KNOWLEDGE MANAGEMENT AND INNOVATION (KMI) UNIT

DBSA Research Agenda

ISSUES AND OPPORTUNITIES IN SOUTHERN AFRICAN WATER SECURITY

April 2016

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Water security

Most metropolitan and large urban municipalities are currently water secure although there have been limited, short duration, supply interruptions due to administrative failures. Sanitation services have been sustained and expanded although the treatment of wastewater sometimes fails to meet standards. In small towns and rural areas, a substantial and growing proportion of households are already water insecure, due mainly to ineffective management of available infrastructure. While household sanitation improvements have been made, these are often not sustainably operated and wastewater treatment generally fails to meet standards. An increasing proportion of the fiscal transfers from national government, intended to support the provision of basic services, is being directed to providing higher levels of service, which are being expanded without adequate provision for subsequent operating costs. Limited control on actual water use, related to falling levels of payment for water, contribute to service failures.

Water resources are adequate to meet the needs of all metropolitan areas and most large towns in the short to medium term. Supplies for small towns and rural areas are constrained by the investments required. Water quality is deteriorating due to increased human impacts, with local 'hot-spots' (e.g. mining pollution) and poorly managed municipal wastewater works generally. Climate change will only become more significant than 'normal' variability in the long term (>20 years) but its potential impacts must be taken into account in current system planning. The ability of the relevant institutions to manage, develop and allocate the resource is in question. Catchments such as the Olifants are already at risk and processes to allocate limited water have stalled while catchment level management has not yet been generally established. Institutional reform to support resource development and management for large urban areas and industry is also delayed.

Financing opportunities will remain limited until there is greater clarity about and discipline in the implementation of government's policy on support for water services and a willingness to regulate the performance of muncipalities. Failure to proceed with the reform of institutions for water resource management is also limiting opportunities for off-budget finance in that sub-sector.

RISKS AND OPPORTUNITIES

Significant risks to South Africa's water security could cascade across many other sectors of social and economic life. At the same time, addressing these would create business opportunities, many of which could in present significant prospects for lending operations.

Many challenges could be addressed with better management at municipal level; this would be reinforced by more active regulatory intervention from national government. There is a clear case for greater oversight of the use of conditional grants backed by enforcement of conditions where substantial expenditures are associated with declining performance. In many cases, it would be reasonable to require specific functions to be performed by external service providers; these could be regional public utilities (water boards) or private contractors. There is however a risk that any substantial extension of the mandate of water boards might undermine their performance.

The principal risk in water resource management is that the performance of the planning-implementation-operation cycle will continue to deteriorate. This will leave systems more vulnerable to failure. The institutional reforms proposed in infrastructure management and development and the strategic oversight of planning and operation and

catchment management would help to reduce this risk. It would also reduce the burden on the fiscus and create more lending opportunities.

Municipal funding opportunities include:

- Traditional project based loans for direct implementation by the Client;
- Short-term 'grant-bridging' finance to municipalities;
- Performance based lending for revenue-enhancing development activities; and
- Financing of private sector and public utility partners for BOTT and similar projects.

Water resource funding opportunities include:-

- Limited recourse project funding
- Balance sheet structuring and funding of new WRM institutions

RECOMMENDATIONS FOR DBSA AND ITS PARTNERS

In **water services**, DBSA's engagement would be facilitated by policy clarity about the standards to be adopted and the focus of and balance between grant funds and municipalities' own sources.

In the absence of coherent financial policies for service provision in rural and small town municipalities, it will not be possible for DBSA to support their funding.

Delegation of municipal service provision to regional public utilities could undermine the performance of their present functions and their ability to raise loan finance.

Mechanisms to give external (public and private) parties assured access to inter-governmental transfers would substantially enhance the potential for service provision partnerships.

DBSA should draw the attention of national government to these issues whose resolution would facilitate a greater development finance contribution to enhancing and sustaining South Africa's water security.

In **water resources**, DBSA should continue to participate in the funding of DWS projects such as Lesotho Highlands Water Phase 2 as well as others, initiated by municipalities and water boards.

DWS should ensure that key systems are effectively managed and developed to sustain the water security of Gauteng, Ethekwini, Nelson Mandela Bay, Cape Town and surrounding regions.

DBSA should consider helping to facilitate and structure complex regional water management interventions in stressed areas such as the Olifants catchment and to deal with specific challenges such as AMD. This could identify potential partners and develop lending opportunities.

DBSA's engagement in the sector would be facilitated by the establishment of the proposed National Water Resource Infrastructure Agency, combining the financing role of TCTA and the operational and project development role of DWS's 'Water Trading Entity'. The establishment of catchment management agencies will also provide a useful focus for engagement.

General recommendations are that:

DBSA might usefully undertake a review of the risks that would be posed to its portfolio by a systemic failure of water sector management to guide its involvement in the water sector.

If DBSA chooses to increase its engagement in the water resource sector, a long term commitment will be required to significantly strengthen its internal strategic level capabilities.

SUMMARY: SADC ISSUES & OPPORTUNITIES

FINDINGS

Water security

SADC countries have in general not established full water security in urban areas while access to safe and reliable water in rural areas continues to be limited. The expansion of supplies is progressing as is the establishment of institutions that can sustain their operation. In the absence of infrastructure, there can only be limited response to drought. However, cooperative management of infrastructure on the Zambezi has reduced the impact of floods.

Water resources availability and management, including climate change

Most SADC countries use only a small proportion of their available water resources (only Swaziland and Zimbabwe use more than 10%). They are constrained by economic scarcity – inadequate funds to build the infrastructure needed to use available water more effectively and productively. The primary challenge for SADC countries is to manage the extreme variability of the 'normal' climate. Climate change impacts are not yet widely evident – the current drought is typical of historical 'El Nino' events - but should consider new investments ways to enhance resilience and reduce risks.

Water services

There are limited opportunities for commercial development finance lending into the water services sector. Concessional funding will continue to drive most of the region's investments in this sector, with the possible exception of Namibia and Botswana. There may be opportunities for PPP type arrangements for specific elements of water service development, particularly where these are associated with new economic developments.

Water resources

There are limited opportunities for commercial development finance lending into the water resources sector. There is clear regional demand for hydropower projects and there are opportunities to facilitate and fund its development, notably by identifying potential users. Opportunities to finance multipurpose water resources development may also arise in association with private sector development in areas such as gas production in Northern Mozambique.

RECOMMENDATIONS

DBSA should continue to participate as partner in large regional projects such as Lesotho Highlands Water Phase 2.

Since a South African offtake agreement is, in many cases, a critical success factor for regional hydropower projects, DBSA may have an opportunity to take a more active role in the preparation of such projects.

If DBSA chooses to increase its engagement in the SADC region's water sector, a long term commitment to strengthen internal strategic capacity will be needed.

Issues & opportunities in water security

1. WATER SECURITY, WATER RESOURCES AND WATER SERVICES

This report considers current issues in the water sector in South and Southern Africa and the potential opportunities that may become available for DBSA. It uses the perspective of water security to consider conventionally defined ***water services*** (the provision of water supply and wastewater disposal services for domestic, commercial, industrial and institutional use) as well as the development and management of multi-purpose ***water resource*** infrastructure which assures the availability of water from the environment as well as environmental protection.

For the purposes of this review, communities or countries are considered to enjoy ***water security*** when they have:-

> "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies"[1]

In South Africa, the Constitution of 1996 as well as the subsequent legislation distinguishes clearly between water services and water resources management. "Water and sanitation services limited to potable water supply systems and domestic waste-water and sewage disposal systems" (Schedule 4B) are functions for which a municipality "has executive authority in respect of, and has the right to administer" (s.156(1)). Other water-related functions, specifically the management of water resources which are not specifically allocated to provinces or municipalities, are the competence of the national government. For municipal water services, national government sets basic standards and regulates municipal performance.

In SADC, there is a diversity of arrangements for the allocation of these functions between different public institutions, outlined in Table 8 below.

