence to those most in need. Hence, the legal content of the human rights to water and sanitation encompasses availability, accessibility, acceptability, affordability and quality."

The World Health Organisation (WHO) and the United Nations International Children's Emergency Funds (Unicef) indicate that progress in drinking water and sanitation had been achieved between 1990-2014 with over two billion people gaining access to improved water sources and 116 countries having met their target for water and sanitation – including South Africa. The report further states that over half of the world's population (almost four billion) now have piped water connected to their homes. Yet, approximately one billion people in the world did not have access to an improved drinking water resource in 2012, as indicated per region;

Sub-Saharan Africa – 325 million
Northern Africa – 13 million
Asia – 361 million
China – 112 million
India – 92 million
Latin America and Caribbean – 36 million
Oceania – 5 million.

CLIMATE CHANGE

Climate is a fundamental driver of the water cycle and determines how much water is available (supply) and how much water is needed (demand). According to the World Bank, climate change adversely affects Third World countries, as they experience water variability, making it more difficult to achieve water security.

The impact of climate change on water availability and water quality drastically affects energy production, infrastructure, human health, agriculture, ecosystems, tourism and recreation, among others. Rising temperatures further increase water demands for humans, animals and plants to ensure healthy survival – thereby accentuating climate change effects and water scarcity.

According to the Environmental Protection Agency (EPA), the number of storms with heavy rainfall, caused by climate change, has risen notably by as much as 20%, compared to 50 years ago. Heavy rainfall problematically increases the volume of runoff into rivers and lakes, washing sediment, nutrients, pollutants, trash, animal waste and other materials into water supplies, making water unusable, unsafe and requiring

treatment. Storm water – together with melting polar ice and snow on mountains – causes sea levels to rise, thus posing a danger to populations settled in coastal regions. Additional dangers include permanent land loss and outbreak of water-borne diseases, among others.

WATER IN AFRICA

According to the WHO and Unicef, most of the world's countries agreed to the Millennium Development Goal (MDG) strategies how to attain high rates of available drinking water and sanitation by 2014. However, of the 45 countries that were unable to meet the MDG targets, most are in sub-Saharan Africa. The report put the population affected by such lack of access to fresh drinking water at 700 million.

Sanitation issues include; open defecation, resulting in human excreta being washed into water resources and these being used without prior purification treatment. The United Nations estimate nearly 1.1 billion people practise open defecation and 82% of them live in the following ten countries: India, Indonesia, Pakistan, Nigeria, Ethiopia, Sudan, Niger, Nepal China and Mozambique. Citing the example of Niger, the population grew by 7.7 million people between 1990 and 2013, but only one million of these people have access to sanitation, as reported by a non-governmental organisation WaterAid. This problem is also of particular concern in informal settlements in South Africa, where overpopulation and lack of sanitation is the norm.

Open defecation is prevalent in the world's poorer countries and causes diseases that can cause death and also ultimately adversely affect the economic growth of the country. The November 2014 UN report on water and sanitation stated that 1.8 billion people use a source of drinking water that is faecal-polluted, posing a severe health risk in the affected regions. Water and Energy Relationship in Africa

Water supply systems depend on energy. Hence, energy shortage poses a great threat to water security. The electricity supply shortage in South Africa during 2007 / 2008 and the present situation since 2014 of power outages continue to impact negatively on secure water supply. A report by Frost & Sullivan, entitled, "Africa Utility Market Intelligence Report", stated that the rising cost of energy could have a major effect on the actual cost of water supply services. The report also recommended that utilities revise their business models to meet the demands for a low-carbon economy. The 2014 UN report indicated that sub-Saharan Africa has huge potential for renewable sources of energy, especially solar and hydropower that require exploitation.

WATER IN SOUTH AFRICA

As will be discussed below, South Africa is considered a water-scarce country and water is forecast to become as problematic in the future as the current electricity supply is experiencing if stringent measures are not taken. The National Development Plan (NDP) and the National Water Resource Strategy 2 (NWRS-2) have prioritised water issues together with those of electricity. South Africa ranks the thirtieth-lowest country in per capita water availability, having 450 mm/y rainfall compared to the global rainfall average of 870 mm/y.

> "... THE DRINKING WATER PROVIDED NATIONALLY IS SAFE FOR HUMAN CONSUMPTION AND DOES NOT POSE POTENTIAL HEALTH THREATS AS MOST ANALYSED DETERMINANTS ARE WITHIN ACCEPTABLE LIMITS ACROSS THE COUNTRY." (DEPARTMENT OF WATER AND SANITATION, 2015)

In addition, geographically and socio-politically, South Africa's water is unevenly distributed and the situation exacerbated by a rapidly growing population, urbanisation and a resultant growing middle class, with higher water, food and electricity demands.

The awareness of the private sector of growing water insecurity in South Africa has been increasing steadily, although remaining low in terms of participation in specific mainstream projects such as the CDP's water programme to enhance corporate water stewardship. There have been notable improvements in the quality of water disclosure; this is important, given that South African companies are relatively more vulnerable to water shortages than their global counterparts. Vast improvements, however, are needed in "assessing water-related risks, the levels of understanding of supply chain risks and the nature of water accounting practices".[3]

As far back as 2006, there was evidence that water quality was being undermined in rural areas in South Africa by; poor performance of councillors and municipal management; poor salaries and working conditions among them; lack of skills among those responsible for "chemical dosing" of water; very few structured training programmes addressing these lacking skills; shortages of finances for equipment and chemicals; and inadequate laboratories and skills for testing. These were worsened further by operational challenges such as; overloaded purification plants; lack of spare parts; long delivery times for purification plant parts; shortages of funding for maintenance; poor supplier relations and minimal cost recovery; lack of constant electricity supply; as well as a lack of community involvement.[4] These led to recommendations for the organisation of expert teams that could support the structures at provincial and local levels; and that lineages with tertiary education and research centres be enhanced to support the system in the long term.

Other critical challenges facing South Africa's water security include; deteriorating infrastructure; declining resource quality; and skills shortages. The skills challenge – in theory – is addressed by NWRS-2 and the Energy and Water Education Training Authority. A Commissioner for the National Planning Commission, an author of the NDP, expressed the view that South Africa should improve water supply by increasing the water mix by using the underutilised water resources such as groundwater, the reuse of water, desalination, rainwater and

[3] CDP (2014). CDP South Africa Water Report 2014.
[4] Offering, G.; Moolman, A. & Msibi, I. (2006). Presentation: Water Quality in Rural South Africa: Problems & Possible Remedies. Presented to the Parliamentary Portfolio Committee, 20 June 2006.
[5] McKenzie, R.S. & Bhagwan, J.N. (1999). Some Recent Developments in Water Demand Management in South Africa. Accessed at: http://www.miya-water.com/user_files/Data_and_Research/miyas _experts_articles/2_NRW/10_Some%20recent%20developments%20in%20water%20demand%20management%20in%20south%20africa.pdf
[6] Muhairwe, W.T. (2013). Barclays Africa Water Utility Workshop. Presentation: Water Utilities Management and Financing. Accessed at: http://www.cesa.co.za/sites/default/files/20141008_Water%20Utilities%20Mngt%20and%20Financing_Dr%20William%20Muhairwe.pdf

fog harvesting. Present water demands include; irrigation, urban, rural, mining, power generation, afforestation and transfers-out. The security of South Africa's water, according to the NWRS, will rest on the more efficient use thereof and on the availability of adequate human and financial resources, coupled with the political will to occasionally make unpopular decisions, ensure fully functioning institutions, and acknowledge that water resources will increase in cost and need to be central to all future planning.

In the 1990s, the rapidly increasing water demands led to a shift away from new water transfer schemes, to an emphasis on water conservation.[5] The potential savings, while recognised for years, only led to the enactment of legislation and little by way of judicious usage. South Africa has lagged the global trend in water demand management as an emphasis.

Desalination, one technological alternative, is thought to have the potential to provide for the growing demands for water in South Africa. However, desalination remains very costly and uses vast amounts of electricity for which current capacity is inadequate. Notably, a seawater desalination feasibility study is being conducted by the City of Cape Town, which could lead to a large-scale desalination plant at some point in future. There are suggestions to commercialise the recycling and treated sewage effluent as successfully done in Namibia and Singapore. Reusing highly-treated municipal sewage effluent is achieved through a process known as indirect potable reuse (IPR). The process involves "treating the sewage effluent to a very high degree by advancing water treatment processes before the purified water is released into a lake or groundwater system used for drinking water supply".

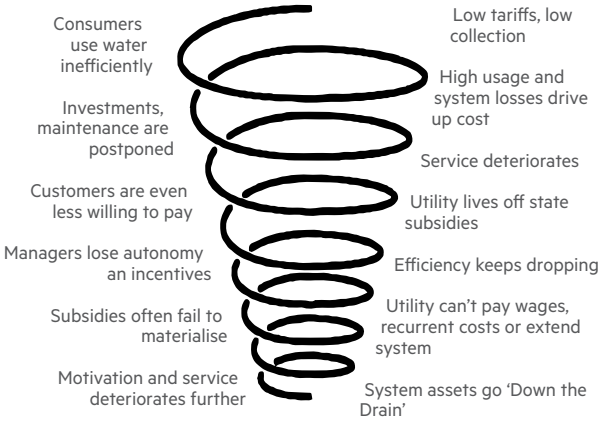
Another sewage treatment method available, called direct potable reuse (DPR), is already being practised in South Africa, the US and Australia. The process involves taking the municipal sewage treatment to a level suitable for drinking and re-depositing it into a drinking water distribution system. The following are some of the reuse IPR/DPR projects in South Africa: IPR of wastewater in Mossel Bay (10 Ml/day) Direct industrial reuse of wastewater in Durban (47Ml/day) Direct potable use in mine water in eMalahleni (50 Ml/day).

PowerTech (2015) set out some of the challenges facing South Africa's water sector as follows;

- Skills shortages
- Water shortage and protests by local communities in several provinces
- The deteriorating water quality of the Hartebeespoort Dam
- in North West and the Vaal River in Gauteng
- On-going acid mine drainage (AMD) in the West and East Rand of Johannesburg, Gauteng
- Lack of funding and investment
- Theft and vandalism of water infrastructure
- Low level of water literacy and awareness among the public
- Deteriorating water infrastructure.

