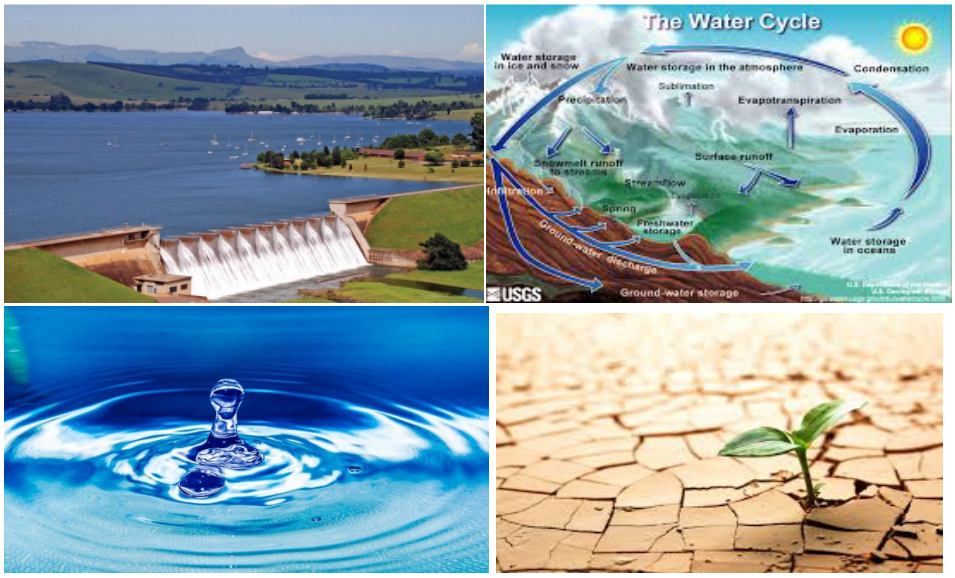
THE WATER SECTOR

Options for growth despite the crisis



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1. INTRODUCTION

Water is fundamental to every aspect of human life which it in multifaceted and disparate ways, from hospitals to restaurants, and from farms to coal mines. Every sector within modern industrial production is reliant upon the availability of water. There is no more water on our planet today than there was millions of years ago and we can neither make nor destroy it[1]. Although 70% of the earth is covered with water, only 2% of it is freshwater. While renewable energy provides an alternative to coal-based electricity production, there are no substitutes for water and no technological innovation currently exists that allows us to replace it. The actual value of water has become more apparent especially with its scarcity becoming more prevalent and with droughts becoming more commonplace, and recently the World Bank estimated that as a privatised commodity, it is worth $1 trillion.[2] Although 87% of the world's population has access to improved water resources, it is estimated that by 2030 close onto 3.9 billion people will live in water scarce regions, an increase of 1 billion from current figures (van der Westhuizen,2011:31). The global water sector is a $450-$500 billion industry with the fastest growth in water-related investments in the developing world.[3] Despite this, there are global problems with water provision and these include water scarcity, investment backlog, climate change effects on rainfall, water affordability for the poor, pollution of water sources.[4] The focus globally is now shifting to demand management. All countries are affected including the wealthiest such as the USA which loses an estimated $2.6 billion worth of clean water due to decrepit infrastructure. [5] The effect of climate change on natural resources, in particular the availability and variability of fresh water resources has added to this stress. Consequently the world is faced with twin challenges regarding water. The first relates to managing existing water in an environmentally sensitive manner while the second deals with finding ways to increase the amount of freshwater for human use, and for industrial and commercial development without depleting groundwater reserves. This then provides the lens through which to South Africa's current water crisis and identify where possible the areas for growth and investment.

2. GLOBAL WATER USE

Source water is collected from rivers and dams, the pollutants are removed and it is then distributed for human use. Similarly waste water systems gathers water and sewage, removes the contaminants, before releasing clean water back into the rivers and lakes for reuse. Although the

[1] We can however degrade it to the point where it is not fit for human consumption.
[2] http://www.theguardian.com/commentisfree/2015/apr/05/observer-view-on-global-water-shortage
[3] Gottelier 2104.
[4] After four years of severe drought, California began in April 2015, to impose mandatory restrictions on water use for the first time in their history.
[5] Vd Westhuizen,2011:31

world's water resources have remained constant over millennia they have come under stress due, in part to rapidly increasing populations and accelerated industrialisation. Close onto 1 billion people lack access to safe, drinking water.[6] There is an alarming and rapidly growing imbalance between water supply and demand. The world uses 2.1 trillion m^3 of water every year.[7] To put it into perspective that is the equivalent of draining the world's largest lake, Lake Superior, twice, and not replenishing it. That is 17.5 million gallons of water every second[8] and this situation cannot be sustained for very long. The generally accepted minimum per person requirement for good health is 100 litres of water per day or 36.5 cubic metres per year. An additional 730 cubic metres per year is needed for agriculture, industry and energy production for each person. This adds up to an accepted minimum per capita water requirement of 766.5 cubic metres and we were to multiply this to the current population, then we should be using 5.3 trillion cubic meters of water per year. However, latest statistics show how badly this picture has been skewed:

- North Americans use 1,280 cubic metres
- Europeans and Australians use 694 cubic metres
- Asians use 535 cubic metres
- South Americans use 311 cubic metres
- Africans use 186 cubic metres[9]

In essence North America exceeds the minimum per person requirement by over two thirds, and based on current global water use and degradation there is now only enough freshwater capacity to support 50% of world demand. Furthermore, and equally alarming is the fact that the 25% of the world's population lack adequate water for drinking and sanitation. A further illustration of the global uneven distribution of water is that in Malaysia, 35 million cubic feet of water is shared amongst 100 people, while in India the same volume is supplied to 350 people and in Israel, close onto 4000 people must share this (Gottelier; 2014:1) Not only is demand outstripping supply but 20% more water than is currently available will be needed to feed the additional 1½ billion people who will be living here in 2025 and a mere five years later, demand will outstrip supply by 40% (Gottelier, 2014:1). The reasons for this imbalance are due to the following factors:

[6] http://www.theguardian.com/environment/2014/feb/09/global-water-shortages-threat-terror-war
[7] One cubic metre is equal to 1000 litres
[8] As a comparison, we use 155 201 litres of oil every second.
[9] http://www.green-world.it/en/aqua_love/how_much_water_on_earth.asp

2.1 Population growth

Water was first formed 4.5 billion years ago and it predates human existence by several millennia. However, from the first appearance of humans, and barring a few lulls, there has been a steady and very rapid expansion of the population. At the beginning of the 19th century the population reached 1 billion and since then population increase has been frighteningly phenomenal: every 30 seconds, 75 people are added to the planet. The world's population is expected to increase by roughly 1 billion people every 12 years and this in turn necessitates an increased freshwater demand of about 64 billion cubic metres per year.[10] Furthermore, close onto 90% of the expected 3 billion people that will be added to the population in the next three decades will be in developing countries, mostly in regions where the current population does not have sustainable access to safe drinking water and sanitation.[11] UNESCO has warned that unless countries dramatically changed their use of resources, the planet could experience a 40% shortfall in just 15 years.