Drought in Southern Africa has highlighted the challenges of achieving and sustaining water security. Aside from obvious impacts on agriculture and water supply services, hydropower generation in the region has been constrained while low stream flow and hot weather have also negatively impacted on water quality and the environment more generally. Over the past two decades, many parts of the region have also suffered from the impacts of floods which have disrupted agriculture and damaged transport and water infrastructure. But alongside these and other risks, there are opportunities to contribute to their mitigation.

[1] Grey D, Sadoff CW (2007) Sink or swim? Water security for growth and development. Water Policy 9 (6)

2. WATER SECURITY, WATER AND DEVELOPMENT, CLIMATE: STATUS

2.1 South Africa: Water services & Water resources

Water Services

Almost 95% of South African households have access to a **supply of safe water**, as measured by the provision of infrastructure against current national standards. 90 % have access to piped water either to the household or through a nearby public tap[2]; a further group has access to a borehole or other protected source bringing the total to 95%[3] as shown in Table 1.

However, the existence of infrastructure is not necessarily the same as reliable access to safe water. Reliability and safety are a function of both the operation and management of the water services system itself and the management of the water resources which underpin those services. Experiences during the drought that is currently affecting much of Southern Africa helps to elucidate the concept of 'water security' and the inter-relationship between resources and services.

Another set of issues relates to the safety of the water supplied. SALGA[4] reported that, at national level, compliance with drinking water quality standards in relation to bacteriological quality was at only 93% (the target is 99%). Only 64% of systems met the standards for safe operations, suggesting that the safety of supplies from the remainder were at risk.

The provision of sanitation services at a household level lags behind that for water supply. Access to acceptable **household sanitation** is more difficult to evaluate than water supply. The physical specification for basic sanitation had to cover a wide range of situations, from isolated rural households to dense, multi-story urban buildings. It is thus generic and simply requires:-

> "a toilet which is safe, reliable, environmentally sound, easy to keep clean, provides privacy and protection against the weather, well ventilated, keeps smells to a minimum and prevents the entry and exit of flies and other disease-carrying pests."

Measured against this standard, in 2014 79.5% of households had access to what StatsSA considered to be **"improved" sanitation** that met government's basic standards, 'flush toilets connected to a public sewerage system or a septic tank, and a pit toilet with a ventilation pipe' (see Table 2). This was up from 62.4% in 2002 (Table 3). Access in the rural provinces ranged from 54% in Limpopo to 78% in the Eastern Cape[5].

[2] StatsSA Household Survey 2014

[3] UN-JMP 2015 and see Table 1

[4] SALGA 2016 Municipal Benchmarking Initiative

[5] StatsSA 2014 Household Survey

There is however considerable contestation about the standards. Specifically, there is an understandable desire in most of the communities concerned to provide water-borne sanitation as the basic level of service and for each household to have a separate sanitation facility. StatsSA's Household Survey does not record how many households share a sanitation facility. Neither the standards nor the surveys cover the disposal of other wastewater which becomes a major problem in large settlements with household water connections.

Nor are statistics reported for the general performance of household sanitation services. However, respondents who used **shared sanitation facilities** complained of a lack of security (19.5%) and lighting (26%); a smaller but still significant proportion about blocked toilets (9%) or no water to flush toilets (10%). There is also no information at the household level about the quality of disposal and treatment of the effluent although this has been identified as a serious concern at municipal level.

Water services/water resources interface

The high level planning for South Africa's metropolitan areas aims to ensure that water resources are available to meet their demand at a 98% level of security, i.e. in in 49 out of 50 years. This goal has generally been met[6]. For water services, the regulatory goal[7] is that basic water supplies should be available "with an effectiveness such that no consumer is without a supply for more than seven full days in any year"[8].

While the water supply to the metropolitan areas has generally been sustained, there has been an increased incidence of localised problems and restrictions. In many smaller towns and rural areas, there has been widespread failure to meet the standard. At national level, 25.7% of households reported interruptions in service of more than 48 hours and/or more than 15 days per year and 12% reported that their service was "poor"[9]. This situation was particularly serious in rural provinces of Mpumalanga and Limpopo and deteriorated significantly between 2010 and 2014 in Free State and North West, where it was aggravated by drought.

Poor management of existing services has resulted in extensive uncontrolled usage and high levels of physical losses. The combination of drought and the failure to control and restrict demand led to serious supply failures in a number of small towns. Similar problems have affected rural water supplies, particularly larger regional schemes that distribute water over extensive distribution networks.

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[6] While there have been interruptions or limitations in supply in metro areas, these have usually been due to local distribution challenges although some restrictions have been introduced on a precautionary basis. The exception has been in the Nelson Mandela Bay area where, while water resources are available, there has been a delay in completion of a water treatment works to process it.

[7] Regulations relating to compulsory national standards and measures to conserve water under section 9 of the Water Services Act (Act 108 of 1997)

[8] It is proposed in draft regulations (Notice 1153 of 2015, Gov Gazette 13 November 2015) to reduce this standard and require that supply should be 'available for at least 350 days per year and not interrupted for more than 48 consecutive hours per incident.' These amendments have not yet been promulgated.

[9] StatsSA Household Survey 2014

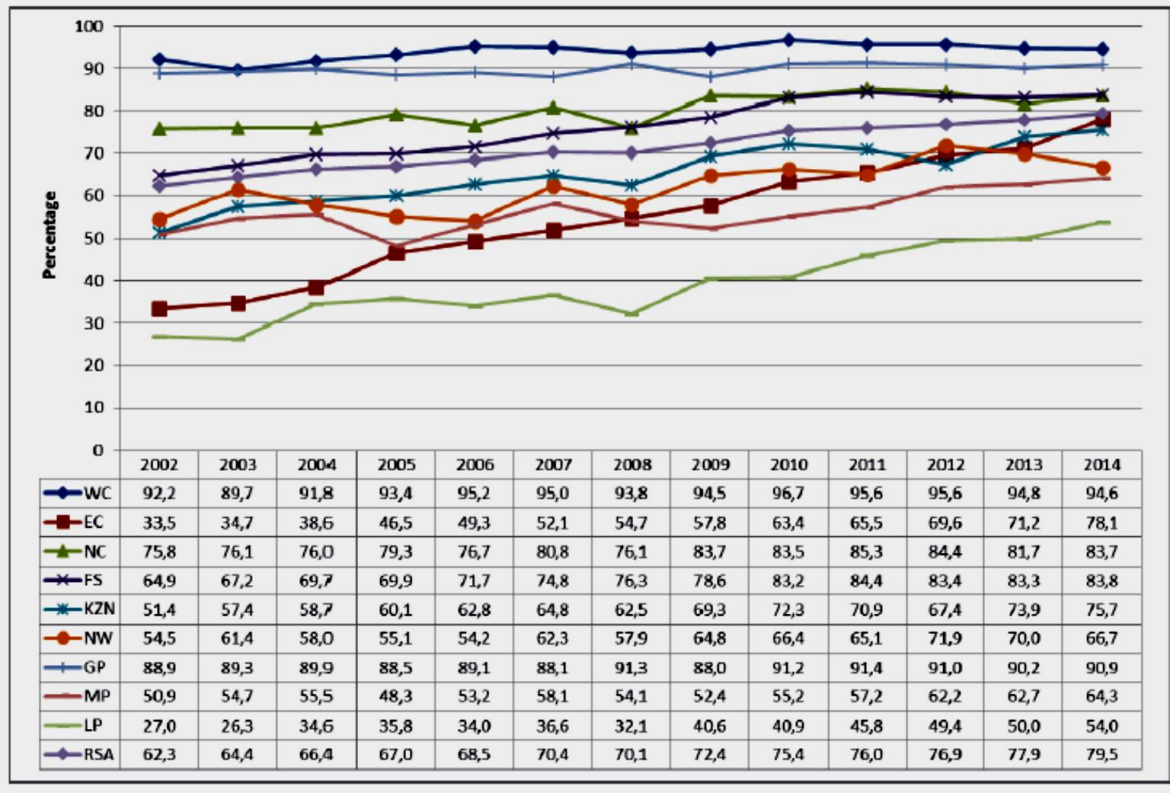
Table 1: South Africa – Domestic water sources 2002 – 2014