As is the case in many other developing countries, a "spiral of poor performance" affects South Africa's water utilities, whereby the poor delivery of the utility undermines the willingness of the users to pay for the service, which in turn weakens the utilities' financial position and capacity to deliver.[6]

SPIRAL OF POOR PERFORMANCES



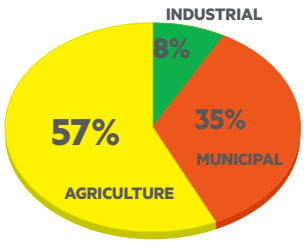
Source: New Designs for water and sanitation trasactions: making private sector participation work for the poor. WSP/PPIAF. 2002

The National Development Plan recognises the constraints on South Africa's water resources and also makes recommendations for the more effective and efficient management of the resource. However, South Africa is said to be "over-exploiting" its freshwater supply, taking insufficient steps to balance future supply and demand, and is at risk of developing a "gap" between the water available for consumption and that required.[7] According to the former Minister of Water and Environment Affairs, Edna Molewa;

> "THE SITUATION CURRENTLY IN SOUTH AFRICA IS THAT WE HAVE 98% OF THE WATER IN THE COUNTRY BEING CONSIDERED "FULLY ALLOCATED". THIS MEANS THAT MY CHILD AND YOUR CHILD THAT IS BEING BORN TOMORROW ONLY HAVE 2% OF WATER FOR USE GOING INTO THE FUTURE."[8]

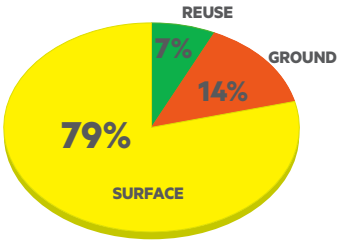
The Institute for Security Studies estimates water demand and supply as follows;

TOTAL CURRENT DEMAND: 15.6KM^3



Source: IFs version 7.0. historical data from NWRS2 (ch.2.p.29

TOTAL CURRENT SUPPLY: 14.6KM^3



Source: IFs version 7.0. historical data from NWRS2 2004 and the FAQ's Aquastat database

[7] Hedden, S. & Cilliers, J. (2014). Parched Prospects: The Emerging Water Crisis in South Africa. Institute for Security Studies.
[8] Molewa, E. (in Hedden & Cilliers, 2013).
[9] DWA (in Hedden & Cilliers, 2014)
[10] Turton, A. (2013). Mean Annual Precipitation Conversion to Mean Annual Runoff – a ratio of converting rainfall to water in rivers and thus economically useful.
[11] Hedden, S. & Cilliers, J. (2014). Parched Prospects: The Emerging Water Crisis in South Africa. Institute for Security Studies.

Whereas current demand is estimated at 15,6 km3, the supply of a mere 14,6 km3 means that a shortfall of 1 km3 or 6,85% of total supply exists already. Not only does that represent over-exploitation, but the fact that as much as 79% of supply is surface supply directly dependent on annual rainfall, and as much as 57% is for agricultural purposes, water supply is both vulnerable and places national food security at risk.
The root of the challenge described by the Department of Water Affairs, is the state of sources of supply, where,

> "OF THE 223 RIVER ECOSYSTEM TYPES IN SOUTH AFRICA, 60% ARE THREATENED AND 25% OF THOSE ARE CRITICALLY ENDANGERED. THE SITUATION WITH THE 792 WETLAND ECOSYSTEMS IS EVEN WORSE."[9]

Exasperating the issue is the supply question of the so-called MAP/MAR Conversion[10], the rainfall versus the resultant runoff that is usable, arising from the rain that ends up in rivers and is accessible for use. Given that the average annual rainfall in South Africa is only 495 mm compared to the world average of 1 033 mm, and the limited rainfall is unevenly distributed, with some regions receiving less than 100 mm of rain in a year on average[11], efficient and sustainable capture and usage thereof is paramount. Africa's MAP/MAP Conversion, for instance, is estimated to be;

> "...20%, BUT THE SADC REGION'S IS ONLY 10%, AND SOUTH AFRICA'S IS EVEN LESS: SPECIFIC RIVER BASINS - LIKE THE ORANGE AND THE LIMPOPO, WHICH ARE THE MOST ECONOMICALLY SIGNIFICANT FOR SOUTH AFRICA - ONLY HAVE A CONVERSION RATIO OF 5%. ...THE SOUTH AFRICAN COMPONENT OF THE ORANGE RIVER BASIN ONLY HAS A 3% CONVERSION RATE".[12]

Alarmingly, irrespective of these constraints, the average per capita water consumption in South Africa is 235 litres per person per day, 26% higher than the world average of only 173 litres per person.[13] This is exasperated by losses incurred through failing infrastructure and leaking taps and pipes. The Water Research Commission estimated in 2012 that a shocking 36,8% of municipal water is lost through physical leakages or commercial losses.[14]

So too, water management and water quality pose challenges in South Africa, where the well documented case of "Acid mine drainage ... is a major risk in the Witwatersrand gold fields and Mpumalanga coal fields".[15]

South Africa, the southernmost member of the SADC community, is in possession of over half of the large dams in sub-Saharan Africa, but estimates the need to invest about R700 billion in the next decade to refurbish the country's water infrastructure and improve supply.[16] Paradoxically, according to Turton, South Africa already has 270% storage for 100% water supply available in rivers, and ought not incur the ecological and economic costs of building more dams. He argued instead for "aquifer recharge", a technology that reduces evaporation to increase runoff to rivers and for storage in underground aquifers in particular – reducing the risks associated with pollutants thriving under warming climate conditions in dams. Turton saw private-public partnerships as a key mechanism for responding to the challenge.

Investment as described above, is likely to require private public partnership to be viable. Due to the constraints affecting African states, private sector investment in infrastructure related to water is crucial, but these depend on; reforms in the sector; improved performance by state-owned utilities; normalisation of tariffs to reflect costs and achieve cost recovery; vastly improved sector planning; unpopular but critical adoption of transparent procurement processes; improved country risk perceptions; and the allocation of project development resources to create "bankable projects".[17]

WATER AND ECONOMIC PERFORMANCE

According to Turton[18], Africa's economic performance today is still "coupled" to rainfall, meaning that the performance of the continent tracks that of climate rainfall. Naturally, that represents considerable risk to a continent with low levels of development and high levels of poverty. Turton argued that these must be "decoupled" for Africa to break away from climate dependence. Although South Africa, he observed, had succeeded through industrialisation and economic diversification, to decouple, the poor maintenance of water infrastructure was putting the country at risk of sliding back to a rainfall dependent state, as neighbouring Zimbabwe has in recent years. Already, he observed, in the mining sector, water is considered the single biggest non-mining risk affecting the industry. In this vein, water security is not merely a concern for existing businesses, but a prerequisite for the business confidence[19] required to invest in long-term ventures that create jobs and grow the economy. Water insecurity, therefore, is a limiting factor for economic progress.

While water supply problems continue to exist across much of SADC, South Africa has enjoyed a number of decades of consistent supply to a narrow segment of the population. While water distribution has been extended rapidly, increasingly breakdowns of established supply systems are affecting private and industrial / bulk consumers. With high projections for urbanisation, the supply both in terms of quantity as well as quality and consistency of supply are projected to face a crisis. Successful handling of water requires sophisticated integrated thinking, including massive water supply projects such as dams, pipelines, etc. that depend on reliable water sources, as well as planning for the transportation, processing, treatment and consumption of the water, and in addition the processing of used water.

Options exist for independent water provision such as through desalination, but these projects are costly and require investment.

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[12] Turton, A. (in Gibbons, 2013). The Biggest Risk in Business. Acumen.
[13] Hedden, S. & Cilliers, J. (2014). Parched Prospects: The Emerging Water Crisis in South Africa. Institute for Security Studies.
[14] Hedden, S. & Cilliers, J. (2014). Parched Prospects: The Emerging Water Crisis in South Africa. Institute for Security Studies.
[15] Hedden, S. & Cilliers, J. (2014). Parched Prospects: The Emerging Water Crisis in South Africa. Institute for Security Studies.
[16] Turton, A. (in Gibbons, 2013). The Biggest Risk in Business. Acumen.

Hartebeespoortdam South Africa

POLICY PERSPECTIVE: WATER SECURITY IN RSA AND SADC

The primary focus of this section of the paper will be on the policy discussions and thinking around water management and planning, as espoused by the Republic of South Africa's government primarily and South African Development Community (SADC) partners more generally. Yet, before examining key policies around the matter of water planning, an overview of the situation is required. Following this introduction, an overview of the period 2011 to 2012 is presented with the aim of illustrating how dynamic water planning has become as a policy subject in SA of late. This is followed by a chronological examination of primary and selected SA water policies, which have influenced or necessitated new thinking around water planning in the country and region.

GOVERNMENT OVERVIEW

This overview illustrates how rapidly occurring events have come to characterise adaptations in water planning and thinking, in South Africa and internationally in recent years.

AUGUST 2011: Human Settlements Minister Tokyo Sexwale reveals that 86443 households in 51 municipalities across South Africa still use the bucket toilet system.	**SEPTEMBER 2011:** The United Nations Human Rights Council passes a resolution calling on member states to ensure enough financing for the sustainable delivery of water and sanitation services.
OCTOBER 2011: The City of Cape Town issues a tender for a feasibility study into a seawater desalination plant for the city.	**NOVEMBER 2011:** South Africa's largest seawater desalination plant is opened in Mossel Bay.
DECEMBER 2011: The Southern African Development Community unveils its climate change adaptation plan for the water sector.	**DECEMBER 2011:** The Department of Water Affairs initiates a study to assess longer-term solutions for South Africa's acid mine drainage problem.
JANUARY 2012: The Trans-Caledon Tunnel Authority announces it is making progress in implementing emergency near-term projects to tackle acid mine drainage.	**FEBRUARY 2012:** The Carbon Disclosure Project's Water Disclosure South Africa Report indicates that South Africa will experience a 17% gap between water demand and supply by 2030, unless urgent action is taken.
FEBRUARY 2012: Lawyers for Human Rights claim in a letter to then Water and Environmental Affairs Minister Edna Molewa that 84 mines are known to be operating without a valid water licence.	**MARCH 2012:** Then Water and Environmental Affairs Minister Edna Molewa announces that the South African government hopes to attract about R25-billion in water infrastructure funding from foreign investors.
MARCH 2012: The World Health Organisation and the United Nations Children's Fund announce that the Millennium Development Goal of halving the number of people without access to clean water was met in 2010– five years ahead of the 2015 deadline	**APRIL 2012:** The Water Resources Council inaugurates the 'Water Resources of South Africa 2012' study.
MAY 2012: The planned publication date for the Green Drop progress report for 2012.	