This growing population has been accompanied by unchecked pollution and rapid industrialisation throughout large parts of the globe. Along the way, the planet's climate has also changed irrevocably. All of this has huge implications for water availability and its use. It is estimated that by 2025, close onto two thirds of the globe will be severely water stressed. As ever more parts of the globe becomes industrialised and more areas of land are taken over by agricultural production, so are there ever greater demands for water. With global water demand predicted to increase by 55% by 2050 there is also the alarm that water reserves would diminish as the effects of climate change on the environment begins to takes its toll. In just one century the world's population has tripled but the demand for water has increased sixfold, and within the next decade 20% of the world's population will live in regions of water scarcity where demands outpaces supply.[12]

2.2 Water supply and distribution

The distribution of water is largely dependent on wealth. Affluent societies and countries are able to utilise their resources to meet demand but poorer countries are without the resources to maintain and deliver clean, safe water. Furthermore it is these very societies that are dependent on extractive industries such as coal mining which in turn is predicated on the contamination of already-scarce,

[10] United Nations Development Report **Water in Changing World**.
[11] United Nations Development Report **Water in Changing World**
[12] http://www.theguardian.com/commentisfree/2015/apr/05/observer-view-on-global-water-shortage.

valuable water supplies. So while recent announcement of water restrictions in California many inconvenience the super wealthy of that state as they are cannot water their massive lawns or replenish their swimming pools, the situation is much more desperate in large parts of the impoverished world.[13] It is estimated that 780 million people lack access to clean water while water-related diseases kill 840 000 people a year (Early,2015). Furthermore, women and children spend 140 million hours a day collecting water often from dangerous and unclean sources. It is widely accepted that the ravages of climate change are more acutely felt in the developing world. Consequently the ways that water is needed there and the way that is it provided by the environment are invariably misaligned because the consequences of climate change make it less predictable. Societies were constructed around the availability of water and the ability to produce food and shelter, quite often all in close proximity to each other and this model has sustained civilization for millennia. Climate change has altered the hydrological cycle irrevocably thus affecting our ability to make accurate predictions around rainfall, floods and droughts based on historical patterns.

Agriculture is the largest consumer of water worldwide, accounting for about 70% of annual global water use. Irrigated agriculture covers 275 million hectares (20% of cultivated land) and accounts for 40% of global food production and its success resulted in a 30 year decline in food prices, but this trend has now been reversed. A large part of the current pressure on water resources is directly attributable to increased demand for animal feed, particularly since meat production requires 8-10 times more water than cereal production.[14] By contrast, the industrial and commercial sectors of the global economy only account for about 22% of water use. Close onto 20% of total water used emanates from groundwater sources and this is increasing rapidly, more specifically in dry areas.[15] Given current growth rates, human use of available freshwater is projected to rise from about 54% currently to over 90% of all available freshwater within 25 years.[16]

In late February 2015, a report was presented at the United Nations headquarters in New York which showed that 2.9 billion people in 48 countries are set to face water shortages within the next decade and that by 2030 there will be a global supply shortfall of about 40% which would jeopardize the stability of the very countries where these people live. The world's water supply is in a precarious position and it has been suggested that by 2050, the planet will require 50% more water than it does currently. The oft talked about long term consequences of global warming such as extreme weather

[13] Fioramonti, L (2015)
[14] UN Water in a changing world p9
[15] UN Water in a changing world.
[16] http://www.triplepundit.com/2009/10/water-wars-the-beverage-industry-as-a-canary-or-future-innovation-leader/

events and its effect on water supply has finally arrived and in many places the situation has changed, in many cases irrevocably from bad to desperate. On its own, a drought, flooding or vanishing tributaries could destroy crops and endanger the livelihoods of indigent communities, but over time when they become trans-boundary water issues and are combined with various other climate and politically-related violent upheavals, this could pose a threat to civilizations and in some cases, the resulting warfare could endanger the very existence of the affected countries. Africa's water resources are seldom, if ever confined to the borders of one particular country. The continent plays host to 63 international trans-boundary river basins which covers 64% if its land area and contains 93% if its total surface water resources. This situation provides a fertile breeding ground for conflict. It is worth noting that the Arab spring was sparked off as much by seething anger over poverty, corruption and the maladministration of despotic regimes, as it was by the demand from impoverished communities for equal access to basic amenities such as water. Consequently intelligence agencies consider the prospect of water shortages as serious a threat to geo political stability as terrorism and the weapons of mass destruction (Aleem,2015).

2.3 Infrastructure

The rapid increase in urban growth has similarly made huge demands on water infrastructure that was not designed to cope with the levels of use to which is it being subjected and consequently between 30-40% of water being lost to leakage. In San Diego the target threshold for water leakage or non-revenue water is less than 10% of treated water. Although able to meet this target, this is done at exorbitant cost, with the city losing $21.8 million annually. The USA's Environmental Protection Agency conducted a study in 2008 which identified an investment requirement of $298 billion for the upgrading and maintenance of its wastewater and stormwater infrastructure network. In London more than 25% of residential water is lost to leakage, mainly as a result of infrastructure that is 150 years old. It is estimated that if leakage were to be reduced by only 1%, it will provide sufficient water for 224 000 people. Through determined effort and continuous investment in water infrastructure, Manila was able to reduce its NRW from 19.5% in 2008 to 11.2% in 2011, in the process saving the city millions of dollars (Gottelier,2014:5).

2.4 Extreme weather

When a planet warms it alters the Earth's glaciers which store large reserves of freshwater. Rising temperatures accelerate glacial melt and the corresponding depletion of this freshwater source has catastrophic effects on surrounding ecosystems. Global warming as a result of climate change has changed rainfall patterns and altering the hydrological cycle irrevocably. Southern Europe's rainfall

has decreased in recent years and places like Spain and Portugal are expected to experience summers which could be 6% hotter in the coming decades. The el Nino inspired drought that is currently devastating large parts of South Africa, culminating this week in notifications of impending water cuts, and coming as it does on the back of the past two years of electricity cutbacks, has focused the spotlight on this country as a potential flashpoint. El Nino's debilitating effect on weather patterns has also made its presence felt throughout much of Africa, and coinciding with sluggish growth and in some places, famine and the violence that is associated with political instability, there are predictions that swathes of the continent could yet again be caught up in upheavals of one sort or another. Climate change will impact the entire water cycle across the globe in three specific ways:

Table 1: Climate change and the water cycle

Heavy rain
This will damage crops and adversely affect the quality of surface and groundwater. In so doing it will bring pressure to bear on urban and rural infrastructure
Drought
This will result in land degradation, lower yields and crop/livestock failure and besides the increased food and water shortages, there will be reduced hydropower generation and massive rural flight, thereby increasing pressure on already overburdened urban water infrastructure.
Tropical cyclone
Besides the widespread crop damage, the associated power outages will disrupt public water supply. Private insurers will withdraw risk coverage in vulnerable areas which will invariably affect the poor and industry the most.

Source: Gottelier,2014:7

3. WATER SHORTAGES AND CONFLICT

Water shortages imperil food production and energy supply and this in turn puts additional stress on governments that are caught in the quagmire of trying to ameliorate poverty and social tensions. Globally, the losses of water reserves are a cause for grave concern. In just seven

years, starting in 2003, parts of Turkey, Syria, Iraq and Iran along the Tigris and Euphrates Rivers have lost 144 cubic kilometres of stored freshwater (roughly the same amount of water in the Dead Sea) of which 60% was due to groundwater reductions.[17] In South Asia groundwater losses over the past decade was even higher with groundwater being pumped out 70% faster than in the previous decade, with close onto 54km³ of groundwater being lost every year.[18] About 50% of all available water is trans-boundary, which means that it is located in the rivers, lakes or groundwater systems of two or more countries and in two thirds of those areas there is no agreement over its use. Consequently trans-boundary water has become a site for violent contestation between countries at times leading to war. The Pacific Institute has provided evidence of hundreds of instances of water related conflicts ranging across the globe, sometimes within a country such as water related riots in Kenya and South Africa, inter-state conflict in India over access to the Kaveri River, inter-ethnic conflict such as that witnessed in Sudan in the 2000s, to conflict between states such the Arab-Israeli conflict of 1967 which was rooted in part over access to water. Close onto 13 out of the 22 countries that comprise the Arab League are amongst the world's most water scarce nations, and it is envisaged that in the coming decades instability in the Arab countries will become more acute due to the impact of water on food supply and sanitation services. In 2011 and 2014 the Canadian province of Manitoba was ravaged by floods and this lead to the budget deficit to swell, eventually resulting in the resignation of political leaders. In 2015 alone there were water related riots in Ireland, Karachi and Sao Paulo. More recently, ISIS have used water or rather the access to it as a tool in Iraq and Syria. Closer to home, the service delivery protests that have beset the South African political landscape over the past few years will take on a potentially more violent turn once the impact of water restrictions begin to be felt. [19]