Water source	Statistic	Year											
		2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Piped water in dwelling	Number	4 409	4 607	4 749	4 980	5 163	5 611	5 622	5 862	6 294	6 504	6 845	7 221
	Percentage	40,8	40,4	40,5	41,2	41,6	43,7	42,3	42,7	44,4	44,5	45,3	46,3
Piped water on site	Number	3 009	3 367	3 490	3 681	3 838	3 501	3 743	4 019	4 106	4 055	4 051	4 213
	Percentage	27,8	29,5	29,7	30,5	30,9	27,3	28,1	29,3	29,0	27,7	26,8	27,0
Borehole on site	Number	290	188	160	141	155	155	190	157	212	203	259	293
	Percentage	2,7	1,6	1,4	1,2	1,3	1,2	1,4	1,1	1,5	1,4	1,7	1,9
Rainwater tank on site	Number	142	38	33	49	61	68	44	45	91	82	74	68
	Percentage	1,3	0,3	0,3	0,4	0,5	0,5	0,3	0,3	0,6	0,6	0,5	0,4
Neighbour's tap	Number	60	260	257	250	265	336	358	346	388	424	388	426
	Percentage	0,6	2,3	2,2	2,1	2,1	2,6	2,7	2,5	2,7	2,9	2,6	2,7
Public/ communal tap	Number	1 465	1 682	1 858	1 852	1 910	1 996	2 201	2 131	2 008	2 307	2 290	2179
	Percentage	13,6	14,7	15,8	15,3	15,4	15,6	16,5	15,5	14,2	15,8	15,2	14,0
Water-carrier/ tanker	Number	68	69	115	134	123	146	171	200	134	199	230	198
	Percentage	0,6	0,6	1,0	1,1	1,0	1,1	1,3	1,5	0,9	1,4	1,5	1,3
Borehole off-site/ communal	Number	300	297	273	273	199	248	209	177	183	165	189	199
	Percentage	2,8	2,6	2,3	2,3	1,6	1,9	1,6	1,3	1,3	1,1	1,3	1,3
Flowing water/ stream/river	Number	606	519	421	390	406	442	507	433	374	336	382	420
	Percentage	5,6	4,5	3,6	3,2	3,3	3,4	3,8	3,2	2,6	2,3	2,5	2,7
Stagnant water/dam/ pool	Number	77	62	35	30	52	37	30	41	53	30	42	55
	Percentage	0,7	0,5	0,3	0,2	0,4	0,3	0,2	0,3	0,4	0,2	0,3	0,4
Well	Number	146	113	76	124	64	70	50	37	75	55	71	77
	Percentage	1,3	1,0	0,6	1,0	0,5	0,5	0,4	0,3	0,5	0,4	0,5	0,5
Spring	Number	208	196	226	158	146	188	119	208	172	191	143	148
	Percentage	1,9	1,7	1,9	1,3	1,2	1,5	0,9	1,5	1,2	1,3	0,9	0,9
Other	Number	28	17	45	24	26	32	59	75	82	70	143	105
	Percentage	0,3	0,2	0,4	0,2	0,2	0,3	0,4	0,5	0,6	0,5	1,0	0,7
Subtotal	**Number**	**10 806**	**11 413**	**11 737**	**12 087**	**12 409**	**12 830**	**13 303**	**13 731**	**14 172**	**14 620**	**15 107**	**15 601**
	Percentage	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**
Unspecified	Number	8	12	16	20	76	55	0	0	1	11	0	0
Total	Number	10 814	11 425	11 753	12 107	12 485	12 885	13 303	13 731	14 173	14 631	15 107	15 601

Table 2: Sanitation facility used by households, by province, 2014

Type of sanitation facility	Thousands									
	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpumalanga	Limpopo	South Africa
Flush toilet connected to a public sewerage system	1 589	714	213	617	1 157	514	3 805	426	264	**9 300**
Flush toilet connected to a septic tank	33	20	13	17	172	58	103	55	60	**531**
Chemical toilet	8	*	*	*	28	*	31	*	2	**70**
Pit latrine/toilet with ventilation pipe	2	588	34	105	683	211	165	269	473	**2 530**
Pit latrine/toilet without ventilation pipe	5	224	22	67	471	327	267	328	598	**2 310**
Bucket toilet (collected by municipality)	37	12	9	42	3	3	51	*	4	**162**
Bucket toilet (emptied by household)	12	*	2	11	*	*	*	*	*	**34**
Ecological Sanitation Systems	*	*	*	*	*	2	*	*	*	**13**
None	28	132	17	17	124	55	31	81	74	**558**
Other	2	*	*	6	17	*	21	*	*	**49**
Unspecified	*	2	*	*	7	3	21	*	6	**44**
Total	**1 720**	**1 695**	**312**	**883**	**2 663**	**1 177**	**4 501**	**1 168**	**1 483**	**15 602**

Table 3: South Africa – Access to improved sanitation 2002 – 2014

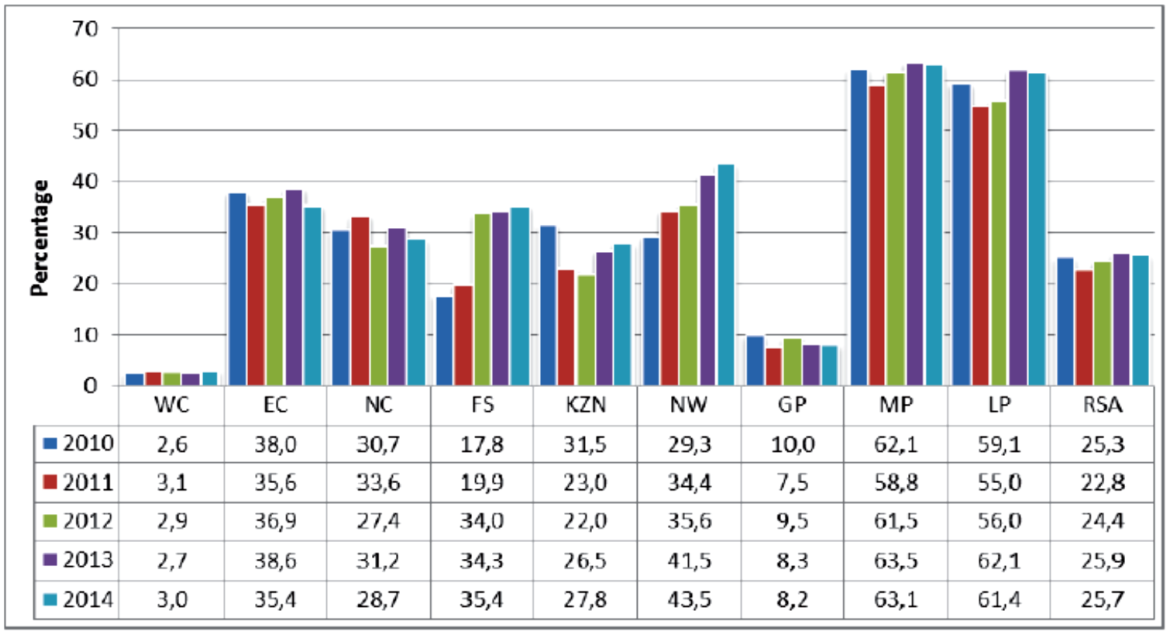


	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
WC	92,2	89,7	91,8	93,4	95,2	95,0	93,8	94,5	96,7	95,6	95,6	94,8	94,6
EC	33,5	34,7	38,6	46,5	49,3	52,1	54,7	57,8	63,4	65,5	69,6	71,2	78,1
NC	75,8	76,1	76,0	79,3	76,7	80,8	76,1	83,7	83,5	85,3	84,4	81,7	83,7
FS	64,9	67,2	69,7	69,9	71,7	74,8	76,3	78,6	83,2	84,4	83,4	83,3	83,8
KZN	51,4	57,4	58,7	60,1	62,8	64,8	62,5	69,3	72,3	70,9	67,4	73,9	75,7
NW	54,5	61,4	58,0	55,1	54,2	62,3	57,9	64,8	66,4	65,1	71,9	70,0	66,7
GP	88,9	89,3	89,9	88,5	89,1	88,1	91,3	88,0	91,2	91,4	91,0	90,2	90,9
MP	50,9	54,7	55,5	48,3	53,2	58,1	54,1	52,4	55,2	57,2	62,2	62,7	64,3
LP	27,0	26,3	34,6	35,8	34,0	36,6	32,1	40,6	40,9	45,8	49,4	50,0	54,0
RSA	62,3	64,4	66,4	67,0	68,5	70,4	70,1	72,4	75,4	76,0	76,9	77,9	79,5

As a result of these challenges, while it is correct to say that nearly 95% of the population is served by water supply infrastructure adequate to provide basic minimum supplies, the unreliability and poor quality of the services now provided means that the actual number who access safe water that complies with the minimum standards set by national government is closer to 70% (Table 4).