Source: Creamer[20]

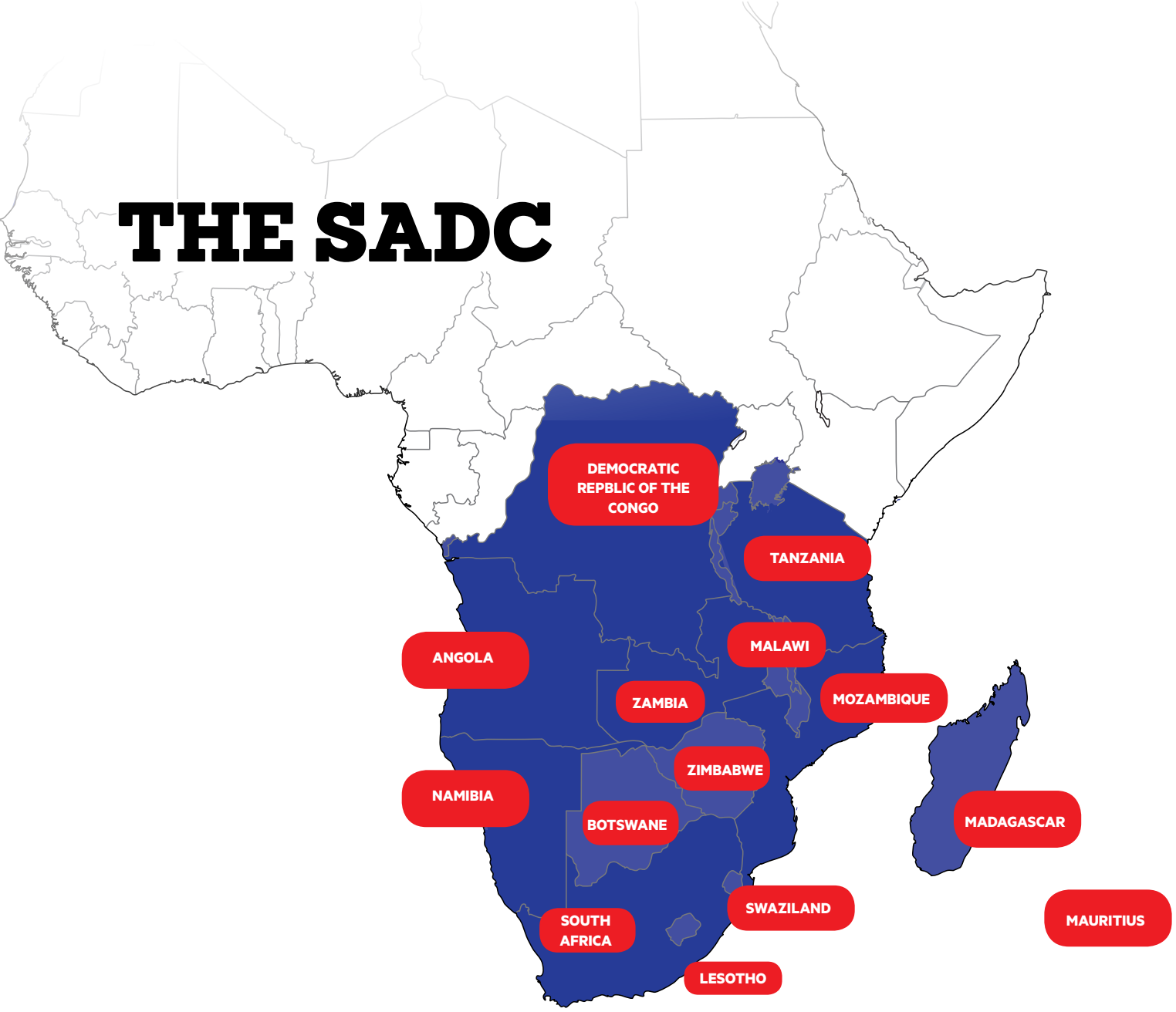
[17] Muhairwe, W.T. (2013). Barclays Africa Water Utility Workshop. Presentation: Water Utilities Management and Financing. Accessed at: http://www.cesa.co.za/sites/default/files/20141008_Water%20Utilities%20Mngt%20and%20Financing_Dr%20William%20Muhairwe.pdf

[18] Gibbons, C. (2013). The Biggest Risk in Business. Acumen.

[19] Jackson, J. (in Gibbons, 2013). The Biggest Risk in Business. Acumen.

[20] Creamer Media. 2012. Water Report. May. The material contained in this report was compiled by Martin Zhuwakinyu and the Research Unit of Creamer Media (Pty) Ltd, Johannesburg, South Africa.

THE SADC



OVERVIEW

SADC as a region or conglomeration of self-governing and individual sovereign States has been challenged to reconsider its water planning more recently, due in part to environmental and socio-economic developmental factors affecting the issue in the region[21]. The SADC states (Angola, Democratic Republic of the Congo, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe) have to plan collectively around the water challenge through international and supranational forums, whilst maintaining separate approaches accommodative of each other's sovereignty.

Some of the key challenges facing SADC in relation to water thinking and planning, have been the region's susceptibility to fluctuating environmental conditions. For instance, unfriendly environmental conditions within SADC, "which manifest...in both droughts and floods" have been forecast by the Intergovernmental Panel on Climate Change as follows; "...temperatures in Southern Africa have risen...the region will become hotter and drier...in the next 50 to 100 years, with reduced rainfall projected in the winter months" (2012:7)[22]. It is these scientific and environmental dangers that have necessitated that the twelve SADC states not only approach water planning individually, but also collectively and with a long-term perspective.

It is for this reason that the SADC regional strategy proposes;

This strategy goes on to argue for the need to develop infrastructure projects like water-storage facilities and to improve water supply and sanitation more generally[24].

The goal of this water thinking and planning is to assist the 98 million SADC citizens who lack access to safe water, plus ensuring that those one 154 million citizens without sanitation[25] may experience the benefits of proper water planning and provisioning. This context sets the scene for analysing the various policy developments that have characterised and informed the South African government's policy positions.

[21] Msangi, J.P. (2014). Managing Water Scarcity in Southern Africa: Policy and Strategies. Chapter 2. Combating Water Scarcity in Southern Africa, Springer Briefs in Environmental Science.
[22] Creamer Media. (2012). Water Report. May. The material contained in this report was compiled by Martin Zhuwakinyu and the Research Unit of Creamer Media (Pty) Ltd, Johannesburg, South Africa.
[23] Creamer Media. (2012). Water Report. May. The material contained in this report was compiled by Martin Zhuwakinyu and the Research Unit of Creamer Media (Pty) Ltd, Johannesburg, South Africa.
[24] Msangi, J.P. (2014). Managing Water Scarcity in Southern Africa: Policy and Strategies. Chapter 2. Combating Water Scarcity in Southern Africa, Springer Briefs in Environmental Science.
[25] Creamer Media. (2012). Water Report. May. The material contained in this report was compiled by Martin Zhuwakinyu and the Research Unit of Creamer Media (Pty) Ltd, Johannesburg, South Africa.
[26] Department of Water Affairs and Forestry (DWAF). 1994. Water Supply and Sanitation Policy: Water an indivisible national asset. White Paper.
[27] Department of Water Affairs and Forestry (DWAF). 1994. Water Supply and Sanitation Policy: Water an indivisible national asset. White Paper.

> "…A 20-YEAR PLAN TO INTEGRATE WATER RESOURCES MANAGEMENT ALSO CALLS FOR MECHANISMS TO MOBILISE FINANCIAL RESOURCES. IT POINTS TO THE FACT THAT, BY DECEMBER 2010, ONLY $46.64-MILLION HAD BEEN CHANNELLED THROUGH BILATERAL AND MULTILATERAL FUNDING MECHANISMS TO SUPPORT CLIMATE CHANGE ADAPTATION IN AFRICA"(2012:7)[23].

WATER POLICY IN SOUTH AFRICA

Three key points of departure and subsequent policy discourses are taking place in South Africa under the auspices of the Department of Water and Environmental Affairs (DWAF). Firstly, the operationalisation of water to citizens is approached using both national and local government institutions. Secondly, the issue of water provision within the South African context carries constitutional and historically informed nuances and considerations. Finally, water security policy in South Africa has to date, been developed taking into consideration SADC discourses and debates.

Policy responses to the above situation and challenges
The RSA government has been guided primarily by the White Paper on Water Supply and Sanitation of 1994, the Water Services Act (No 108 of 1997) and the National Water Act (NWA) of 1998 in relation to water and sanitation. However, other legislation, guidelines and policies have also been developed.

Department of Water Affairs and Forestry (DWAF), Water Supply and Sanitation Policy (White Paper); Water an indivisible national asset Republic of South Africa, 1994
One of the first policy decisions taken by the post-1994 government (Department of Water Affairs and Forestry), was to set up a Strategic Management Team (SMT) to advise the Minister and also a Chief Directorate of Community Water Supply and Sanitation. This Directorate was entrusted with, (a) assuring the effective ongoing operation of potable water supply systems for which the DWAF is responsible; (b) planning the expansion of services in collaboration with the provincial governments and in keeping with the policies outlined in this White Paper; (c) promoting such investments as may be necessary to achieve the expansion of services; (d) developing the organisations needed at both local and regional level to achieve the goals of the Government of National Unity as expressed in the Reconstruction and Development Programme; and (e) monitoring and regulating water supply and sanitation activities in accordance with the Constitution[26].
To ensure that these goals are achieved, the DWAF established eight key policy principles to guide how it would provide and develop its approach to water. Certain of these policy principles explained that;
(1) Development should be demand driven and community based – that decision-making and control will be devolved as far as possible to accountable local structures
(2) Basic services are a human right and do not imply the right of an individual person or community to demand services at the expense of others
(3) Equitable regional allocation of development resources be sought – key matters arising from this being population size and levels of development
(4) Water has economic value – the way in which water and sanitation services are provided must reflect the growing scarcity of good quality water in South Africa
(5) The "user pays" principle be employed – this being a central principle to ensure sustainable and equitable development
(6) Integrated development be undertaken – that water and sanitation development are not possible in isolation from development in other sectors[27].