Water is also a source of cooperation, even in areas of political tension. Despite fighting three wars during the last fifty years, India and Pakistan have co-operated in the management of the Indus River while Israelis and Palestinians despite their political conflict cooperate on water related matters albeit not on equal terms.[20]

[17] http://www.theguardian.com/environment/2014/feb/09/global-water-shortages-threat-terror-war
[18] This includes the eastern Pakistan, northen India and Bangladesh
[19] See Aleem (2015) and Goldenberg (2015)
[20] http://www.theguardian.com/sustainable-business/global-water-crisis-politics-business-security

4. WATER: THE SITUATION IN SOUTH AFRICA

South Africa, the 30th driest country in the world, not only experiences extreme climate and rainfall fluctuations but its average annual rainfall is half the global average. This rainfall is unevenly distributed with some regions receiving less than 100mm in a year on average. South Africa currently has access to surface water (77% of total use), groundwater (9% of total use) [21] and recycled water (14% of total use). [22] Approximately 11 out of 19 water catchment areas have negative water balances and in 2004, the Department of Water Affairs predicted that the country would reach an overall water deficit of 1.7%. However, the absence of water infrastructure in rural areas means that74% of all rural people are dependent on groundwater while the urban nodes derive their water from surface sources like the Limpopo and the Komati rivers. Of the country's 223 river ecosystem types, close onto 60% were threatened, with 25% being critically endangered.[23] The Department of Water Affairs has determined that in the next decade, SA will need about 20% more water supply than it currently uses and accordingly has identified R2.7 trillion of possible projects to satisfy this demand increase over the next 20 years.[24] A large portion of the country's GDP is directly dependent on water availability and provision. The water services sector which deals with water supply services and sanitation services, amounts to 1.5% of GDP.[25] Water is not only a crucial component for food production, but is also integral to the country's industrial, mining and power generation sectors which use 10% of its freshwater while contributing close onto 40% to the country's total GDP (Hornby). Agriculture accounts for 15% of GDP and uses 60% of the water supply. The industrial sector which contributes 29% towards the GDP uses 11% of the water while mining, which makes a chunk of this sector, has, through acid mine drainage, had a negative effect on water. Although the energy system only uses 2% of water, it is dependent on efficient supplies for electricity generation The main driver for agricultural water demand emanates from the 1.6 million hectares of land that is used for irrigation. The main driver of industrial water demand is power generation (2% of total SA water usage). The main driver of municipal water demand is the country's rapidly urbanising population which currently sits at 33.2 million. (Hedden and Cillers,2015:5). In addition, the growth in rural settlements is increasing the strain on SA's water supply with close onto 19% of the rural population without access to a reliable water supply and 33% lack basic sanitation services. Furthermore, over 26% of all school (urban and rural) and 45% of clinics have no water

[21] Groundwater refers to wells and pumps
[22] http://12.000.scripts.mit.edu/mission2017/case-studies/water-access-in-south-africa/Water Access in South Africa

[23] Hedden, S & Cilliers, J (2014) Parched prospects: The emerging water crisis in South Africa Institute for Security Studies
[24] http://www.bdlive.co.za/national/science/2015/11/03/why-the-water-crisis-is-far-worse-than-eskom-woes
[25] Water resources sector includes the development and management of infrastructure to utilise water sources.

access. To further compound matters, rural municipalities lack efficient and effective water cleaning facilities resulting in areas with not enough potable water with recent estimates showing that waterborne illnesses affected 60% of rural South Africa.

Most of South Africa's rain falls in the eastern part of the country, (due in no small measure to the warm Indian Ocean) and therefore the water system is not only highly dependent on dams but on pumping water uphill in order to get it to other parts of the country. Large storage dams have been built to deal with the problem of variable river flows and there are over 500 dams and 25 existing inter-basin schemes in South Africa responsible for transferring water from one catchment area to another in order to balance supply and demand.[26] Often these dams are located in neighbouring countries, such as Lesotho, whose dam provides water for Gauteng's industry and for irrigation in the Free State and Mpumalanga. On average the country's rivers receive about 50 billion m^3 of water annually with a further 6 billion m^3 coming from underground aquifiers. For its urban, industrial and irrigation water supplies, the country relies on surface water resources. Although the last two droughts in 1983 and 1992 were severely debilitating, the country was able to withstand it due in part to the fact that not only was the population much smaller (39 million as opposed to 52 million now) so too was its industrial base.

South Africa's water management system is complicated, perhaps even more so than that which exists for electricity provision. Dams which store the bulk of the country's water are built by the national water department, or in some cases, a municipality.. Water treatment and its transport is normally the preserve of regional water boards in Gauteng, eThekwini, Msunduzi, Ballito, Mangaung and Polokwane, while in Cape Town and Nelson Mandela Bay, the municipalities assume responsibility for it. Thereafter it is distributed to households by municipalities. Most municipalities should have a water services development plan which articulates how many people are to be supplied, how much water they would need, where it will come from, what the infrastructure costs are and how this will be borne. The metropolitan municipalities should also have systems and personnel in place to monitor this and should be able to estimate how much water they need and how much they will use. Accordingly, they are able to derive the requisite revenues for this that in turn funds infrastructure renewal and expansion. The smaller municipalities with their limited resources are unable to do this and cannot fund new water infrastructure since their limited revenue is invariably spent elsewhere.

[26] DBSA http://www.dbsa.org/EN/DBSA-Operations/Proj/Sector/Documents/Water.pdf

Water services are the responsibility of the following utilities:

- Water Services Authority (WSA)- this is any municipality that has executive authority for water services within its jurisdiction.
- Water Services Provider (WSP)-this entity has the responsibility to physically provide water supply services to consumers. This function can also be performed by the WSA.
- Water Board (DB)- 14 have been established in terms of the Water Services Act, 1997. The WB is a public WSP and its primary function is to supply water to the WSA.[27]

The 14 Water Boards supply a total bulk water volume of 2.39 billion m³ per year with a total asset value of R21 billion and an annual operating cost of R4 billion. In 2009, the Water Boards supplied water to 28 million people and several large industries. The country's 283 municipalities are serviced by 169 Water Service Authorities and their distribution per province highlighted below:

Table 2 Water distribution per province

Province	District Municipality	Local Municipality	Metro	Grand Total
Eastern Cape	6	10	1	17
Free State	1	20	-	21
Gauteng	1	8	3	12
KwaZulu Natal	10	3	1	14
Limpopo	4	7	-	11
Mpumalanga	2	17	-	19
Northern Cape	5	27	-	32
North West	3	10	-	13
Western Cape	5	24	1	30
Total	**37**	**126**	**6**	**169**

[28]

According to the Water Research Commission close onto 50% of the water that municipalities are supposed to route to households is lost through leaks from old infrastructure. Nationally the picture gets bleaker still: dams are behind schedule, e.g. the De Hoop Dam in Limpopo was five years behind schedule while the next phase of the Lesotho Highlands Project is three years behind schedule. It should be noted that the main reason for these particular dams was that they are meant to store enough water to ameliorate those situations where water is scarce. In 1996 the government implemented a system of Free Basic Services to households that earnt less than the poverty line which was defined as below R800 per month. Close onto 44% of total South African households qualify for free basic services and.the provision of FBW as of November 2010 is as follows:

[27] vd Westhuizen ,2011:6
[28] Van der Westhuizen,(2011) Collection, purification, testing and distribution of Water in Who Owns Whom

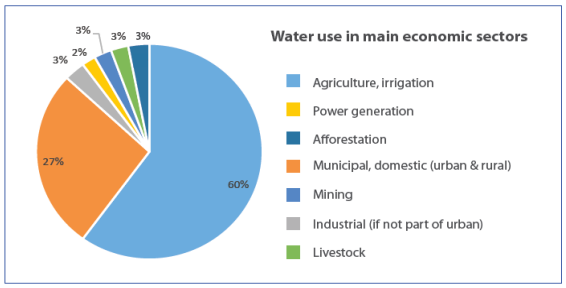
Table 3 Free Basic water

Province	Households Served	%	Poor Households Served	%
Western Cape	1 376 594	95.5%	212 674	97.9%
Eastern Cape	1 208 348	75.0%	688 643	79.5%
Northern Cape	253 357	94.9%	90 880	93.5%
Free State	743 709	92.9%	433 517	99.6%
Kwazulu-Natal	2 053 053	83.1%	1 063 238	80.6%
North West	777 071	83.4%	366 052	83.7%
Gauteng	3 008 932	88.3%	1 080 536	90.3%
Mpumalanga	835 298	91.8%	453 969	88.9%
Limpopo	1 027 964	81.1%	664 945	87.5%
Total	**11 284 325**	**86.10%**	**5 054 454**	**86.55%**

Source: Van der Westhuizen, 2011: 22

5. WATER USE IN SOUTH AFRICA

South Africa uses 98% of its predicted total water resources but this is not being used efficiently. On top of the stolen or lost water, the country also loses 1.5 billion cubic metres of water a year due to faulty piping. The graph below provides a picture of sectoral water use in terms of the National Water resource Strategy that was drawn up in 2012.