Table 4. South Africa Water service reliability

(percentage of households that received municipal water and reported interruptions that lasted more than 2 days at a time, by province, 2010-2014)



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
2010	2,6	38,0	30,7	17,8	31,5	29,3	10,0	62,1	59,1	25,3
2011	3,1	35,6	33,6	19,9	23,0	34,4	7,5	58,8	55,0	22,8
2012	2,9	36,9	27,4	34,0	22,0	35,6	9,5	61,5	56,0	24,4
2013	2,7	38,6	31,2	34,3	26,5	41,5	8,3	63,5	62,1	25,9
2014	3,0	35,4	28,7	35,4	27,8	43,5	8,2	63,1	61,4	25,7

Where waterborne sewerage reticulation has been provided without adequate water supplies, the lack of water often aggravates sanitation failures, leading to frequent blockages and spillages which create health hazards and pollution impacts. In addition, even where there is wastewater treatment infrastructure, its operation has failed in many municipalities, contributing to the pollution of local water resources and a general decline in water resource quality. This is aggravated by industrial pollution, particularly from the mining industry.

The maintenance of supplies for water services in metropolitan areas and the deteriorating quality of water resources due to poor wastewater management by other municipalities is a further area of interface between the management of water resources and that of water services.

Other dimensions to water resource management

The water resources management function goes well beyond its support to the provision of water services. The mandate and objective of government, as outlined in the National Water Act (NWA 1998),

"is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors -

(a) meeting the basic human needs of present and future generations;
(b) promoting 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;
(k) managing floods and droughts."

An immediate function is to ensure that the needs of principal water users, in addition to municipal consumers, are met sustainably and that the aquatic environment is protected. Irrigated agriculture is the main consumptive user of water in South Africa, with 60% of total abstraction[10]; afforestation accounts for a further 3% through evapotranspiration losses. Municipal services accounted for 27%, large industrial users (who were supplied directly) 3%, mining 2.5% and power generation 2% (although an increasing proportion of coal fired generation is 'dry cooled' and the Koeberg nuclear power station uses seawater for cooling) [11] .

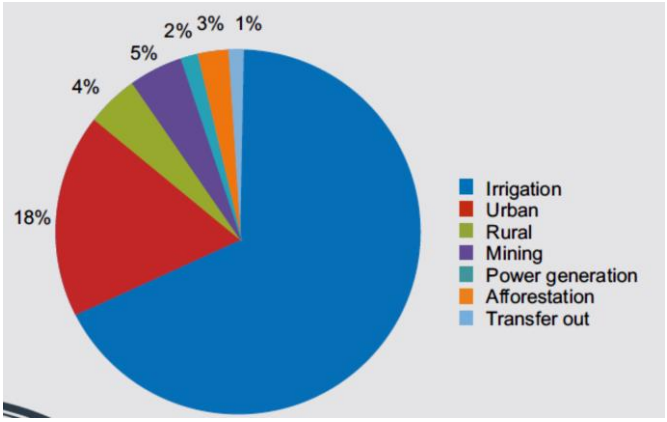


Figure 1: Contribution and current water needs of major economic sectors

[10] These terms highlight the challenge of accounting for water use. Some users such as power stations and municipalities, abstract water from a water resource but then return all or part of it, usually in a modified – warmer or more polluted - state. Other users, such as agriculture take water and apply it to fields where most of it is lost to the atmosphere through evapotranspiration – although, particularly where use is inefficient, some flows into groundwater or back to rivers. In the case of hydropower, water simply flows through a turbine and carries on down the river. All of these applications are considered to be 'water use'.

[11] DWA National Water Resource Strategy 2, v2, 2013

These figures do not fully reflect the demands placed on the resource by each sector. Since power station use is considered to be highly strategic, its supplies are planned to be 99.5% reliable (i.e. to fail only during the worst drought in 200 years). On the other hand, agricultural users are expected to accept much lower assurance and their reliability is often cited as 80% (failure 1 year in 5); as indicated, metropolitan municipal supplies are designed, built and operated to achieve a 98% reliability. In order for planning to be reliable, a critical management function is to maintain records of water allocated and used to ensure that the resource is not 'over-allocated'.

An increasingly important dimension of water resource management is the maintenance of acceptable **water quality**. This has to balance the capacity of rivers to remove pollutants and the amount of waste actually disposed. As part of this, it is also necessary to establish 'receiving water quality objectives' which reflect the environmental quality desired. This in turn will guide the licence conditions to be imposed on municipalities or industries that seek to discharge wastewater to the environment. These water quality management objectives and instruments also link to the broader concept of South Africa's water law which requires the determination of the 'environmental reserve', the amount of water that must be left in rivers for environmental purposes, and its quality.

For South Africa, a final strategic consideration is the coordination of the management of **rivers which are shared with neighbouring countries**, such as the Orange, Limpopo, Komati and Pongola. Agreements are in place with the countries concerned but, to maintain reliable supplies in South Africa and not prejudice our neighbours, particular attention has to be paid to water use in these rivers.

2.2 SADC: Water services & Water resources

The water security status in many of the SADC member states excluding South Africa was already poor before the current drought, which has aggravated underlying weaknesses. While countries such as Botswana, Namibia, Swaziland and Zambia have reasonably good urban water supplies, others such as Angola and Zimbabwe still face major problems and the drought has resulted in severe restrictions in both Botswana and Namibia. Meanwhile, across the region, rural communities still do not have adequate, safe supplies.

The distribution and management of water resources is also very uneven. SADC countries have access to some major water resources, such as the Zambezi and Okavango[12] rivers, while Namibia and Lesotho share the Orange River with South Africa, to which Botswana has also laid a claim. However, in some countries notably Botswana and Namibia but also Mozambique and Zimbabwe some major population centres are a long way from the available water resources. And, throughout the

[12] It is often not appreciated that the Okavango River has a Mean Annual Runoff of 10km3, over 90% of the MAR of the Orange River according to the FAO's Aquastat database.

region, there is limited infrastructure to allow the resources to be exploited. In consequence, only a small proportion of the available water is actually abstracted for use, as shown in the Table 5 below.

Table 5: SADC water service and resources - status summary

COUNTRY	URBAN SERVICES	RURAL SERVICES	RESOURCE
Angola	Capital and major towns do not have full, uninterrupted water supply coverage. Improving sanitation coverage	Very limited formal water services. Virtually no improved sanitation	Extensive water resources but limited infrastructure. Significant hydropower potential
Botswana	Capital and major towns were well served but recently affected by drought and slow expansion of infrastructure.	Extensive formal water services. Significant improved sanitation	Extensive water resources but very distant from main population centres which suffer water shortages
Lesotho	Reasonable water supply and sanitation provision in capital and towns.	Extensive formal water services. Limited improved sanitation.	Adequate water resources but limited infrastructure in difficult terrain.
Malawi	Capital and major towns do not have full, uninterrupted water supply coverage.	Limited formal water services. Some improved sanitation	Limited water resources on a per capita basis, considering rural nature of economy
Mozambique	Capital and major towns do not have full, uninterrupted service coverage. Sanitation coverage limited, particularly in peri-urban areas	Limited formal water services. Some improved sanitation.	Extensive water resources but limited infrastructure. Particular challenges in the dry but populous southern region. Existing hydropower with potential for more.
Namibia	Reasonable water supply and sanitation in capital and main towns	Extensive formal water services. Some improved sanitation.	Extensive water resources but very distant from main population centres. Already dependent on high tech solutions in urban areas
Swaziland	Reasonable water supply and sanitation in capital and main towns.	Some formal water services. Some improved sanitation.	Very high proportion of limited water resource used for sugar production.
Zambia	Reasonable water supply and sanitation in capital and main towns	Limited formal water services. Some improved sanitation.	Reasonable water resource endowment and significant infrastructure development. Significant hydropower,
Zimbabwe	Capital and major towns do not have full, uninterrupted service coverage. Sanitation services in poor state, in part because of absence of water, leading to health challenges.	Limited formal water services. Some improved sanitation.	Limited water resources in many parts of the country and growing backlog in the provision of infrastructure to meet domestic and economic demand. Limited hydro with some additional potential

(Sources: JMP 2015, Progress on sanitation and drinking water – 2015 update and MDG assessment. UNICEF and World Health Organization 2015. World Water Development Report 2012, UN-Water-UNESCO. Aquastat FAO)

Data on many dimensions of the region's water resources is limited, as the primary source of global water resource data (UN-FAO Aquastat database) illustrates. As an example, the most recent data for water use at country level is that from Zimbabwe (2007), which only reflects administrative allocations rather than actual use.