WHO DOES WHAT? (POLICY IMPLEMENTATION)

The White paper of 1994 was also able to explain in great detail that the responsibility of water and its provisioning needed to be administered in a sequential and orderly manner. It explained that,
"Provincial Governments clearly share the responsibility for assuring service provision, specifically through the promotion of effective local government. In this context, the need for close collaboration between provincial and central agencies is clear. While Central Government may be responsible for assuring essential functions where local structures are unable to do so, this has to be done in such a way as to support the development of Local Government to proceed with its own affairs under provincial supervision" (1994:10)[28].

Therefore, to ensure that this dual responsibility of water provision and development is adhered to, the White Paper of 1994 argued for the establishment of Provincial Water Liaison Committees. It was expected that these Committees would; (a) connect with the Department and (b) direct operations linked to operationalising the Reconstruction and Development Programme as it relates to water supply and sanitation.

OTHER NOTABLE CONSIDERATIONS

PRIVATE SECTOR

The White Paper of 1994 also outlined the role the private sector would play in resource (water) provision and development in some instances. The DWAF had hoped or planned to lean on the private sector for (a) capital investment; (b) operation and maintenance; (c) training and capacity building; (d) organisation development; and (e) financing and commercial services[29]. While this segment of the paper does find it interesting and indeed notable that the private sector was seen as a key role player by the White Paper of 1994 and the DWAF, it should be noted that this reliance hinged on non-governmental organisations also playing some role.

[28] Department of Water Affairs and Forestry (DWAF). 1994. Water Supply and Sanitation Policy: Water an indivisible national asset. White Paper.
[29] Department of Water Affairs and Forestry (DWAF). 1994. Water Supply and Sanitation Policy: Water an indivisible national asset. White Paper.
[30] Department of Water Affairs and Forestry (DWAF). 1994. Water Supply and Sanitation Policy: Water an indivisible national asset. White Paper.
[31] Department of Water Affairs and Forestry (DWAF). (1994). Water Supply and Sanitation Policy: Water an indivisible national asset. White Paper.
[32] Department of Water Affairs and Forestry (DWAF). (1997). Regulations relating to compulsory national standards and measures to conserve water. Water Services Act 108 of 1997.

SADC

Furthermore, the DWAF and White Paper also encouraged the international community to assist its policy and developmental goals, through technology transfers and other such means. However, one of the key commitments the White Paper and the DWAF outlined in 1994 was that RSA was obligated to, or should try assisting neighbouring states in part because of their assistance during the Apartheid periods and assist in their socioeconomic development. The White Paper outlined key areas in which RSA could assist its neighbours, namely; (1) Policy development; (2) the exchange of experience, skills and expertise; (3) technology exchange; (4) information; (5) training materials and resources; and (6) research, and many other possible contributions[30].

BOARDS

Importantly, the White Paper states that, "Water Boards will be considered as the primary agent of the Department of Water Affairs and Forestry in the development of water supply and sanitation services at regional level. Water Boards will continue to function as non-profit parastatal autonomous utilities as described in the Water Act of 1956, under the authority of the Minister of Water Affairs and Forestry"(1994:24)[31].

THE WATER SERVICES ACT 1997 (WSA)

The WSA can be said to operate according to three key tenants. These tenants speak to the rights and duties of (1) consumers and end users, who have a constitutional right to receive water and related water services, but who also have a duty to ensure that such water is not wasted or polluted; (2) local government structures, called water services authorities, who are responsible for the provision of water services to the water services providers; and (3) water services providers who provide the water and related water services to the consumer and end user[32].

An additional point to note from the WSA is its inclusion of grey water, as a matter needing to be addressed. Grey water, which is understood differently across the world, can simply be understood to mean, "the wastewater generated from household uses like bathing and washing clothes. ... distinguished from more heavily contaminated "black water" from toilets [often] combined with black water in a single domestic wastewater stream" (2010:5)[33]. The inclusion of the issue of grey water in the WSA indicated the need to begin addressing growing concerns with water management within the development discourse of South Africa.

THE NATIONAL WATER ACT (1998)

The NWA 1998 introduced two key points to the debate or position on water in South Africa. Firstly, the 1998 Act laid out eleven reasons for water usage. It explained that water use includes; (1) taking water from a water resource; (2) storing of water; (3) impeding or diverting the flow of water in a watercourse; (4) engaging in stream flow reduction activities; (5) engaging in controlled activities; (6) discharging of waste water containing waste; (7) disposing of waste in a manner that may detrimentally impact on a water resource; (8) disposing of heated or waste water; (9) altering the bed, banks, course or characteristics of a water course; (10) removal of underground water; and (11) using water for recreational purposes.[34]

Yet, importantly the NWA 1998, though encouraging these eleven areas, made it very clear that a license / authorisation regime ought to guide such activities. While the eleven forms of usage were termed as rights society enjoys in terms of water usage, the DWAF is compelled to consider additional points of licensing and authorisation by the NWA 1998. These points were set out as; (a) basic human needs of present and future generations; (b) the need for equitable access to water; (c) redressing the results of past racial and gender discrimination; (d) promoting the efficient, sustainable and beneficial use of water in the public interest; (e) facilitating social and economic development; (f) providing for growing demand for water use; (g) protecting aquatic and associated ecosystems and their biological diversity; (h) reducing and preventing pollution and degradation of water resources; (i) meeting international obligations; (j) promoting dam safety; and (k) managing exposure to, and effects of, floods and droughts. These considerations were set out as the compliance framework within which government would be able to permit water usage[35].

WATER-USE LICENSING: THE POLICY AND PROCEDURE FOR LICENSING STREAM FLOW REDUCTION ACTIVITIES 1999

This policy, as derived from the National Water Act (Act no. 36 of 1998), explains that stream flow reduction activities (SFRAs) require licensing (Section 36). SFRAs is;

> "... ANY ACTIVITY (INCLUDING THE CULTIVATION OF ANY PARTICULAR CROP OR OTHER VEGETATION)... [THAT]... IS LIKELY TO REDUCE THE AVAILABILITY OF WATER IN A WATERCOURSE TO THE RESERVE, TO MEET INTERNATIONAL OBLIGATIONS, OR TO OTHER WATER USERS SIGNIFICANTLY" (1998:36)[36].

The interpretation of SFRA is limited to land-based activities here (Chapter 4 Part 4 of the NWA).

However, only commercial plantation forestry was identified in the Act as an SFRA, others could be included later on. The Department set up a commission to research and clarify the practical interpretation of Section 36 of the Act, and to identify activities other than commercial forestry for declaration as SFRAs.

It is important to note that the paper set out the policy and procedure for the licensing of land uses that have the impact of reducing stream flow. The approach adopted was based on the fact that within any one water management area as defined in the Act, SFRAs are among several kinds of water use that must be treated fairly in the process of allocating and licensing water use. This particular consideration is critical not only to industrial usage of water in different business or commercial sectors, but also for South African citizens, especially those in

[33] Christian-Smith, A.L. & Palaniappan, M. (2010). Overview of Greywater Reuse: The Potential of Greywater Systems to Aid Sustainable Water Management. November. Pacific Institute.
[34] Department of Water Affairs and Forestry (DWAF). (1998) . National Water Act, Act No 36. August.
[35] Department of Water Affairs and Forestry (DWAF). (1998) . National Water Act, Act No 36. August.
[36] Department of Water Affairs and Forestry (DWAF). (1998) . National Water Act, Act No 36. August.
[37] Offering, G.; Moolman, A. & Msibi, I. (2006). Presentation: Water Quality in Rural South Africa: Problems & Possible Remedies. Presented to the Parliamentary Portfolio Committee, 20 June 2006.

> “ONE OF THE KEY CONSIDERATIONS WATER POLICY MUST ADDRESS IS HOW TO DEAL WITH AREAS WHERE WATER DISTRIBUTION TO TAPS IS NOT YET WIDESPREAD.”

rural areas. Notably, there remains a discrepancy between the urban water quality, which has enjoyed a reputation as being among the best in the world, versus rural water quality, which is often poor.[37]

Policy and Strategy for Groundwater Quality Management in South Africa 2000 (GQM)

One of the key considerations water policy must address is how to deal with areas where water distribution to taps is not yet widespread. In attempting to address this problem, the DWAF formulated and enacted the 2000 Groundwater Quality Management policy. Key to this policy’s existence was the statement that,

“traditionally, groundwater has been the only source of water supply in most of South Africa’s rural areas, making up about 65% of our total supply... In a country where eight million people do not have adequate access to a potable water supply – a basic need of the highest priority – groundwater will, in many cases, be the most cost-effective source” (2000:3)[38].
For this reason, the policy rightly ought to be considered one of South Africa’s key policies for both individual citizens and South African commercial interests.

The GQM was concerned with attempting to address the matter of groundwater access and its quality for future usage in three ways. Firstly, it sought to define and explain the functional strategies (Sections 4, 5 and 6) concerned with ground water quality. Secondly, ground water management was addressed by organising institutions to gain access to ground water (Section 7). Finally, the policy sought to clarify matters pertaining to how to implement its strategy (Section 8). In recognising that groundwater is a precious commodity, policies such as these took the approach of seeking to ensure that society and government know what is and is not acceptable for groundwater usage and related development.

This approach to water management and development in general led to an interest in how water usage should be guided for older sectors and newer ones. One such sector was notably the agricultural sector.

Guideline for Authorising the Use of Water for Aquaculture
It is important to note changes in water usage as the world economy has progressed or evolved. One such example is the creation of new industries such as aquaculture. The DWAF explains this industry as being concerned with “the propagation, improvement, trade or rearing of aquatic organisms (plant and animal) in controlled or selected aquatic environments (fresh, sea or brackish waters) for any commercial, subsistence, recreational or other public or private purpose”[39].