Source:Turton, 2015:15

As can be seen from this table, municipalities (27%), are the second largest water users. [29] A large part of the problem is that 37% of the water supplied by municipalities is non-revenue water (NRW) which refers to the difference between the volume of water that is inserted into the water distribution system and the volume that is sent through to customers.[30] It comprises three components. Besides leaks, it comprises commercial losses (metering inaccuracies and water theft) and unbilled authorised consumption.[31] Research commissioned by the Water Research Commission showed that 1.58 billion cubic metres of supplied water is unaccounted for each year.

[29] Average water consumption is 235 litres per person per day (l/d/d) which is 26% higher than the global average of 173 l/p/d.
[30] Close onto 36.8% is nonrevenue water and this equates to the level of water loss from urban supply due to non-payment of accounts (unbilled metered and unbilled unmetered) illegal offtake and leakage from faulty infrastructure.
[31] Free water given to certain groups

While this figure for NRW is on par with the global average[32], it is much higher than other water scarce countries like Australia whose non-revenue water is less than 10% of municipal demand (Hedden & Cilliers,2014:6). South African's use 27% more municipal water that should be expected, given the size of the urban population. Water that is lost through leakages constitutes 25% of non-revenue water which translates into 9.3% of the country's total consumption. Reducing the volume of non-revenue water will go a long way towards curtailing the rise in municipal water demand and this can be achieved through better monitoring of municipal and industrial water supply. In order to do this advanced metering infrastructure must be deployed and if, by 2035, municipal consumption were brought on par with the world average, the demand/supply gap would be reduced by half (Hedden & Cilliers,2015:8).

Close onto 75% of the country's water assets were constructed between 1960 and 1990 and because much of this infrastructure is at least 39 years old, while some having being in operation for over 100 years, the situation with regards its replacement has become desperate (Munshi,2012:30).[33] Close onto 60% of the country's water services infrastructure is in need of urgent repair. While, in the past the focus was on the extension of services to previously marginalised communities, this has increased the pressure on already dilapidated infrastructure. Furthermore maintenance backlogs have contributed to the leaks through which 40% of the country's water has been lost. In 2012 the Water Affairs Minister announced that the budget had increased from R573 billion to R668 billion for the next decade to deal with infrastructure. By their own estimations, more than R800 billion (R80 billion per year) is needed over the next decade in order to overcome the maintenance backlog in water infrastructure. The country's bulk water infrastructure which is administered by the DWA is where the majority of the problems emanate as close onto 37% of the water supply is lost through leaks costing at least R11 billion per year. Infrastructure that is owned and operated by national government has a replacement value of R139 billion and a current value of R54 billion, depreciating at R1.4 billion per annum. In addition there has been a skills flight from the National Department which has impaired its ability to function, in some cases there has been a reported shortage of close onto 60% of engineers at the national department (Munshi,2012:34). Despite this brain drain, the Department has still managed to increase its number of non-technical directors and these human capacity constraints will severely impede any meaningful progress.

[32] The global average in developing countries is between 40-50%
[33] Munshi, R (2012) Water: Is this SA's next crisis Financial Mail special report

Unlike the electricity crisis, which manifested itself quite dramatically with blackouts and load shedding, the water crisis has announced itself gradually and by the time the dams run dry, there would be very little that can be one to avert a catastrophe. The country is on the cusp of the perfect storm; limited available resources, population growth of 1.3% per annum and two decades of infrastructural neglect of infrastructure, which is estimated at R700 billion to address and now a drought, which is the worst since 1992 and which is severely debilitating large, previously productive parts of the country. The country already uses 98% of its available water supply while close onto 40% of its waste water treatment plants are in a critical state. In 2010 it was calculated that roughly 60% of the country's water service authorities do not have the requisite permits for their treatment works and that R300 billion needed to be spent over the next four years in order to avert a full scale water crisis. The reality though is that this figure is roughly 100 times the budget that Treasury has allocated to water management for the entire country. [34]

5.1 ACID MINE DRAINAGE

The South African economy is often out of kilter with the natural equilibrium. In order to maintain economic growth, more water is required but that which is available, is wasted and contaminated. Nowhere is this most visible than in the mining sector. Acid mine drainage occurs in the gold and coal mines when rock chemistry generates sulphuric acid which turns neutral water into a harmful and often poisonous liquid.

In addition acid mine drainage also contributes quite significantly to the toxicity of the country's water. Over the past century, the more than 120 mining companies operating here have deposited large tailings dumps that have been spilling uranium, low grade ores and other heavy metals. Studies have shown that during heavy rains, the tailings ponds overflowed and water contaminants coursed into rivers, reservoirs and dams. 2002 surface water in the country's lakes was found to have 40 000 times the natural level of uranium in freshwater, making people prone to kidney disease and cancer. The East and West Rand in Gauteng already suffers from this and the increase in coal licences in Mpumalanga could soon foretell a similar tale in that province. The Olifants River is also affected by acid mine drainage as is the Hartbeespoort Dam and the Umgeni River (Fioramonti 2015).

[34] http://12.000.scripts.mit.edu/mission2017/case-studies/water-access-in-south-africa/Water Access in South Africa

Various solutions have been forward for Acid Mine Drainage. The first involves capping and sealing openings in the mines to prevent the outflow of toxic water and then monitoring the already contaminated water. Attempts could then be made to neutralise the contaminated water by removing the heavy metals and then chemically desalinizing the water. Another option, passive underground mine water purification, comes with a R360 billion price tag and is beyond the currently budgetary limits of the national department. There is though, a cheaper and possibly less harmful method, which uses existing biological and chemical processes and which involves the construction of wetlands near abandoned mines.

5.2 TOXIC WATER SUPPLY

There is an increasing problem of toxicity of the water used in South Africa for human consumption and this is due to increased bacterial growth. A 2010 study found a bacterial count in water that was five times the limit allowed by the World Health Organisation. In essence the country's anthropogenic activities are quickly ensuring that the water supply is actually decreasing and there is the distinct possibility of SA being plunged into a health crisis as a result of the drought combined with its poorly managed water infrastructure. In the Western Cape it is predicted that agriculture and agro-processing would be hardest hit, followed closely by the apparel, beverage and pharmaceutical industries. This will no doubt be mirrored throughout the country where sectors dependent on water and which are also major employers will be severely affected. Amidst devastating crop failures, farmers are struggling to deal with the ever increasing costs of production and added to this, food prices may rise due to grain and water shortages. With some areas of the country experiencing the driest seasons in 75 years, it is envisaged that the biggest systemic failure that the current drought would highlight would be the near collapse of sewage management and processing systems countrywide. Close onto 4 billion litres of untreated sewage currently contaminates SA's strategic water storage capacity while more than 60% of the 50 biggest dams were eutrophic, that is the water contains nutrients that promotes plant and algae growth. These dams are contaminated by cyanobacteria fed by sewage and stimulated into exponential growth due to elevated temperatures. A common species of cyanobacteria produces microcystin which is a potent toxin similar to cobra venom. It has been found that the microcystin levels found in many of the major dams such as the Hazelmere, Vaal, Midmar and Hartbeesport are amongst the highest worldwide and besides the obvious health consequences that could unfold should this situation persist, there are obvious investment risks especially within the developed world which regard

microcystin toxin levels that are three levels below that which is found in South Africa with extreme concern. It is one thing to be aware of a problem and its potentially catastrophic consequences, it is quite another to have in place the mechanism to be able to deal with it or better still, to eradicate it. However, recent evidence suggests that none of the country's 1085 water supply systems have the capacity to remove it (Jeffery 2015).[35] Furthermore, the wastewater treatment works that are administered by municipalities are invariably responsible for the quality of water and if they fail to maintain the water infrastructure, this regularly ends up in the water, becoming an even bigger problem.