The data can, however, be used for indicative purposes. It shows is that, in general, countries in the region use a very small proportion of their available water. The exceptions are Swaziland, Zimbabwe and South Africa; in the first two, agricultural withdrawals, primarily for sugar, make up the bulk of consumption.

The data also highlights the fact that availability of water resources is not a primary constraint for the countries of the region. The principal problem is rather the absence of infrastructure to enable the available water to be exploited as well as the region's spatial challenges and financial limitations.

Table 7: SADC Water resource availability and use

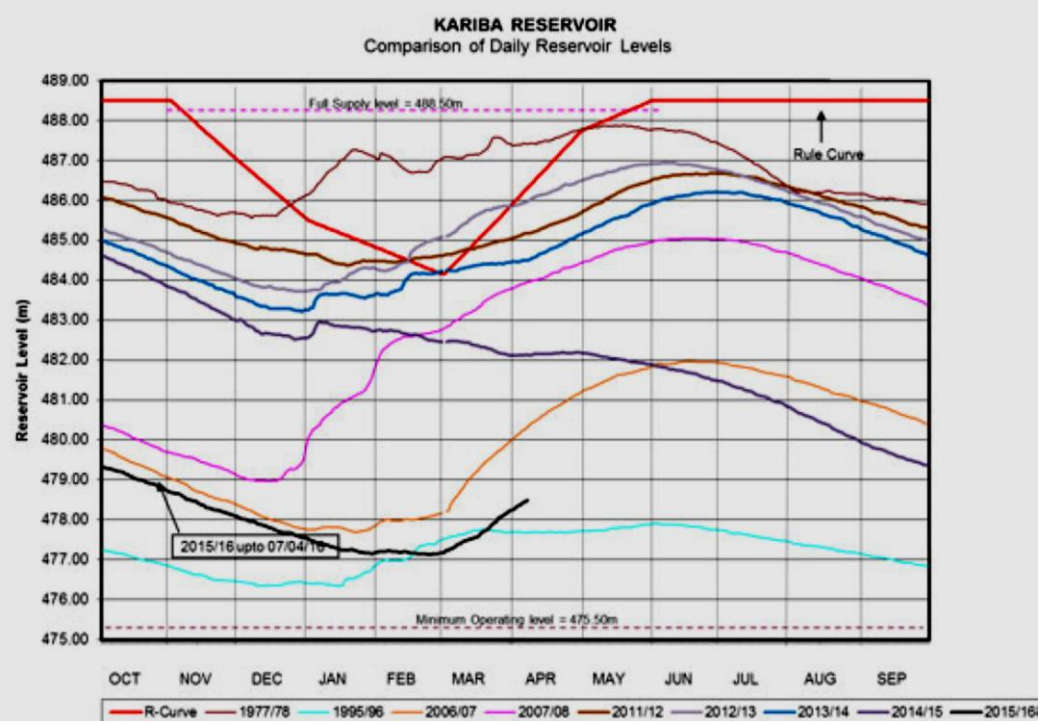
	SADC Total renewable water resource					
COUNTRIES	*Total/cap*	*used*	*agric use*	*use per person*		
	m3/p/yr	*%*	*%*	*m3/p/yr*	*l/p/day*	*Use data date*
Angola	5931	**0.48**	0.1	37	101	2005
Botswana	5411	**1.6**	0.65	109	299	2000
Lesotho	1415	**1.45**	0.13	23	63	2000
Malawi	1004	**7.9**	6.7	100	274	2005
Mozambique	7760	**0.41**	0.32	46	126	2001
Namibia	16230	**0.71**	0.5	147	403	2002
South Africa	942	**24.2**	15.3	270	740	2000
Swaziland	3504	**23.1**	22.3	963	2638	2000
Tanzania	1800	**5.4**	4.8	145	397	2002
Zambia	6464	**1.5**	1.1	141	386	2002
Zimbabwe	1282	**17.9**	14.7	269	737	2007

There is already significant hydropower production with ongoing expansion in Zambia and Angola. But a feature of the region is that the hydropower capacity of the Zambezi river has not been developed to its full potential with substantial opportunities for further development in Zambia, Zimbabwe and Mozambique.

The consequences of a failure to develop the full potential is currently being demonstrated. Hydropower generation on the Zambezi, particularly from the Kariba Dam, has been severely curtailed due to drought. It was already clear in June 2014 that after the dry summer of 2013/4, reservoir levels were dramatically below normal. But the early warnings to reduce dam outflows (and thus power generation) were not heeded by authorities who were already struggling with inadequate generating capacity at national level. The consequence was that even greater reductions in supply were required, highlighting the importance of disciplined resource management. Evidence of this is provided by the fact that Cahora Bassa Dam downstream was still over 60% full in January 2016 when Kariba had dropped to 15%.

If the three proposed projects on the river had been developed (Batoka Gorge, Cahora Bassa North and Mphanda Ncuwa), the same water flows would have generated more than twice the power produced by the existing installations. The failure to develop these projects reflects the challenges of coordination between the power and water sectors and the countries concerned, since the viability of any development will require adequate power purchase arrangements to be in place.

Figure 2: Kariba Dam reservoir levels



2.3 Challenges of climate variability and change

In general, as the experience on the Zambezi illustrates, the challenges posed by 'normal' climatic variability are far greater in the short (0 – 5 years) and medium (5-20 years) term than the impact of climate change which will only become significant in the longer term (20+ years). Many practitioners thus believe that the current priority for developing countries should be to manage current variability since it will build their capabilities for dealing with longer term challenges[13].

An example of 'normal' variability is provided by the current drought which is attributed to the well-known cyclical 'El Nino' phenomenon. Annual aggregate rainfall across all of South Africa in the 2015/6 season is reported to be 50% less than the long run annual average. At a local level, it is common for rainfall to vary by far greater amounts. Since river flow and groundwater recharge depend not just on rainfall but also on the aridity of the surface on which rain falls, streamflow varies even more. As an example, the average annual flow at the mouth of the Orange River is around 6 000 Mm3/year; the maximum annual flow recorded was over 26 000 Mm3/year, the minimum was 1 100 Mm3/year[14].

[13] Muller and Sadoff, Water Management, Water Security and Climate Change Adaptation: Early Impacts and Essential Responses, Global Water Partnership, Stockholm, Sweden, 2008.

[14] Water resources of the Orange River, DWA 2016

The reality of current extremes does not mean that the long term challenges should be ignored. In general, the assumptions made in resource planning for 'normal' hydrology should always be tested against current assumptions for the impact of climate change. When this is done, it is still usually found that, on a twenty year horizon, these impacts are relatively small and that, at longer time frames, the uncertainty is so great that little reliance can be placed on projections. Projections of supply for the Western Cape (see figure below) illustrate this – they show that the impact of climate change may be to require a slight acceleration in the implementation of potential augmentation projects. However, they also show that the reduction in water availability in order to meet the requirements of a strict environmental reserve in local river systems will be significantly greater than the likely impact of climate change).