While no standalone policy exists for water usage within this sector, what is in place though is a document termed ‘Guideline for Authorising the Use of Water for Aquaculture 2007’. This document needs to be understood as a guiding document for how aquaculture operates. There is a recognition that more work is needed in this sector.

THE NATIONAL DEVELOPMENT PLAN 2030 AND NATIONAL RESOURCE STRATEGY 2013.

The NWRS 2013 (NWRS2) is the second edition of the National Water Resource Strategy (NWRS1), originally formulated in 2004 as a plan for water resource management and the requirement of the 1998 National Water Act, providing data of present and future availability of and requirements for water in each of the then 19 water management areas leading up to 2025.[40] It outlines a strategy of the NDP’s targets[41];

- 100% of citizens to have access to clean running water in homes by 2030
- RSA to achieve a food trade surplus.
- RSA should produce sufficient energy
- A 33% increase in the area of land currently under irrigation.

The NWRS strategy has been based on a “high future requirements scenario”, taking into account the normal huge variability in South Africa’s climate and climate change, and “could be delayed if necessary”, but would be “very difficult to bring forward”, should the demand increase more than expected.[42]

PRELIMINARY CONCLUSIONS ON POLICY

While acknowledging the development of newer policies by the South African government, such as the National Development Plan, it is critical to note that the water policy in South Africa still draws very heavily on the pre-2000 policy positions of the DWAF. These policies have developed in line with some of the most pressing water related developments such as grey water research, dam storage concerns and other environment considerations.

Yet, this fine balancing act aiming to guarantee citizens access to high quality water, while trying to economise a finite resource, is increasingly under severe pressure as most government departments and independent research confirm. The governing of water will now and in future require more strategic and stringent policy thinking and implementation or risk seeing SADC and South Africa transverse the treacherous prospect of extreme scarcities or waterlessness. This appropriately brings us to a consideration of water from the perspective of sustainability.

[38] Department of Water Affairs and Forestry (DWAF). (2000). Policy and Strategy for Groundwater Quality Management in South Africa. Pretoria.
[39] Department of Water Affairs and Forestry (DWAF). (2007). Guideline for Authorising the Use of Water for Aquaculture .Pretoria.
[40] Hedden, S. & Cilliers, J. (2014). Parched Prospects: The Emerging Water Crisis in South Africa. Institute for Security Studies.
[41] Hedden, S. & Cilliers, J. (2014). Parched Prospects: The Emerging Water Crisis in South Africa. Institute for Security Studies.
[42] NWRS (2012) Presentation: Water Security - NWRS Workshops. Directorate: national Water Resource Planning. Accessed at:

A GLOBAL SUSTAINABILITY PERSPECTIVE ON WATER

Water is a fundamental aspect of sustainable development, which has been captured in the new UN Sustainable Development Goal to "ensure availability and sustainable management of water and sanitation for all" (Goal 6). At present, municipalities account for 12% of total freshwater withdrawal globally and industries for 19%, while agriculture takes up the remaining 69%, mostly through irrigation.

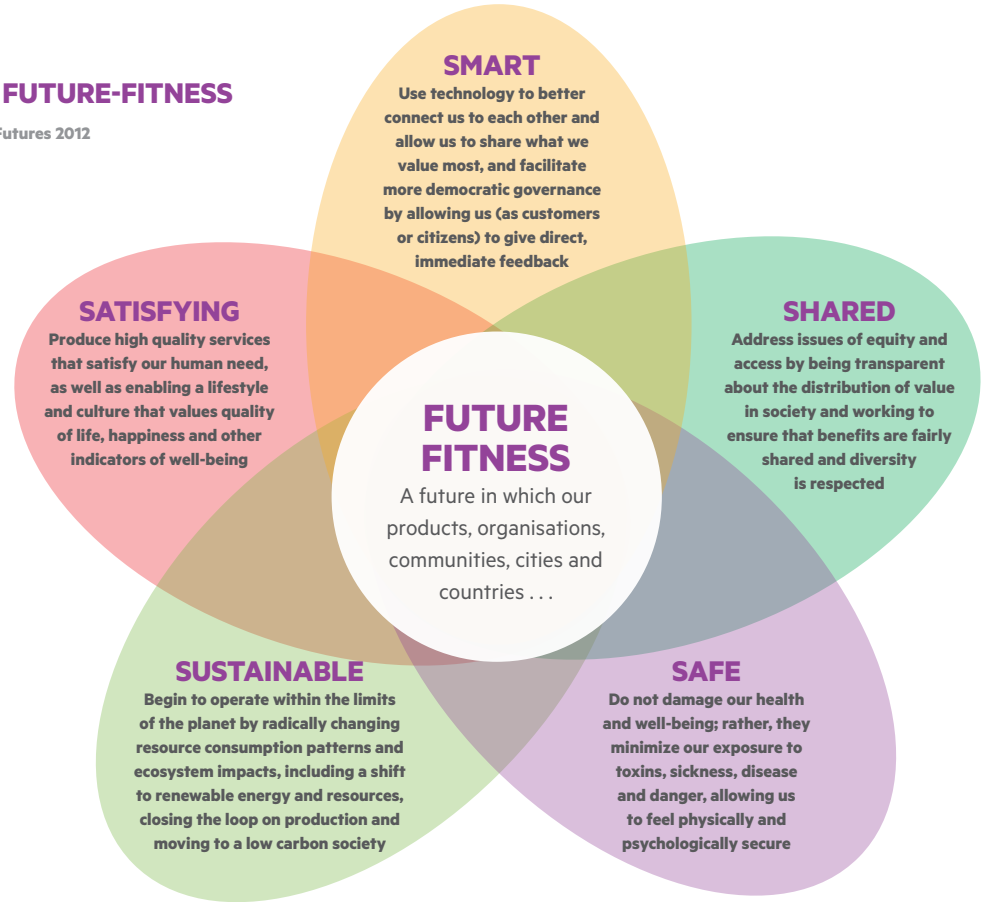
As with so many sustainability issues, water cuts across all five of the UN SDGs five critical areas (prosperity, people, planet, peace, partnership) and is linked to all 16 of the other SDGs. The SDG goal for water builds on significant achievements made under the UN Millennium Development Goals for water and sanitation[43]:

- 1.9 billion more people have gained access to piped drinking water, from 2.3 billion in 1990 to 4.2 billion in 2015
- In 2015, 91% of people use an improved drinking water source, compared to 76% in 1990
- Of the 2.6 billion people who have gained access to improved drinking water since 1990, 1.9 billion gained access to piped drinking water on premises
- Globally, 147 countries have met the MDG drinking water target, 95 countries have met the MDG sanitation target and 77 countries have met both.

The percentage of sub-Saharan Africans using an improved drinking water source (i.e. piped water) improved from 48% (1990) to 68% (2015). This falls short of the MDG (which was to halve the number of people not using an improved drinking water source, i.e. to move from 48% to 74%), but still reflects a positive 20% shift. Nearly half of the world's population still using unimproved water sources are living in sub-Saharan Africa.[44]

THE 5 S'S OF FUTURE-FITNESS

Source: Kaleidoscope Futures 2012



[43] UN (2015) Millennium Development Goals Report (2015). p.7.
[44] UN (2015) Millennium Development Goals Report (2015). p.58.
[45] Kings, S. et al. (2015). South Africa's great thirst has begun, Mail & Guardian, 23 January.
[46] Crowley, K. (2015). Water shortages loom for SA: worst drought in two decades, BizNews, 20 May.
[47] Turpie, J. (2010). Wastewater treatment by wetlands, South Africa. The Economics of Ecosystems and Biodiversity (TEEB).
[48] Pearce, F. (2006). When the Rivers Run Dry: What Happens When Our Water Runs Out? London: Eden Project Books.

A SUSTAINABLE WATER FUTURE FOR SOUTH AFRICA

A sustainable water future for South Africa is one in which the water cycle of nature is not compromised. This relates strongly to the UN SDG 6.6 to, "by 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers".

In South Africa, according to the Department of Water Affairs' National Water Resource Strategy 2013, water ecosystems are not in a healthy state. Of the 233 river ecosystem types, 60% are threatened, with 25% of these critically endangered. Of 792 wetland ecosystems, 65% have been identified as threatened, and 48% as critically endangered.[45] South Africa is the 30th-driest nation on Earth, according to the government, which expects water demand to outstrip supply as early as 2025.[46]

Increasingly, however, the economic value of water-based ecosystems is being recognised. For example, one study calculated the value of the Fynbos Ecosystem of the Western Cape's wetlands' service as US$12,385 per hectare per year, high enough to compete with alternative land uses.[47]
To determine what this means in practice, the following three principles can be applied: water must be renewable, reusable and recyclable.

RENEWABLE WATER

Renewable water refers to surface water, which falls as rain and is abstracted from rivers, lakes and dams. According to the Department of Water Affairs, South Africa currently uses about 10 200 million m3 of water per year from its major dams. This amount is about 20% of the total mean runoff volume of water South Africa receives a year. Evaporation accounts for a very high 8% loss of stored water resources (the hot climate contributes to this, as well as the large surface areas of many dams), and a further 6% is lost through various land-use activities. Most water consumption can be attributed to drinking, irrigation, electricity, mining processes and industrial processes.

Underground water, stored in aquifers is essentially non-renewable. Globally, it is estimated that only a tenth of one percent (0.1%) of the fresh water in the world's aquifers is replaced each year by rains.[48] Put another way, if they are drained through human extraction, they would take a thousand years to be replenished. Underground water, therefore, should be regarded as a non-renewable resource, like fossil fuels or minerals.

India, China and Pakistan account for more than half of the world's total use of underground water for agriculture, exceeding natural recharging of their acquifers by 150-200 cubic kilometres a year. Fred Pearce, in When the Rivers Run Dry, concludes that "they are living on borrowed time, sucking dry the continent's water reserves ... The boom has so far lasted twenty years; the bust could be less than twenty years away."[49]
Two-thirds of South Africa's surface area depends largely on underground water, although in total this only contributes 13% to bulk water supply. This is largely used to meet rural needs and represents between 52% and 82% of community water-supply schemes in the Eastern Cape, Limpopo, Northern Cape, North West and KwaZulu-Natal. It is estimated that about 6 billion m3 a year of underground water can be developed economically. However, further exploitation of underground water should be treated as an unsustainable long-term strategy.