5.3 WATER MANAGEMENT

The current situation with regards water management, is eerily similar to that which we've just experienced regarding electricity provision. There have been years of erratic planning, severe underinvestment in infrastructure and in many cases the sale of this resource (water) at prices that do not adequately reflect the actual cost of supplying it. Furthermore, the cumulative effect of this, combined with a debilitating drought has finally manifested itself with the prospect that the country could soon experience nationwide water cuts. In some places, Gauteng and the City of Cape Town, water restrictions are already in place. Smaller municipalities will be hit first, and hardest. The Kannaland Municipality (Caltizdorp) only has a month of water left while parts of KZN – northern Ethekwini, the South Coast and the rural north – are facing water restrictions as dams dry up. If this persist, much of South Africa will be declared an official drought zone. The Ugu district municipality in southern KZN, recently announced that some areas would have water 'restrictors' installed while others would experience scheduled water interruptions. The two local municipalities hardest hit would be Umuziwabantu (Harding) and Vulamehlo (inland from Pennington).

Furthermore, allegations persist that large consumers, particularly industrial users are accused of receiving water at discounted rates and in some cases of paying a flat fee for water that does not increase irrespective of their usage.[36] Not surprisingly, government has begun a review of its water pricing strategy. Ironically, this coincides with moves by industry to reduce their water footprint through recycling and a variety of efficiency measures. The net effect of this would to reduce their reliance on state water suppliers, thereby lowering their water bill to municipalities.

[35] Also Turton 2015

[36] This is not applied uniformly and the price differs between municipalities, water boards or the national department.

5.4 MUNICIPALITIES and WATER TREATMENT WORKS

Many of the reasons for the current water problem can be linked to the sorry state of the bulk of the 824 municipal water treatment works that are scattered across the country. These plants receive 4900million litres per day (Ml/d) of sewage flows of which only 1259 Ml/d (26%) is treated satisfactorily while the remaining 73% flows back into the country's rivers as partially or untreated sewage (Jeffery 2015). The most likely scenario is that municipalities fail to treat effluent properly at the sewerage works before it is returned to rivers. A case in point is the Olifants River in Mpumalanga as it courses from the eMalahleni to the Kruger through six water supply loops which all derive their water from a sewage contaminated waterway. Most of the country's major river basins are similarly afflicted and the situation is exacerbated by the fact that very few of the current potable water treatment works are able to effectively source their bulk water from rivers that are uncontaminated by sewage.

Municipalities lose R11 billion each year in distribution losses that includes leaks and unpaid or unbilled water. In the 2013/14 financial year Johannesburg's nonrevenue water (lost,unbilled,stolen) was 41%, Ekurhuleni's was 38% while Cape Town's was slightly above 21%.[37] It was recently reported that the city of Durban lost 237 million litres every day due to leaks and that this amounted to R602 million per year. Furthermore this has been part of an ongoing trend; the city lost 36.4% of its water in 2008, 38.9% in 2009 and 37.5% in 2010. [38] For most municipalities, water tariffs are the third most important revenue source[39] and according to the recent State of Finances Report, it constitutes 12% of Johannesburg's revenue, while for eThekwini it is 11%, for Cape Town it is 10% and Ekurhuleni it is 13% (Donnelly: Drought bites everywhere). Rand Water sells water to large industrial consumers who make up 3% of their revenues at a slight premium compared to other customers such as cities of Johannesburg, Tshwane and Ekurhuleni (which account for 90% of its revenues). Their charges are intended to reflect the true cost of supply and therefore, as a result of the complexity of the network to facilitate distribution to municipalities, it is more expensive to supply domestic users as opposed to one bulk point for industrial users. In addition, large industrial customers pay to have the infrastructure installed and this is invariably an upfront payment. The drought however has changed this picture somewhat and utilities such as Rand Water, in reviewing this scheme would probably have to treat all customers, including industrial users equally. The only exception would be Eskom and Sasol, who are both large consumers, but since they receive untreated water it is highly unlikely

[37] For Cape Town this figure includes free water provided to informal settlements and water not accounted for due to metering inaccuracies.
[38] Manda, S (2015) *City losing 40% of its water* The Mercury
[39] After electricity and rates

that they will be affected by restrictions. It is doubtful whether a single price exists for industrial water users who normally derive their supply from municipalities and water boards or for the very large users who get raw water from national departments. Instead the cost of water varied from place to place and depended on the volume and quality required.

6. SOLUTIONS

As world populations increase and the flight to urban nodes increase, water utilities across the globe will come under increasing pressure to provide water. In the world's rural hinterlands the situation is even more acute. In rural Africa, poor maintenance has resulted in an estimated 50 000 water supply points failing. This results in 1000 children dying every day from waterborne diseases. Furthermore a lack of visibility over water consumption in developing countries has exposed water companies to commercial losses of up to $2.6bn per year. Interestingly, it is this very problem that has provided opportunity to a totally different sector to make an astounding contribution. Water dispensers have been developed for impoverished areas which allow for integration into the water supply of communal water points and mini grids in off grid areas (where water is drawn from the ground). In order to access the water, people charge a smartcard with credit via their mobile phones, insert it into the dispenser and pay for the water that they require. Such systems have been active in seven African countries, including Kenya and Uganda. With no cash transactions taking place, close onto 100% of the revenues from the dispensers are automatically directed into the water utility. This means that companies are able to demonstrate the transparency that is required by donors.[40]

Although South Africa's policy and legislative environment is well developed, there are nevertheless huge challenges with regards implementation. Plans are afoot to develop an independent regulatory framework for the water sector. The South African government declared 2014 as the target for providing basic water supply and sanitation to all. The previous targets were in 2008 and 2010. One 2014 target in particular was to curb water losses by 20% and government intended to spend R30 billion on the establishment of 15 mega water resource infrastructure projects. It was estimated that municipal capital expenditure on water and sanitation services would be roughly in the region of R13 billion per year.

[40] Earley, K (2015) How mobile technology is creating a vital link to clean water in developing countries

To make water drinkable costs R4-R5 per kilolitre but this is invariably used to wash cars, water gardens or flush toilets.[41] This is a cost the country can ill afford, coming as it is on the back of an ever spiralling energy crisis and a remedy needs to be found quickly. As a start, a reduction in average household water consumption by 20% would assist in building the 8-10 year water reserve needed in order to circumvent future water cuts. Similarly, while much focus has been on building new dams, it should be noted that these are costly endeavours which invariably run behind schedule and most of the suitable sites were already used in the early phase of dam construction during the 1970s and 1980s. Instead of focussing on building new dams, the focus should shift to repairing existing pipelines. Water losses through leaking pipes, dripping taps and other infrastructure failures account for between 30-60% and if this were rectified, the urgency to build new dams would diminish. Some municipalities have been proactive in this regard; Durban has embarked on a programme to repair its water infrastructure and will recoup the cost in under a decade. Unfortunately smaller municipalities do not have this luxury; many are unable to collect monies owed for water services or in some cases are unable to send accounts through to users.