Since there is limited reliable information about likely climate change impacts on water resources, the appropriate response is first, to consider the potential impact of possible extreme floods and droughts and design systems to accommodate them. Other contributors to resilience should then be reviewed. These may include developing a portfolio of sources for large systems, rather than relying on just one major supply; inter-linking systems, since the risk of both systems failing is lower than that of each individual system and also considering demand-side interventions.

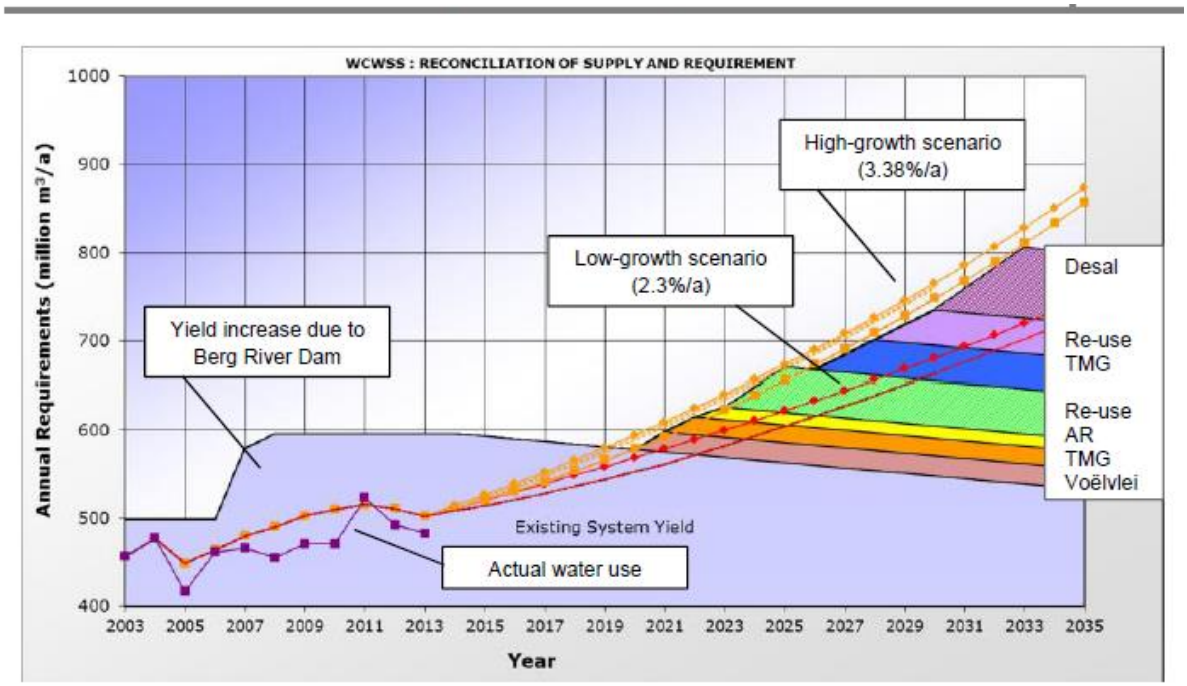


Figure 3: Water Reconciliation Strategy for Western Cape. Downward slope shows how climate change & environmental reserves may reduce system yields

(ex: Water Reconciliation Strategy for the Western Cape Water Supply System Status Report 2013)

On the demand-side, resilient water use strategies may include, in agriculture, a mix of perennial crops (vulnerable to loss in drought) and annual crops (which can be 'sacrificed') since this will be more resilient than a single perennial crop. Institutional arrangements must also be considered. During recent extreme, multi-annual droughts in Australia and California, temporary trading of water between farmers has enabled water use to be optimised with very limited economic losses as a result. It is thus unfortunate that South African water policy makers are considering restricting water trading[15], since this will reduce the flexibility required to manage future droughts.

3. WATER PLANNING, LOCAL NATIONAL AND REGIONAL

3.1 South Africa: Water services & water resources planning

While many of the challenges of water security have to do with management weaknesses that result in the ineffective use of existing infrastructure, there are also a range of investments required to optimise the use of, rehabilitate and expand existing water supply infrastructure. There also remains a significant backlog in access to adequate sanitation provision; in urban areas, this relates to the provision of water-borne reticulation and waste-water treatment. In rural areas, there is a continued need for support for improved on-site sanitation solutions at a household level.

In terms of the Constitution, formal responsibility for the planning of ***water services*** lies with local governments which have been nominated as water service authorities (WSAs). Municipal legislation empowers the Minister of Cooperative Government and Traditional Affairs (COGTA) to determine whether a District or Local municipality is nominated as the WSA for a particular jurisdiction. 153 municipalities are presently nominated as WSAs, out of a total of 278.

Service planning is guided by funding policy, which is that all households should be able to access basic water services. Where users are unable to afford this minimum level of services, the provision of the necessary infrastructure is funded by conditional grants from national government; operational costs are intended to be supported by the local government's equitable share of national revenue.

Municipal water services planning is governed by a series of overlapping requirements. In terms of the water sector's legislation, municipalities that are designated as WSAs have to prepare a Water Services Development Plan (WSDP) outlining how they intend to meet their service provision objectives. The WSDP is explicitly intended to form part of the municipalities' overarching Integrated Development Plans, required by municipal legislation[16]. In addition, National

[15] DWS Water Policy review 2014
[16] Local Government: Municipal Systems Act 32 of 2000

Treasury requires municipalities to include a section on 'Drinking water quality and waste water management' as part of the 'measurable performance objectives and indicators' supporting information in their budget documents[17]. One consequence of this plethora of planning requirements is that they are frequently treated as matters of administrative compliance and their content often bears little relation to actual priorities and available financial resources.

A specific challenge in water supply that has now become a focus in municipal audits and as a performance indicator is the extent of '**non-revenue water**' (NRW). This is water that is either lost through physical leaks in the public infrastructure (i.e. not inside private premises) together with water that is taken from the system but not paid for. The current levels of NRW are estimated to be 34% but this varies from an average of 33% in metro municipalities to almost 50% in rural municipalities with worst cases in small towns reaching 60% and in rural areas over 80%.

Although reducing NRW is now a national priority, including a target set in the President's 2010 State of the Nation address to 'reduce leaks by 50% by 2014', little progress has been made. In large measure this reflects general management weakness and, in particular, municipal failure to monitor and control water usage. The focus on NRW reduction is thus useful because it focuses attention on the need to establish the management systems that would enable reductions to be achieved.

A general services challenge is the need to ensure **adequate bulk infrastructure**. This includes treated water supply to ensure reliable supply to new developments. Where water borne sanitation is provided, wastewater transmission, treatment and disposal facilities must be built to cope with the additional load. Many cases of service failure are caused by the extension of reticulation infrastructure without adequate investment in the supporting bulk infrastructure.

Water boards, discussed in more detail below, have been established to provide a bulk supply to a number of different WSAs. The Boards, with their focus on the capacity of regional water supply systems, perform an important planning function. Because they are the bulk providers to a range of municipalities, they are in a particularly good position to monitor actual water use as well as to influence the management approaches of the municipalities and enforce conditions for supply; this includes indicating the cost of expanded supplies and cases where water conservation and demand management measures would be more appropriate than new supplies.

Responsibility for ensuring that there are adequate ***water resources*** to support service provision lies jointly with the municipalities and the national Department of Water and Sanitation (DWS) with the support of the Water Boards, where appropriate. Municipalities have the responsibility to identify the extent of the need and to consider options for meeting it. The DWS regulates the abstraction and use of water (and the return of wastewater treated to acceptable quality, to the environment). It is responsible for assessing requests and issuing licences and setting conditions for abstraction and waste discharge.

[17] Municipal Budget Circular for the 2010/11 MTREF, MFMA Circular No. 51, 2010

As part of its **resource planning function**, the DWS has the responsibility to assess the demands placed on any water resource from the diversity of its users and to seek approaches to reconcile reliably available supplies with the demands. The strategies that may be used for this purpose might include the recommendation to the municipality to develop and use local sources of underground or surface water; to take water from a shared resource; or to develop additional infrastructure that can make additional water available from a shared resource. Alternatively, the DWS may refuse to make additional allocations available until the municipality (or other users) take action to reduce demand through, for instance, programmes to reduce NRW.