REUSABLE WATER

Reusable water refers to the practice of using water, without treatment, more than once and for multiple purposes. At the most basic level, irrigation reuses water that has already been used by the ecosystem. Analysis of Africa's irrigation needs demonstrates an attractive internal rate of return, ranging from 12% in central Africa for large-scale irrigation to 33% for small-scale irrigation in the Sahel.[50]

Besides irrigation, water can be abstracted from a stream and re-used several times in a factory process; or water from a domestic bath or shower can be reused to water the lawn. There are massive lost opportunities for water reuse, especially by business and households. The most obvious is the practice of rainwater harvesting. One study in Canada estimated that the installation of rainwater harvesting tanks could offset mains water use by between 13 to 47%.[51]

In South Africa, it costs R4-R5 to treat a kilolitre of water to drinking standards, but this costly water is being used for watering gardens and flushing toilets. If average household water consumption was cut by up to 20% – for example by using grey water for gardens and toilets – this would help to build the 8-10-year water reserve needed to avoid future water cuts.[52]

RECYCLED WATER

Recycled water refers to the practice of treating water before reusing it. An example is Mars Petcare that has developed a recirculation system that reduces by 95% the potable water used for cooling in its pet food production process. Wastewater is also down by 95% and gas by 35% through the use of a treatment method that keeps the water microbiologically stable. In Brazil, water used in sugar cane processing has been reduced from 5.6 to 1.83 cubic metres (m3) per tonne in recent years, due to improved technologies and practices in wastewater treatment.[53]

In South Africa, Anglo American is pioneering in this space, with the construction and operation of the eMalahleni Water Reclamation Plant, whereby water is purified to potable quality by reverse osmosis – the only mining initiative to be endorsed by the United Nations Framework Convention on Climate Change (UNFCCC) Momentum for Change Initiative at COP 17 in 2011. To date, the eMalahleni Water Reclamation Plant has treated in excess of 70 billion litres of water, 50 billion of which have been sent to the municipality (meeting around 12% of the water-stressed local municipality's water requirements) with the rest reused within Anglo American's coal operations.[54]
Another example is Ikusasa Chemicals, which is supported by the Industrial Development Corporation. The company works in the fields of water purification and desalination, essentially using membrane ultra-filtration (UF) to turn dirty, undrinkable water into potable water for rural regions. It also has a desalination plant in Sedgefield, on the Western Cape's Garden Route.[55] Globally, BASF is a significant player offering water

[49] Pearce, F. (2006). When the Rivers Run Dry: What Happens When Our Water Runs Out? London: Eden Project Books, p.79.
[50] WWAP (United Nations World Water Assessment Programme) (2015). The United Nations World Water Development Report (2015): Water for a Sustainable World. Paris, UNESCO, p.37.
[51] Farahbakhsh, K.; Despins, C. & Leidl, C. (2009). Developing Capacity for Large-Scale Rainwater Harvesting in Canada. Water Quality Research Journal, 44(1), pp. 92-102.
[52] Mathews, C. (2015). SA's water crisis is already here, warn engineers, Business Day BdayLive, 27 July.
[53] Visser, W. (2014). Meeting water and energy challenges in the agri-food sector with technology, The Guardian, 13 August.
[54] Anglo American (2015). Anglo American Demonstrates a Solution to the Looming Water Crisis in South Africa, 26 August.

purification and desalination technologies. South Africa's desalination plant, constructed by Veolia Water Solutions & Technologies, supplies 10 megalitres of potable water to the Mossel Bay Municipality, and 5 megalitres of processed water to PetroSA. The South African government estimates that by 2030, desalination plants could provide up to 10% of SA's urban water supply. According to a Cape Town desalination plant feasibility study, a 450-megalitre a day desalination plan would cost R16.5 billion and would cost R1.2 billion a year to operate, but could meet 22% of the city's water needs.[56]

A SAFE WATER FUTURE

A safe water future for South Africa is one in which the water is not contaminated by human or industrial pollution and therefore has no deleterious impacts on the health of humans, other species or the ecosystems on which we depend for life. The first cause of unsafe water is inadequate sanitation. This relates to SDG 6.2 to, "by 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations".

This is to address the finding by the WHO and the Unicef Joint Monitoring Programme (JMP) for Water Supply and Sanitation that 1.8 billion people are using a source of drinking water that is faecally (TBC)-contaminated.[57] Investments in water and sanitation services result in substantial economic gains; in developing regions, the return on investment has been estimated at US$5 to US$28 per dollar. An estimated US$53 billion a year over a five-year period would be needed to achieve universal coverage – a small sum, given that this amount represented less than 0.1% of the 2010 global GDP.[58]

The second cause of unsafe water is industrial pollution. The cost to the global economy of chemical pollution – much of which makes its way into the world's water systems – has been estimated at $546bn. This is projected to rise to $1.9tn by 2050, or 1.2% of global GDP.[59] This relates to SDG 6.3 to, "by 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally". Apart from effective policies and pricing to regulate effluent water quality, a shift to green chemicals can be expected in future. One research report suggests that the green chemicals market will grow from $2.8 billion in 2011 to $98.5 billion by 2020 and will save the industry $65.5 billion through direct cost savings and avoided liability for environmental and social impacts. Others are even more bullish, predicting growth in the bio-based chemicals market from $78 billion in 2012 to $198 billion by 2017, eventually accounting for 50% of the chemicals market by 2050.[60]

Incabex is a South African company that has led the introduction of green chemicals through the environmentally-friendly Betona process for cleaning and coating steel. They have calculated that a facility treating 100 000 tonnes of steel per annum could expect to see annual reductions in energy consumption (1 MW h), water consumption (45 000 cubic metres), raw material loss (3 000 tonnes), hazardous waste (1 000 tonnes) and wastewater (50 000 cubic metres).

A SHARED WATER FUTURE

A shared water future for South Africa is one in which water is distributed equitably. This relates to SDG 6.1 to, "by 2030, achieve universal and equitable access to safe and affordable drinking water for all". Currently, only 5% of Africa's potential water resources are developed and average per capita storage is 200 m3 (compared to 6000 m3 in North America). Only 5% of Africa's cultivated land is irrigated and less than 10% of hydropower potential is utilised for electricity generation.61 Financing is key for closing the water equity gap. Since 2010, the WaterCredit initiative in Kenya and Uganda has empowered almost 115 000 people to obtain financing from seven financial institutions (FIs) for long-term, sustainable water and sanitation solutions.62

Making water accessible and affordable, especially to the poor or disadvantaged groups in South Africa, is primarily the responsibility of government. However, there are also entrepreneurial solutions that can help. One celebrated example is the Hippo Roller for transporting water in underserved areas. Approximately 44 000 Hippo Water Rollers have been distributed mostly in South Africa and at least 20 other African countries, directly benefitting in excess of 300 000 people. To date, more than 7 billion litres of water have already been 'rolled' over a combined distance of 500 million km.[63]

Another example is Kick Start, a not-for-profit organisation that specialises in irrigation technology, which is making portable water pumps accessible to farming communities across Africa – most significantly in Kenya, Tanzania and Mali. The pumps cost $35 to $95 and since 1991 have lifted 860 000 people out of poverty and created 170 000 new businesses, enabling economic activity equivalent to more 0.6% of the GDP in Kenya alone.[64] The Unesco Institute for Water Education has recently documented 50 innovations for water and development, which could significantly improve equitable access to water in developing countries like South Africa.[65]