There are efforts to investigate how our water is used, in particular water that is of drinkable quality. The WRC is considering a shift towards more water efficient waste management technologies as well as new ways of thinking about waste management. Some of these new methods include the replacement of our current toilet systems with pour flush systems which use half a litre of water and bio waste systems which use no water at all. Similarly, waste infrastructure could be decentralised and be located much closer to households. Furthermore, consideration could be given to providing households with grey water for sanitation rather than drinking water which is currently the case. Durban Water Recycling, a private plant commissioned by eThekwini Municipality in 2011, supplies 40 million litres of recycled water daily and provides a compelling case of harnessing water conservation to meet rising demand.

Another area to consider efficiencies is agriculture. At least 60% of the country's water use goes to irrigation. While the agricultural sector accounts for 2.39% of GDP, the effect of the drought on the sector, which will result in rising food prices, has much larger economic ripple effects. The issue though is to ensure that South Africa's irrigation is efficient, in other words, the same amount of food could be produced with less water and this could be achieved with the introduction of irrigation technologies that replaces flood irrigation systems with micro jet and drip irrigation. Consideration

[41] Mathews, C(2015) SA's water crisis is already here, warn engineers

could also be given to satellite technology that would enable farmers to better predict yields as well and this could be complimented by the introduction of drought and salt-resistant crops. Finally, groundwater, which has the potential to provide 30% of our water requirements should be regarded as a supplementary water source, to be used only when needed.

Part of the problem relates to the fact that since the last formal estimate was done in 2000 there has been very little update on how much water was being used and by whom. It is crucial to have this information in order to better understand future water requirements, particularly how these should be met and more importantly whether the price of water reflects the costs. One suggestion is that business pays the full cost of their water supply and where there are shortages they can then pay the marginal cost or perhaps the cost of building the next supply scheme which could then be built into the tariff. In order for any water related scheme to work though, government, including municipalities and water boards, must strive to implement the national water pricing strategy which applies to large users and the national pricing guidelines for municipal use.

Some analysts like Turton have suggested that the country moves to a dual stream reticulation economy which essentially means different streams of water with different qualities should be sold at different prices for different uses. If adopted, this will provide a tremendous boost for technological solutions to recycle water. [42] Furthermore, Turton has calculated that if the country's total resource of 38 billion cubic metres could be recycled 1.6 times, this would be meet projected 2030 demand of 60 billion cubic metres. In order for bulk consumers (i.e. industry) to be eligible for discounts, they must demonstrate as ability to recover their own water, while the country should be able to recover the cost of infrastructure which was is currently happening. The private sector is already taking steps to reduce water consumption, to use it more efficiently and also to recycle; measures that are driven mainly by the desire to reduce cost. This is particularly important as most big users of water have just had to implement factory-wide measures to curb energy costs so they have an added incentive to address water related issues as well. However there is a concern that as industry becomes more self-reliant, there will be revenue implications for municipalities for whom industry is a key customer.

[42] Donnelly,L (2015a)

The most cost effective method of distribution will depend on the population density, and since the eastern parts of the country is the most densely populated, a centralised water distribution system looks to be the answer. The model for its establishment is a Public Private Partnership whereby a private operator could build and maintain the distribution system. One benefit of this is that local government could specify the guidelines for keeping the pipes clean while the requisite provincial government department could distribute the funds to the PPPs to manage the pipes. The western provinces, which are relatively sparsely populated, would, due to the prohibitively expensive cost of maintaining a centralised distribution system, need to devise a decentralized water distribution system that could include wells, pumps and rainwater collection tanks.

The DWA has been able to claim some successes regarding its programmes, water access being one of them. Between 1994 and 2012, water access has increased from 59% to 94.7%, although there is a backlog of 710 000 households, predominantly in rural areas and informal settlements (Munshi, 2012:34). Water demand is currently higher than envisaged in the National Water Resource Strategy document of 2004, due in part to fact that the population has grown to 55 million which was only anticipated for 2025. Furthermore, the National Department's 42% increase in rolling out piped water to domestic households, has surpassed initial projections. However, while commendable in that this has improved the living conditions of millions of South Africans, it has nevertheless put enormous pressure on limited water resources. Finally, the strict standards for wastewater treatment have not been adhered to and instead the deterioration in the quality of return flows has been so marked as to imperil the quantity of suitable water that is available (Turton, 2015:10).

Considering the Johannesburg which was founded on gold without much thought given to its proximity to freshwater sources, South Africa's economic centre is in an unfavourable position in terms of its water supply. The Vaal River supplies most of the water for Johannesburg and Pretoria but it does this by flowing first through mining and power generation plants, encountering acid mine drainage and other pollutants along the way. With very little wastewater treatment to offset the damage, the water is highly polluted before reaching the municipalities where it is intended for human consumption. One strategy is dilution; water is released from the Vaal Dam to dilute the water enough so that it is suitable for human consumption but not only isn't this a sustainable solution, it also waste an extraordinary amount of clean water in the process.

Large water users like Nestle, Eskom, Anglo American and SABMiller have expressed concerns about the security of the country's water supply (Munshi, 2014:35). There are solutions which can be emulated such as that adopted by Sasol which needs 150million cubic litres each year to operate, at least 80% of which it receives from the Vaal River system.[43] In Gauteng's Emfuleni district it found that it could save 10 times more water by reducing leaks in the townships than by making water savings in its plant. The company also embarked on a German Agency for International Co-operation funded initiative with the Emfuleni Municipality that was aimed at tackling leaks and which also included workshops on teaching residents about water conservation. Consequently, between April 2012 and June 2014 close onto 6.8 million cubic metres of water was saved in Sebokeng and Evaton.

This saved the council an estimated R37 million and represented an 8.4% reduction in demand. Sasol is also involved in a R1.3 billion water recovery growth project at their Secunda plant which will treat about 3.4million cubic metres of high organic waste water. [44] It has become apparent that public private partnerships are probably the route to go in order to address the situation. In this regard, the country can learn from Namibia which is almost a decade ahead in terms of planning. The capital Windhoek has been able to overcome the total absence of freshwater resources through an assortment of waste water treatment projects that have had strong private sector buy-in. A public private partnership was used to construct a wastewater reuse plant that supplies 30% of Windhoek's water (Munshi,2012:35). Similarly, the private sector could engage in a build, own and transfer model where once established, new infrastructure could be handed over to the state. There are numerous examples of such BOTs in existence in Africa and these include the wastewater treatment plant near Cairo which garnered $200 million in private investment. Similarly the BOT model has been used for potable water treatment plants, including desalination plants in North Africa. Another option is the lease agreement wherein the public sector retains ownership of water infrastructure but the responsibility for daily operations is transferred to the private sector and successful examples include the Cote d'Ivoire whose 1959 project continues to provide water to 7 million people. Based on the foregoing discussion it is possible to discern a few options to increase SA's water supply and these include the following:

[43] This is roughly 4% of the demand on the river.
[44] Donnelly (2015b)

Table 4 Increasing SA's water supply

Build more dams
More than 70% of available water is from dams and rivers and the limit to the development of surface water sources has almost been reached. However, there are a few dams in the pipeline and these include De Hoop and the Spring Grove Dams as well as the second phase of the Lesotho Highlands Water Project. A huge problem with these large scale infrastructure projects though has been construction delays and budget over runs.
Sewage plants
if upgraded and properly maintained, can yield 5 billion litres of safe water per day. This grey water could be treated to potable standards if the appropriate technology can be installed. In order to do this they would need to be managed properly in line with their current technical capacity to ensure that they can return 5 billion litres per day of safe water back into rivers. Thereafter they can be upgraded with new technology to ensure that 5 billion litres of water of drinkable quality is produced
Tap groundwater
Groundwater use in SA is about 2 billion m^3/year and another 5.5 billion m^3 is available. This is an attractive option for small towns, mines and individual users.
Water meters
One way out if this quagmire is to impose limits of water use and charge penalty tariffs to households that exceed their quota. In order to do this, there needs to be adequate metering
Desalination
These plants, though expensive, can provide freshwater with a quick turnaround time and proposals for similar plants are being considered for Durban, Cape Town and Port Elizabeth. In order for this to be a success though, the Department would have to overcome some of the constraints such as the long term disposal of highly concentrated brine and the prohibitive energy costs.
Reuse
Reused water only accounts for 14% of available water and is an important option for industry. This is particularly since the reclamation and reuse of treated effluent has become financially attractive
Rainwater harvesting
This has not been fully quantified in SA. Applied primarily in rural households it could become an important source of drinking water, livestock and irrigation water. Roof rainwater tanks have become prevalent in many municipalities particularly for domestic use.
Water conservation and water demand management
This is the most important means of reconciling the water balance. The DWA believes that water use in larger systems can be reduced by up to 30% through the adoption of these strategies. Poor management in some smaller towns has resulted in water losses of up to 50% and this is both a cost and a loss which this country can ill afford.