Separate but related to this regulatory and planning function, DWS also has operational responsibility for the development and management of **national water resources infrastructure**. The approach taken at the resource level is to plan each supply system for the worst case (high demand, high level of assurance of supply) and then programme the implementation of investments and other interventions according to the actual evolution of demand and experience of resource variability.

The long-range planning of both water services and water resources requires a good understanding of both the physical resource and the socio-economic context and how they interact. Demand forecasting is difficult and many external projections are based on simple but questionable assumptions. Thus the pessimistic conclusions of a recent ISS report on impending water scarcity[18] are based on the assumption that water consumption will increase with GDP per capita and household incomes. This is contrary to the evidence, both South African and international, which suggests that the densification of settlements that characterises urban growth is associated with reduced water use with less use for gardening, etc. Increased household incomes are also associated with greater concern for environmental issues and in many OECD countries, income growth has been accompanied by a reduction in water consumption, facilitated by the availability of water efficient domestic appliances.

Similarly, in agriculture, it is widely predicted that **water use by agriculture** will have to rise substantially in order to meet the food needs of growing population. Yet both the OECD and the UN's World Water Assessment Programme[19] expect agricultural water abstraction to decline by 2050. This will reflect both increased efficiencies as well as a redistribution of production. South Africa's water resource planning has long assumed that there would be no major infrastructure investments to support irrigation agriculture; expansion of agriculture should be achieved with the available water resources through greater efficiencies[20]. The National Development Plan reflected this approach when it noted that

> "….the 1.5 million hectares under irrigation (which produce virtually all South Africa's horticultural harvest and some field crops) can be expanded by at least 500 000 hectares through the better use of existing water resources and developing new water schemes."

[18] ISS 2016 Parched prospects

[19] Environmental Outlook 2050, OECD; World Water Development Report, 2012

[20] Commission of Enquiry into Water Matters, 1970

This is a key element of the NDP's rural development strategies suggest that up to a million jobs might be created, including 300 000 associated with expanded irrigation.

Agricultural water use is coming under pressure as water use in other sectors grows. This is already evident in the catchment area of the Olifants river, a tributary to the Limpopo. This is perhaps the most stressed of all South Africa's major rivers due to the high level of water use for agriculture coupled with substantial increases in municipal water demand and the requirements of a rapidly growing mining industry.

To meet water needs in areas such as this, institutional arrangements are needed to enable **water re-allocation** to the priority municipal and mining sectors. Although the NWA sets out a process of 'compulsory licencing' for this purpose, this requires a complex process of verification of existing water use followed by proposed reallocations. The DWS has failed to implement this process and is still seeking new interventions to accommodate growing demands even as it opposes the other option, which is to allow **trading of water entitlements**. This situation poses significant future risks to all water users (see below).

As water becomes more intensively used, the **reuse of wastewater** becomes more important. This is already a significant resource and wastewater flows are taken into account in overall water resource planning. As an example, in the Crocodile-Marico system, wastewater from the Gauteng area makes up over 50% of the total flow and is by far the most reliable contributor to the stream which is the main source of water for parts of North West Province.

While there is significant potential for wastewater reuse, there is often confusion about the extent of that potential and the links with water quality management. So the ISS report states that wastewater is underutilised. It assumes that, because only 2 km3/annum of the 3.5 km3/annum total flow is treated, the remainder cannot be used. Yet the untreated water can be used. If it is not purified by natural processes in the rivers, treatment costs are simply transferred to downstream users. This kind of error can result in substantial misstatements - the 1.5km3 which is allegedly 'lost' represents 10% of total national water use in 2014. And one reason that wastewater cannot be reused where it is generated is that, as in the Crocodile-Marico, it often contributes a substantial proportion of downstream flows.

However, **planning to maintain the quality of water resources** is a growing challenge. Municipal and industrial users can usually treat polluted water to a useable quality although this incurs additional costs and is technically more demanding. However, agricultural users are affected by generalised salinity which, in the short term, limits the crop mix that can be grown and may damage soils in the long term. They are also impacted upon by bacteriological pollution insofar as some export markets impose water-related sanitary standards; this has already affected fruit exports from the Western Cape. These factors have to be considered in the planning and allocation of water resources as well as in the operation of water systems. At present, Vaal river flows have to be supplemented by discharges of stored water to maintain salinity at acceptable levels, increasing demands for system storage.

Desalination will be a future source of water. It is already being considered in planning for coastal cities (although it may also be applied in some inland locations). Due to its energy intensity, the cost of desalinated water is still high in comparison with other alternatives (including wastewater reuse), but it is falling as a result of technological innovation. The combination of high capital and running costs complicate the effective integration of desalination into supply systems as a complementary source. A common mistake made abroad has been to introduce desalination as an emergency response rather than as part of a systemic development. However, as with wastewater treatment, desalination opens opportunities for private sector collaboration, which are discussed below.

Planning the development and operation of water resource systems, dependent on highly variable and unpredictable inputs, to meet the needs of multiple user sectors is an information intensive activity. An important task for DWS is to monitor and share **water information**. The National Water Act 1998 (s.139) requires the national DWS to, "as soon as reasonably practicable, establish national information systems regarding water resources". These should cover hydrology, water quality and groundwater and there should also be "a register of water use authorisations". The stated objective is to provide information on the protection, use and management of the resource and to support the development of the national water resource strategy. While some aspects of this are undertaken, and there is information about some regional systems, there are some critical gaps, notably on water quality and water use, of which there has been no comprehensive national assessment since 2004.

Similarly with respect to **water services information**, s.67 of the WSA (1997) states that "The Minister must ensure that there is a national information system on water services" both to "provide data for the development, implementation and monitoring of national policy" but also to "provide information to water services institutions. consumers and the public to enable them to monitor the performance of water services institutions." Again, while some monitoring is undertaken, data is often not available. However, much of this data has not been made publicly available. For political reasons, there is a reluctance to release the results of surveys such as the Blue and Green Drop which review the quality of water supply and wastewater treatment and allow the performance of individual municipalities to be assessed.

3.2 SADC: Water services & Water resources

SADC countries have a range of mechanisms for the planning and delivery of water services (Table 8) and the development of water resources. In general, national government takes a more responsibility for service provision than in South Africa. There are active processes of decentralisation in place in countries such as Zambia; in Mozambique a national asset holding company manages individual concessions in different cities; while in Lesotho, Botswana and Namibia, water supply is the responsibility of a national utility.

Table 8: SADC Institutional responsibility for water service planning, investment and operation

COUNTRY	Water service planning*	WS Investment	WS Operation
Angola	Urban – National Det (DNA) Rural – provincial authorities	DNA, Luanda utility	Luanda utility Provincial/municipal
Botswana	Urban & Rural villages: WUC	WUC	WUC
Lesotho	Urban - WASCO utility Rural – Dept Rural Water Supply	WASCO utility DRWS	WASCO utility Outsourcing
Malawi	Urban – Urban water boards Rural	Water Boards NGOs	Water Boards CBOs
Mozambique	Cities, large towns – FIPAG Small towns Rural - PROSANAR	City water DNA/FIPAG Sanitation & towns - AIAS Rural - PROSANAR	Management concessions Municipal management Community management
Namibia	Urban: NAMWATER & municipalities Rural: Min. of Ag & Water	Urban: NAMWATER & municipalities. Rural: Min. of Ag & Water	Urban: Municipalities Rural: Min. of Ag & Water
Swaziland	Urban & Rural: Swaziland Water Supply Corporation	Urban & Rural: Swaziland Water Supply Corporation	Urban & Rural: Swaziland Water Supply Corporation
Zambia	Urban: Commercial Utilities Rural: Min LG&Housing RWSSU	Urban: Commercial Utilities RWSSU	Urban: Commercial Utilities RWSSU
Zimbabwe	Urban - Municipalities Rural - ??		

* In most cases, responsibility for sanitation service provision follows that for water supply; in some, as in Mozambique and Angola, it is addressed by separate institutions.

Given the scale of need in most SADC countries, planning consists of the identification of potential interventions to address specific opportunities and challenges. Actual implementation depends on the availability of resources. Since most countries are dependent to a greater or lesser extent on external financial support, the priorities and preferences of development partners have a significant influence on decisions.