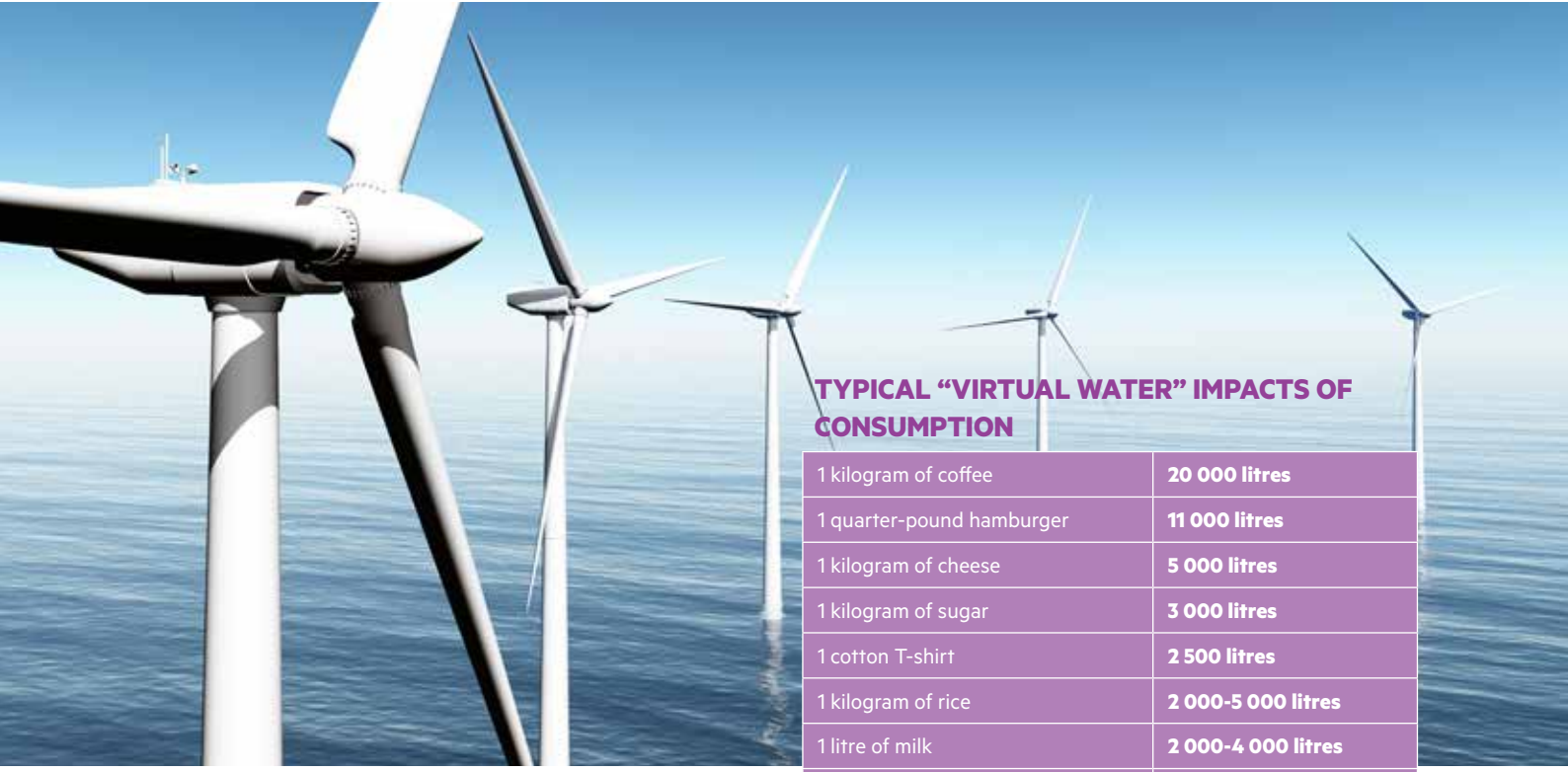
A SMART WATER FUTURE

A smart water future for South Africa is one in which water is managed efficiently, minimising waste (e.g. through evaporation or leakage). By 2050, agriculture will need to produce 60% more food globally, and 100% more in developing countries. As the current growth rates of global agricultural water demand are unsustainable, the sector will need to increase its water use efficiency by reducing water losses and, most importantly, increase crop productivity with respect to water.

Globally, significant reductions in water loss through evaporation have been achieved through drip-feed irrigation, pioneered in Israel. The initial high cost of these systems has been addressed by simple innovations like Pepsees – small polyethylene tubes that come in long rolls, perforated every 20 centimetres or so. While they were designed for use in the confectionary sector (for ice-lollies), India applied them as an inexpensive way of delivering water directly to plants and achieving more "crop per drop".[66]

In the manufacturing industry, the share of total water demand by 2050 is expected to increase from 7% to 22%. The water

[55] IDC (2015) Ikusasa – Works in the Fields of Water Purification and Desalination. IDC website.
[56] Phakathi, B. (2015). Cape Town mulls feasibility of desalination plant, Business Day BDayLive, 11 March.
[57] WWAP (United Nations World Water Assessment Programme) (2015). The United Nations World Water Development Report (2015): Water for a Sustainable World. Paris, UNESCO.
[58] WWAP (United Nations World Water Assessment Programme) (2015). The United Nations World Water Development Report (2015): Water for a Sustainable World. Paris, UNESCO, p.16.
[59] Visser, W. (2014). Why banning dangerous chemicals is not enough, The Guardian, 16 September.



demand increase in BRICS countries (Brazil, Russia, India, China and South Africa) will be sevenfold, while in developing countries, it will come close to increasing by 400%. Hence, radical efficiency gains will need to found.[67] Government water services also need to become more vigilant. The average water loss across South Africa's municipalities – which includes losses in pipes, inaccurate meter readings and unauthorised consumption – stands at 36%[68]. In terms of water revenue, this amounts to a loss of more than R7 billion per year. The Department of Water and Sanitation indicated in 2014 that it needed approximately R600 billion to address the problem.[69]

There are various smart technologies that have potential to address water scarcity. As far back as 2008, the Eastern Cape's Alfred Nzo District Municipality had a fog-harvesting system installed in a bid to boost potable water supplies to the district's residents. In 2011, the Sifika Group in East London introduced an ambient moisture extraction system, which uses solar heat, heat pumping technology and solar photovoltaic panels to extract water from the air for industrial applications. The machines are capable of producing between 20 megalitres and 500 megalitres a day.[70]

More recently, South Africa-based Cirrus Water Management also began promoting a water-harvesting technology that generates clean drinking water from the ambient atmosphere. Cost is still an issue – Cirrus' water is generated at 70c a litre (R1.50 with financing), as opposed to subsidised municipal water at 2c a litre – but it does show the potential of innovation (and already many people pay more than R10 a litre for bottled water).[71]

A SATISFYING WATER FUTURE

A satisfying water future for South Africa is one in which water is used to improve our quality of life through "water-wise" products and services. This means that we need to make customers much more aware of the "virtual water" they are consuming (see Figure72). It is estimated that through consumption of products that require water to grow or produce, an average person in Europe might consume 1 500 to 2000 tonnes of water a year.

TYPICAL "VIRTUAL WATER" IMPACTS OF CONSUMPTION

1 kilogram of coffee	**20 000 litres**
1 quarter-pound hamburger	**11 000 litres**
1 kilogram of cheese	**5 000 litres**
1 kilogram of sugar	**3 000 litres**
1 cotton T-shirt	**2 500 litres**
1 kilogram of rice	**2 000-5 000 litres**
1 litre of milk	**2 000-4 000 litres**
1 glass of brandy	**2 000 litres**
1 kilogram of wheat	**1 000 litres**
1 kilogram of potatoes	**500 litres**
1 glass of wine or pint of beer	**250 litres**

To keep deriving the benefits of water through our food and products, this virtual water needs to be more accurately priced. Economists refer to this as internalising the externalities. Trucost estimates that the true value of one cubic meter of water ranges between $0.10 where it is plentiful and $15 in areas of extreme scarcity. Ideally, these prices should be imposed equitably through government policy.

In the absence of adequate policy, however, some companies are voluntarily applying the full cost of water to shape their future-fit investment decisions. For example, Nestlé uses shadow water pricing of approximately $1 per cubic meter for facilities located where water is readily available and $5 in more arid regions. Nestlé applies this value when considering purchasing new equipment, making tangible the impact of water availability within capital expenditure decisions.[73]
It is clear that to have a satisfying water future, more companies will need to respond proactively to water issues. A survey of over a 1 000 global companies by the CDP Water Disclosure Project found that 68% recognised that water posed a significant risk to their business – and 43% of these believed the risk would materialise within 3 years. As a result, setting ambitious goals is becoming best practice, with more and more leaders signing up to the CEO Water Mandate of the UN Global Company.

Drinks giant SABMiller, for example, is targeting water reductions in their breweries of 25% by 2015 compared with 2008, while the Coca-Cola Company has invested more than US$1 billion since 2001 in wastewater treatment. Diageo Plc saved US$3.2 million in a single year from reducing water withdrawals by nearly 1 million cubic meters, while Cisco is saving more than US$1 million per year. And BASF estimates that water saving, recycling, reuse and drinking water treatment products offer the company potential sales of US$1 billion up to 2020.[74]

[60] Visser, W. (2014). Will green chemistry save us from toxification? The Guardian, 24 September.
[61] WWAP (United Nations World Water Assessment Programme) (2015). The United Nations World Water Development Report 2015: Water for a Sustainable World. Paris, UNESCO.
[62] Water.org and The MasterCard Foundation (2014). Progress on Access to Safe Water and Sanitation, 1 December.
[63] http://hipporoller.org/social-impact/
[64] http://www.kickstart.org/

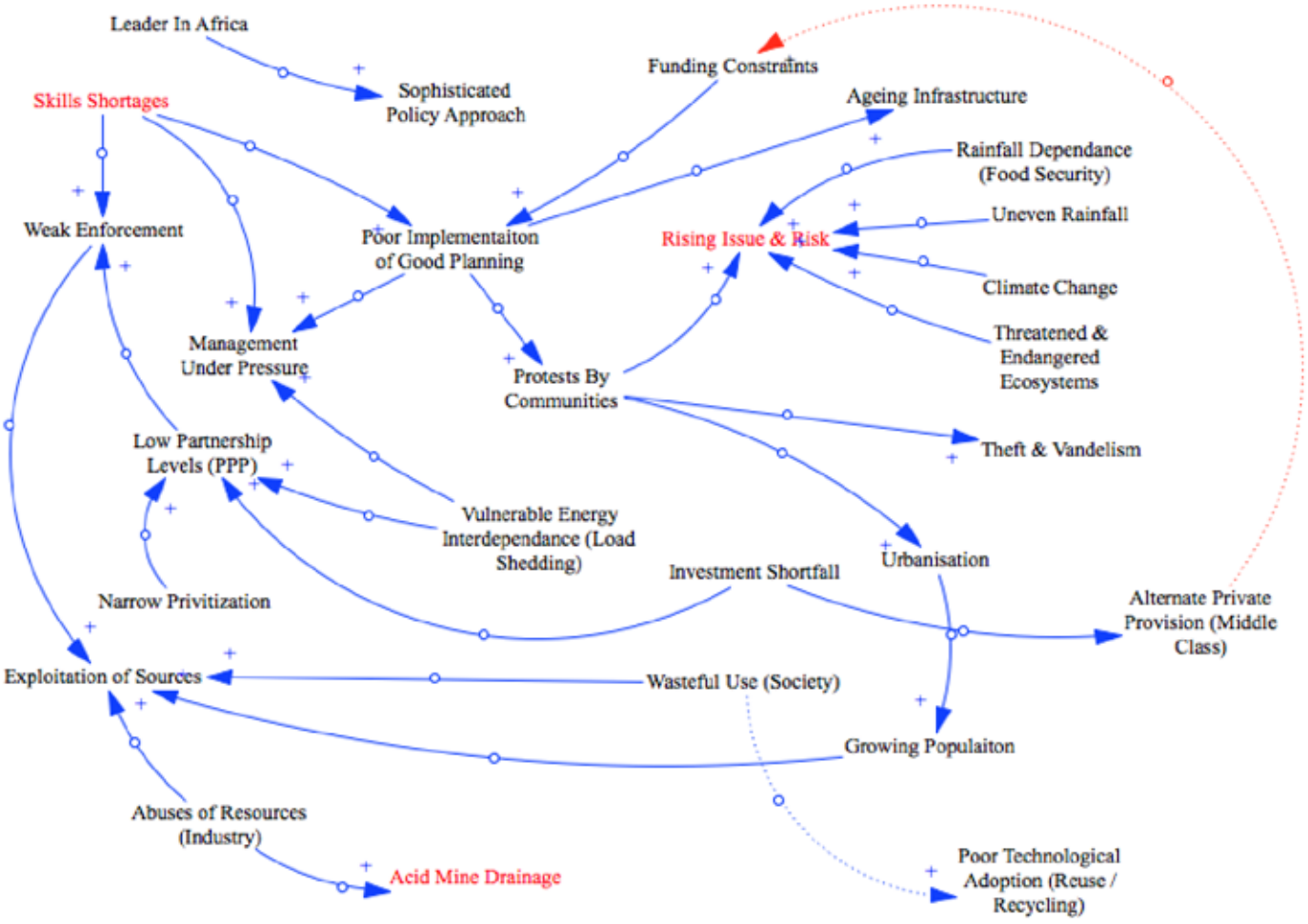
MAJOR TRENDS AFFECTING WATER SECURITY

The major trends affecting water security in South Africa were identified in the following catagories, to acess the current evolution of the issue;