Source: Integrate water resource planning for South Africa-A Situation Analysis, reprinted from Munshi, R (2012)

7 LOOKING TO THE FUTURE

It is within the serious imbalance between water supply and demand referred to earlier, that the key attractions for investing in the water sector will become most manifest. By delineating these two discreet areas it is possible to identify those areas that will appeal to potential investors in what has been estimated to be a $450-$500 billion market(Gottelier,2014).

7.1 WATER INVESTMENT

All investments today are based on fundamentals such as interest rates and energy costs. Another factor that has become increasingly pertinent is that of water, particularly its availability, its cost and its usefulness. Water disruptions affect a company's supply chain and consequently investors put more emphasis on the potential for water shortages as risk factors for investments. In many respects, as alternatives to coal powered generated electricity has become increasingly prevalent, the focus has shifted inexorably to how best to conserve and maximise the limited water resources that currently exist.

Figure 1:The global water industry

Source:Gottelier 2014

To remain competitive, all companies have to be aware of their exposure to water risk and find cost effective ways to mitigate this. Water scarcity and the incorporation of water issues have become increasingly fundamental as companies re-orientate their investment strategies. Examples abound in global business circles: for instance how would Nike deal with a drought in a far flung rural area where the cotton that is required for their products is grown; how would nuclear power stations cool their facilities when groundwater and reservoirs levels are low and is required for public consumption. The global beverage industry provides interesting clues of how to address this.

In some instances especially where water is one of the essential elements of a company's product, they have to constantly manage the very effects of its possible scarcity. It takes 45 pints of water to make one pint of beer and only five of those pints are used in the brewery while the remainder is used to grow the hops and barley.[45] In 2008, SAB Miller determined that its entire supply chain, including the cultivation of ingredients, required nearly 8.4 trillion litres of water, this was almost double the amount of water used by Iceland in 2004. Companies like SABMiller are working hard to reduce their water consumption by 25% by the end of this year but it order to make their enterprise truly sustainable, they have to consider the entire value chain. Consequently they are involved in mapping the watersheds from which they derive their water and conduct water footprinting in all the countries in which they operate. This allows them to better understand the full water input at every stage of production and in so doing they are able to implement the correct water saving methods. Although the water footprint of beer seem excessive when a single glass of beer is 75 litres, wine is even more excessive, coming in at 120 litres of water per glass and while a single cup of coffee takes 140 litres of water to produce. [46]

The SA water utilities industry has total revenues of $3.3 billion (2012) and between 2008 and 2012 this represented a compound annual growth rate of 8.6%. Furthermore, it has been projected that $340 billion has been earmarked for the implementation of infrastructure measures within the next 15 years (Frankson;2015). In order for the country to meet the growing water demand, there would need to be a doubling of investment in the country's water resources over the next ten years. According to the recently released draft National Water resource Strategy, the country requires R670 billion to augment its water sector over the next 10 years and a funding gap of R338 billion has been identified. There are various short term challenges that need to addressed such as inadequate financing and poor investment in maintenance and refurbishment. The document also acknowledges the absence of effective financial management particularly with regards ring fencing of the water business and the need to be able to measure the actual cost of water delivery while ensuring cost recovery in an overall programme that benefits poorer communities and households.

Countries that are keen to increase their FDI have started forecasting the effects that droughts and water rationing could have on GDP and inflation rates and there are already tools in place to assist companies and countries in this regard. The World resource Institute's Aqueduct mapping tool

[45] "In South Africa, the total water footprint is equivalent to 155 litres of water for every 1 litre of beer…with the vast majority of water use (98.3%) associated with crop production, both local and imported" Targeted News Service. August 18, 2009. Water Footprint of Beer More on the Farm than in the Brewery. Retrieved from Factiva.com on October 29, 2009.)

[46] http://www.triplepundit.com/2009/10/water-wars-the-beverage-industry-as-a-canary-or-future-innovation-leader/

highlights those parts of the world that are experiencing some form of water stress and prepares forecasts about potential water risk. Conversely some investors also derive benefit from water risk particularly those funds that invest in companies that provide technological solutions to global water problems, particularly those that focus on repairing or improving water infrastructure.

The issue of ageing infrastructure is a global phenomenon which all countries have to address at one point or another and this huge expense also provides opportunities for investment. The World Business Council for Sustainable Development estimates that the total cost for replacing ageing water supply and sanitation infrastructure in industrial countries will in all likelihood be as high as $200 billion per year. In the USA alone it is estimated that there is a 20% loss from leakage in drinking water systems. The USA has 800 000 miles of water pipes and 500 000 miles of sewer pipes which are supposed to last 50 years but in fact the average age of water infrastructure there is 43 years. In order to overhaul the water and wastewater technology and estimated $1t trillion investment will be needed over the next twenty years, roughly $60 billion annually. Its water utilities are now being viewed as potential investment vehicles since not only will their services appreciate over time, but most of them will pay attractive dividends. It is anticipated that in order to overcome the infrastructural backlog, partnerships will have to be forged with companies that design and manufacture specialised parts, water monitoring devices, leak detection services and wastewater recycling technology.

Another area of possible investment opportunity is desalination. Although still a very expensive technology, the past decade has a decline in prices of over 60% once it reaches price parity with water importation, investment in that sector will spiral. Israel's Sorek facility is the world's largest desalination plant and provides 20% of Israel's running water and supplies 1.5 million people. There are currently 11000 desalination plants in 120 countries globally with an annual capacity of 1.5 trillion gallons.[47] The vast majority of these plants are in the Middle East and as the water crisis spreads across the globe, the investment opportunities that accompany the installation of these facilities will grow exponentially. The global desalination market is expected to show strong growth especially in coastal regions with relatively cheap electricity and the global market growth is anticipated at between 15%-20%. In the 1980s reverse osmosis helped drive the sector which was viewed as a panacea of sorts for droughts. With technological advances, the costs have fallen and new techniques have been unearthed which can desalinate water three times faster than through reverse osmosis.

[47] Using current demand figures as a base, this represents just 0.26% of global demand.

Furthermore the unit costs of desalination have decreased dramatically over the past three decades dropping from $2.50 per m³ in 2972 to $o.65 per m³ in 2010 (Gottelier, 2014:10). China's anticipated investment in this sector for 2015 was supposed to be in the region of $3.7-4.4 billion. This is being implemented on a small scale in SA.[48] The industrial and mining sectors desalinate used water for reuse and brackish groundwater desalination by reverse osmosis provides drinking water to small towns along the west coast. Desalinating acid mine drainage has occurred in in eMahahleni and there are now proposals for the Witwatersrand goldfields and for towns along the southern and eastern Cape coastlines.

Although both the developed and developing world have the same overall objective with regards water provision, their immediate priorities are markedly different and serve as interesting signposts for potential growth in the market. In the developed markets, the immediate priority is to maintain existing infrastructure within the ambit of tightening water regulations and consequently growth tends to be between 3%-4% per year. On the other hand, the developing world is still preoccupied with the initial development of systems and infrastructure, hence the 8%-10% growth. Within the global water value chain there are opportunities exist within the following areas:

Table 6: Opportunities within the global value chain

Water infrastructure
Pumps, pipes and valves-these are relatively commoditised products and growth in the emerging markets is estimated at 10%-15%.
Water reuse, conservation and irrigation equipment-there are attractive growth rates of up to 16% in the emerging markets and Asia
Metering technology-this is predominantly a developed market technology with the potential for growth in the double figures
Infrastructure projects-this is globally a 6% growth business with expectations of growth of between 12% and 24% in the emerging markets
Water treatment
Desalination, filtration and membrane technology-all filters eventually wear out and need to be replaced, resulting in above average earnings for investors, due in part to the high proportion of recurring consumables revenues that are invariably generated. Global growth forecasts hover around the 15%-20% mark with 26% annual growth forecast in China and 15%-20% in India. This category contains companies with high value added products and which command higher margins than other parts of the value chain.
Physical water treatment-these have companies with highly specialised, niche applications and include ozone and ultraviolet water treatment which are commonly found in industrial and utility applications. The global water treatment equipment market is set to grow at 2%-4% while China (13.5%) and India (15%-20%) have projected growth figures that are in line with that recorded as a whole for the sector.

Adapted from Gottelier (2014)

[48] SA currently desalinates 0.025km³ of water (Hedden & Cilliers,2015:5)

There is evidence that water-related investment are outperforming gold, oil and the wider stock market and it is predicted that the demand for it will grow exponentially. Across western Europe and North America close onto one in three people live in water that the UN refers to as a 'water stress' region. What's of concern with this statistic is that this is in the wealthy part of the world where "*population and urbanisation are increasing comparatively* slowly" (Dyson, 2014). The situation is more acute in the developing world whose rapid population growth and mega cities that house up to 20 million people are likely to experience water shortages. Water will be pivotal in meeting the need for food and energy in highly populated and rapidly growing countries like Brazil, India and China. Agriculture's insatiable use of water will increase even more as the demand for meat and water intensive agri-industries increases. Currently agriculture's existing water use is unsustainable, where supply is being reduced just as the need soars, so too are new forms of energy such as biofuels and shale gas extraction also intensifying the pressure on water supplies. This situation has resulted in water stocks (at 97pc) returning more than the wider stock market (51pc) and gold (43pc).[49]

There are numerous examples of the economic cost of a lack of investments in water. In Kenya floods in 1997/8 coupled with droughts between 1998 and 2008 was estimated at $4.8 billion (a 16% reduction in GDP). The Mozambican floods of 2000 caused a 23% reduction in GDP and 44% rise in inflation.[50] The overall economic loss in Africa due to lack of access to safe water and basic sanitation is estimated at $28.4 billion per year (roughly 5% of GDP).[51]

8. CONCLUSION

Water is now regarded as the highest global risk in terms of devastation, ahead of nuclear war or a global pandemic. The 2014 Global Risk Report that was conducted by the World Economic Forum identified the water crises as the third most significant global risk, far above failure of climate change mitigation (Hornby, 2015). This has added significance in South Africa as the country is not only experiencing a physical scarcity of water but also severe economic scarcity of water and in the latter instance, there are many lessons that can be learnt from those countries that have a good economic water security. These countries invest in well maintained water infrastructure, and also in highly skilled workforce that is committed to managing and maintaining their water systems.

[49] See also Bogoslaw (2009)
[50] UN water in a changing world
[51] UN water in a changing world

It is predicted that over the next five years there will be significant growth in the water infrastructure, wastewater treatment, desalination and water recycling sectors. This will become particularly prevalent as the debilitating effects of climate change become more pronounced and global water industry changes. Consequently businesses, municipalities, state regions and utilities will have to invest more in water technologies and infrastructure and there needs to be a different system of provision where efficient water use is rewarded. This will allow smart water meters to replace the existing ones and there should be lower tariffs and tax breaks for efficient use. Rain and grey water harvesting should be practiced countrywide and incremental pricing should be enforced for large consumers. It is estimated that by 2030 the water usage will have increased to 2.7 billion cubic metres which will leave a 17% gap in supply and demand. When one considers the projected population growth and economic development forecasts it seems highly unlikely that meeting the projected demand for water resources in SA will be sustainable. It is therefore imperative that long term, sustainable solutions are found to the current situation and that this crisis is used as an opportunity to catalyse solutions that benefits everyone.

9. REFERENCES

1. Aleem,Z 2015 *Why Water Shortages Are the Greatest Threat to Global Security* in http://mic.com/articles/111644/why-water shortages-are-the-greatest-threat-to-global-security
2. Bogoslaw, D (2009) Investing: the best water plays in http://www.businessweek.com/investor/content/jul2009/pi20090726_722550.htm
3. DBSA http://www.dbsa.org/EN/DBSA-Operations/Proj/Sector/Documents/Water.pdf
4. Donnelly,L (2015a) *Drought bites everywhere* in Mail & Guardian Nov 13-19
5. Donnelly,L (2015b) *Industry can ease the water crisis* in Mail & Guardian Nov 13-19
6. Dyson,R (2014) *Forget gold, invest in water* in http://www.telegraph.co.uk/finance/personalfinance/investing/11081169/Forget-gold-investing-in-water-could-generate-far-greater-returns-over-time.html
7. Earley, K (2015) *How mobile technology is creating a vital link to clean water in developing countries* in http://www.theguardian.com/sustainable-business/grundfos-partner-zone/2015/mar/16/how-mobile-technology-is-creating-a-vital-link-to-clean-water-in-developing-countries
8. Fioramonti,L (2015) *Water shortages about to put load-shedding in the dark* in http://www.bdlive.co.za/opinion/2015/05/05/water-shortages-about-to-put-load-shedding-in-the-dark
9. Frankson, L (2015) *African water industry at the centre of global investment* in http://www.infrastructurene.ws/2015/08/18/african-water-industry-at-the-centre-of-global-investment

   Goldenberg, S *Why global water shortages pose threat of terror and war* in http://www.theguardian.com/environment/2014/feb/09/global-water-shortages-threat-terror-war

11. Gottelier, S *Investing in water: global opportunities in a Growth Sector*
12. Hedden, S & Cilliers, J (2014) *Parched prospects: The emerging water crisis in South Africa* Institute for Security Studies
13. Hornby,B (2015) *And then there is the water crisis* in http://www.bdlive.co.za/opinion/2015/02/20/and-then-there-is-the-water-crisis

14. http://12.000.scripts.mit.edu/mission2017/case-studies/water-access-in-south-africa/Water Access in South Africa
15. http://www.bdlive.co.za/national/science/2015/11/03/why-the-water-crisis-is-far-worse-than-eskom-woes
16. http://www.green-world.it/en/aqua_love/how_much_water_on_earth.asp
17. http://www.sanews.gov.za/south-africa/sa-water-infrastructure-needs-investment
18. http://www.theguardian.com/commentisfree/2015/apr/05/observer-view-on-global-water-shortage
19. Jeffery, A (2015) *Induced water shortage threatens growth, development and health* in http://www.fin24.com/BizNews/anthea-jeffery-induced-water-shortage-threatens-growth-development-health-20151111
20. Mathews**, C(2015)** *SA's water crisis is already here, warn engineers* http://www.bdlive.co.za/national/2015/07/27/sas-water-crisis-is-already-here-warn-engineers
21. Munshi, R (2012) **SA's water infrastructure: Under Pressure** in Financial Mail
22. Teagle, A 2015 *No drop to waste: Tackling South Africa's water crisis* **in** http://www.dailymaverick.co.za/article/2015-11-06-no-drop-to-waste-tackling-south-africas-water-crisis/#.VlXWanYrIy4
23. Turton, A (2015) *Sitting on the horns of a dilemma: Water as a strategic Resource in South Africa* in Liberty, publication of the Institute of Race Relations
24. United Nations world Water Development Report **Water in Changing World**
25. Van der Westhuizen,(2011) *Collection, purification, testing and distribution of Water* in Who Owns Whom
26. Wales, A (2010) *Industry must become water smart* in http://www.theguardian.com/environment/cif-green/2010/apr/29/industry-water-smart