POLITICAL	ECONOMIC	SOCIO-CULTURAL	ENVIRONMENTAL	TECH & INFRASTRUCTURE
Sophisticated Policy Approach	Management Under Pressure	Wasteful Use	Complexity	Deficits in Technology
Leader in Africa	Expoitation of Sources	Growing Population	Interdependence	Reuse Breakthroughs
Weak Enforcement	Vulnerable Energy Interdependence (Load Shedding)	Growing Middle Class	Scarce	Advanced Applications (Pocketed)
Poor Implementation (of Good Planning)	Narrow Privatisation	Poor Conservation Culture	Climate Change Threat (Temp, Storms, Floods)	Vulnerable (Bulk Transfer)
Low Partnership Levels (PPP)	Skills Shortages	High Per Capita Consumption	Uneven Distribution	New Source Usages Needed
Low FDI Attractiveness	Funding Constraints	Urban-Rural Discrepency (Quality and Provision)	Acid Mine Drainage	New Reuse Technologies (Needed)
Protests by Communities	Rainfall Dependence (Food Security)	Urbanisation	Over Expoitation	Theft and Vandalism
Rising Issue & Risk	Investment Shortfall	Misuse of Treated Water	Threatened and Endangered Ecosystems	Ageing, Failing Leakages and Losses
	Abuses of Resource	Externalised "Virtual Water"	Fluctuating Environment	Lost Opportunities for Reuse
	Irresponsible Industrial Practices (Spills)		Large Undeveloped Resources (Africa)	Sanitation System Lag
				Adoption Lag (Irrigation)

[65] UNESCO-IHE (2015). Innovations for Water and Development. Report, 9 February.
[66] Pearce, F. (2006). When the Rivers Run Dry: What Happens When Our Water Runs Out? London: Eden Project Books, p.339.
[67] WWAP (United Nations World Water Assessment Programme) (2015). The United Nations World Water Development Report 2015: Water for a Sustainable World. Paris, UNESCO.
[68] Democratic Alliance leader Mmusi Maimane claims that, in many irrigation and municipal water supply schemes, this figure can reach a high of 60%.
[69] Fin24 (2015). Government Acts to stem SA's R7billion water leaks, 28 August.
[70] Burger, S. (2011). South African firm markets water-from-air system locally, Engineering News, 26 August.
[71] Groenewald, Y. (2015). Harvesting water from thin air, Fin24, 23 August.
[72] Pearce, F. (2006). When the Rivers Run Dry: What Happens When Our Water Runs Out? London: Eden Project Books, p.21-22.
[73] Bolton, S. (2014). Why understanding the true value of water is smart business, Greenbiz, 24 October.
[74] CDP (2014). From water risk to value creation: CDP Global Water Report 2014.

SYSTEMS ANALYSIS OF TRENDS



From the analysis, it is apparent that although South Africa is a "leader in Africa" in terms of water management and supply, and although government has taken a sophisticated policy approach to water management and a good regulatory environment exists, weaknesses in implementation and management continue to undermine water security. Severe skills shortages, particularly at municipal level and in terms of engineering and project management hamper efforts at governance. This is worsened by the rising demands of a growing, urbanising population that also does not make efficient and responsible use of water. As is the case with the private sector, irresponsible use of water sources, exploitation of natural and treated reserves and high levels of consumption place undue pressure on the water system. The negative interdependence between unstable energy supply and constrained water supply interchangeably, do not bode well for the future.

The underlying scarcity of water, worsened by climate change, unreliable rainfall and a threatened and endangered ecosystem, means that responsible use is all the more important – yet illusive. Furthermore, the lag in adoption of technologies and practices that conserve water, or recycle or reuse water, and the shortfall and lack of access to adequte funding for water infrastructure, point to a strained water system for at least the next two decades. The emerging political issue of water security and the risks it poses are enhanced by the likelihood that the middle class and industry would look to private provision in the event of prolonged water supply uncertainty, eliminating the current structural subsidisation that exists between them and the poor, further exasperating the finding and investment shortfall in infrastructure.

ATERNATIVE FUTURE SCENARIOS

The baseline scenario borne out by the analysis is described as;

BASELINE:
"PERI-URBAN WATER CRISIS – NO.1 ELECTION ISSUE 2026"

In this scenario, the well intentioned and evidence-based policies of the Department of Water Affairs have not translated into shared water security for South Africans. A lingering culture of water misuse and over-exploitation by industry and consumers have pushed the water system beyond capacity, while neither domestic private or foreign investment could be rallied timeously to avert the shortfall. Peri-urban, high density settlements are hardest hit, with environmentally and financially costly water diesel-powered trucks now ensuring the basic human right to water. Angry residents vent their frustration with local government by destroying key installations, which cause widespread disruption of supply. Middle-class consumers, secondary and tertiary business sectors migrate rapidly to renewable, reuse and recycling technologies as confidence in a strained system erodes. Rapid exploitation of already beleagered water ecosystems, intended to stem the shortfall of supply is insufficient, given the vulnerability of the dispersed bulk transfer system. A national initiative for the enhancement of water engineering capacity comes online, but is too slow to fully address the need for effective human capital in the system in the short term. Opposition parties harp on the water crisis to garner support among poor and rural voters.

ALTERNATIVE 1:
"CAPABLE STATE MANTRA MARKS WATER TURNAROUND"

In this scenario, the well defined and evidenced-based policies of the Department of Water Affairs have translated into shared water security for South Africans. A newly established culture of water conservation and international reuse by industry and consumenrs have relieved the water system and ensured excess capacity, while domestic private and foreign investment have been rallied to renew infrastructure. Peri-urban, high density settlements are centres of water usage efficiency, with environmentally friendly and financially sound water conservation schemes now tailored to ensure the basic human right to water is upheld sustainably. Engaged residents employ their ingenuity in an array of emergent and creative ways to maximise water reusage. Middle-class consumers, secondary and tertiary business sectors confidently depend on municipal supply, in addition to reuse and recycling technologies as confidence in an evolving system. Tapering off exploitation of vulnerable water ecosystems, through the use of alternative sources to stem the shortfall of supply is effective, given the renewed robustness of the dispersed bulk transfer system. An accelerated national initiative for the enhancement of water engineering capacity comes online to address the need for effective human capital in the system in the short term. Opposition parties find it hard to convince voters against a legacy of effective delivery.

ALTERNATIVE 2:
"BREAKTHROUGH CAPTURE AND STORAGE DISRUPTS WATER SYSTEM DEPENDENCE"

In this scenario, the well-defined and evidenced-based policies of the Department of Water Affairs are quickly overtaken by breakthroughs in alternative water capture and storage, ensuring low cost water security for South Africans. A newly estabilished culture of innovative water conservation and international reuse by industry and consumers have resulted in a decentralised, parallel water system and ensured excess capacity, while domestic private and foreign investment shift from projects intended to renew infrastructure to investments in sustainability technologies. Peri-urban, high density settlements are centres of prototype water usage efficiency systems, with environmentally friendly and financially sound water conservation units now tailored to ensure the basic human rights to water is upheld sustainably. Engaged residents employ their ingenuity in an array of emergent and creative ways to maximise water reusage. Middle-class consumers, secondary and tertiary business sectors position themselves to migrate from an infrastructure-heavy legacy system to a low-use infrastructure light alternative, depending less on municipal supply, to atmospheric capture, reuse and recycling technologies as confidence in a new technologies is enhanced. Tapering off exploitation of vulnerable water ecosystems happens too slowly for popular opinion, since the use of alternative capture is surprisingly effective, drastically reducing the reliance on the dispersed bulk transfer system. An accellerated national initiative for the enhancement of smart water engineering innovation comes online to address the need for effective human capital in the system. Water security does not feature prominently as a political issue, voters being concerned with economic growth prospects instead.

FINDINGS AND RECOMMENDATIONS

Recent efforts at improving water quality through the Drinking Water Quality Regulatory System called "Blue Drop System" certification programme and the related "Water Services Institutions" monitoring process, which includes a focus on asset management and audit of water services infrastructure are promising, but more needs to be done.[75] In addition to improvements in management, improved regulatory and law enforcement will be required, such as the recent case where a company was fined heavily for violating the National Water Act as a result of the work of the "Blue Scorpions", an enforcement unit of the Department of Water and Sanitation. This, however, is an exception to widespread and ongoing infringements of the Act by mines and associated industries that are said to "not be able to cope with the effluent they produce" and as a result, spill contaminants into the river basins and catchment areas.[76] Based on the findings of this study, the following steps must be taken to ensure future water security in South Africa and SADC;

1. Escalate water security to the top of the national and regional agenda given the centrality and importance of the resource to society, business and the sustainability of the nation.
2. Develop a long-term strategy that balances social and economic demands with resource availability in the region, using water conservation and diverse water source strategies as key principles.
3. Streamline the government bureaucracy relating to water management to ensure efficiency and create a centralised pool of high level engineering and expertise for review and maintenance of key water infrastructure nationally.
4. Strengthen alliances and partnerships with tertiary institutions, locally and internationally, to drive technological development and research relating to water conservation and management.
5. Seek innovative models for private public partnerships to create solutions for the most pressing water supply and management situations.
6. Develop scenarios for water insecurity and accompanying plans for proactive steps in resolving such crisis points in the short and medium-term.

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