Responsibility for **water resource development and management** in SADC countries resides in national government although there is some delegation and delegation to government agencies, for example, ZINWA in Zimbabwe and decentralisation, as with the ARAs (regional water agencies) in Mozambique. Given the relatively limited infrastructure endowment, a key focus for water resource managers is the monitoring of the resource and the planning of infrastructural interventions. In this regard, the challenge of water information is even greater in other SADC countries than in South Africa. Monitoring networks are sparse and stations often not maintained. This means that infrastructure planning has to rely on estimates and assumptions which may result in sub-optimal investments.

3.3 South Africa: Opportunities for cooperation and innovation

The diverse and local nature of water services provision offers many opportunities for innovative approaches and collaboration between government, water users and the wider private sector. However, the site-specificity of the problems means that it is often not possible to develop generic approaches that can be applied in a number of different situations. This, together with the relatively small scale of interventions and the physical and institutional complexity of the systems concerned, makes it difficult to find and mobilise the technical and managerial support required for

implementation. Despite this, there have been some internationally recognised examples of innovation and partnership. Equally there are many examples where potential has been identified but it has not been realised.

Water treatment partnerships – services and resources

South Africa's institutional configuration and regulatory framework allows for a range of options to meet water service provision needs beyond the traditional framework of municipal management of services with investment funded by a combination of tariff based resources and national government grants. Metropolitan municipalities and Water Boards routinely use their cash flows and balance sheets to raise investment funds to maintain, rehabilitate and expand their infrastructure capacity. And, in practice, an increasing proportion of grant resources are spent on services beyond the 'basic' levels.

There are also a few long-running examples of management by concession which have continued despite changes in ownership of the original concessionaire. Largest amongst these is the 30 year Mbombela/Nelspruit concession which was initiated in 1999. In operational terms, the concession has performed reasonably well, achieving amongst the best service quality records in the province. However, it did not reach its investment targets over the first decade of the contract.[21]

More specific partnerships with industry have been achieved in a number of other locations. In Ethekwini and in the Limpopo platinum belt, municipal wastewater is being used as an input to industrial processes while in the Mpumalanga coalfields, treated wastewater from coal mining is being used to supplement municipal supplies.

In Ethekwini, the municipality avoided the cost of expanding a sea outfall to dispose of (treated) wastewater by deciding to treat it to a higher standard that could be used as a stream of water for industrial use. This project, which is considered to be the benchmark example of an SA PPP in water reuse was entered into, in part, because

> "Despite the proven technical feasibility of the reclamation project, the economic feasibility remained in doubt until 1997 …. The economic assessment was positive. The costs, technical complexity and the operational risks associated with the proposed tertiary water treatment plant were considered to be beyond the normal functions of EWS. It was therefore decided that a project for the tertiary water treatment works would best be implemented as a Public Private Partnership (PPP)." [22]

The private sector provided extensive technical inputs but the structuring of the 20 year takeoff contracts (with Mondi and SAPREF) was a critical success factor. DBSA was one of the funders of the project. While the Ethekwini project was driven by the municipalities need to dispose of waste water economically, the driver for the Limpopo/AMPLATS projects was mines' water requirement and the identification of municipal wastewater as a potential source.

[21] Case Study – Mbombela (Nelspruit) Water Concession, National Treasury PPP Unit, 2010

[22] The Durban water recycling project – the vision becomes reality, Gisclon 2002

Meanwhile, the goal of the Emalahleni water reclamation project is to enable the private sector coal miners to dispose of polluted water generated by their operations as cost-effectively as possible. It had been found that, while the coal mines used less than 5% of the water in the Upper Olifants Catchment, they generated almost 80% of the sulphate pollution that was impacting on downstream irrigators and other water users[23]. A number of companies, notably Anglo American, are now pumping polluted water from their Mpumalanga mines, treating it to potable standards and supplying it to the local municipality.

While most of the focus has to date been on wastewater treatment and reuse, **desalination offers new opportunities**. Small desalination facilities have already been built to deal with local supply shortages in a number of areas.

In Kenton-on-Sea, the plant was funded through a utility type structure. Designed to supplement supplies for short durations during the holiday season, it was funded through loans, backed by tariffs paid by high-income holiday-makers which include an annual availability charge. The Mossel Bay plant was built as an emergency response to a drought, which included reuse of wastewater and stormwater. It was funded primarily by national government (R92 million) and PetroSA, the largest industrial company in the town (R80 million). As is common in such cases, the drought ended before the plant had been completed in 2011. Local dams are now 95% full, and it is not clear how the desalination capacity will now be integrated into the supply system and the funding recovered. Some form of 'take or pay' agreement is required but its design, to ensure equitable outcomes for all parties, is challenging.

The experience in both Mossel Bay and Emalahleni highlights the need for **equitable mechanisms through which project-based treatment** facilities can be privately built and operated within public systems. Two questions arise in the particular case of treated industrial wastewater in Emalahleni, the equitable sharing of the costs of treatment between the polluter and the user of the treated water and funding arrangements in the event that the mining activity is terminated.

The long-term challenge is illustrated by the difficulty in agreeing responsibility for the operations and costs of treating acid mine drainage (AMD) in Gauteng. There, the mines responsible for the problem have closed, leaving very limited provision for post-closure environmental management. While it is likely that Rand Water consumers will carry the cost and that a public utility arrangement will be put in place to manage the system, tension remains between the need to reduce pollution driver (by limiting the ingress of surface water into the old mines) and the treatment of polluted water when it emerges. This would be aggravated if an agreement with a private contractor incentivised treatment throughput rather than interventions to minimise costs.

[23] The collection, treatment and utilization of water accumulated in the coal mines located in the Upper Olifants River catchment, CSIR/Wates Meiring Barnard, (presented at) Coaltech 2020, 2000

Water resources - Project finance approaches

With more conventional water resource infrastructure, there has been progress since 1994. Before then, most projects were funded directly from the national budget and costs (partially) recovered through water tariffs the national department which operated the schemes. Subsequently, the mandate of the Trans Caledon Tunnel Authority (TCTA) was expanded to allow it to implement projects on a limited recourse basis in cases where there was an adequate cash flow for this mechanism.

The TCTA was established in 1986 as an SPV to implement the South African component of the 1st phase of the Lesotho Highlands Water Project (LHWP) as well as to raise project finance for the entire project. In 2000, TCTA's mandate was expanded to allow it to undertake other projects as directed by the Minister of Water Affairs. Projects funded under this provision include the Berg River Dam (Cape Town); the VRESAP pipeline which improves the water security of ESKOM and SASOL; Spring Grove Dam (augmentation for Ethekwini); and the Mokolo Pipeline (supply to Medupi and associated mining operations). TCTA is also contributing to the implementation of the Olifants river development (to support platinum mining and rural water services in Limpopo province) and the emergency phase of the AMD management programme. In the latter projects, budget finance has been combined with market funding. Recently, however, the TCTA's mandate has been curtailed, notably on the Olifants. The reasons for this have not been explained but the results is likely to increase demands for grant rather than loan funding.

A number of smaller investments have also been made by Water User Associations (WUAs, formerly irrigation boards). WUAs are almost all agriculturally based but in some cases, private finance has supported multi-purpose water resource projects. The Impala WUA built the Bivane Dam on the Pongola river tributary in northern KZN, bringing more land under cultivation and increasing supply reliability for local municipalities as well as farmers; the Blyde WUA's reticulation project reduced water losses from open canals, making more water available for downstream users. Problems arose in both the Blyde and Impala projects when some members of the WUAs sought to escape their financial obligations. Similarly, in the Western Cape, the Koekedouw WUA project to repair and expand the capacity of an existing dam and promote the participation of emerging farmers failed, in part, because low fruit prices reduced the ability of farmers to meet their loan obligations. These cases highlighted the risks of lending to WUAs, which are essentially cooperatives.

However, one exceptional case involved the establishment in the **Olifants River catchment of the Lebalelo WUA** by a group of mining companies, to augment water supply to their rapidly expanding operations. This initiative, involved raising the Flag Boshielo dam and building and operating almost 100km of pipeline, the latter financed and managed entirely by the WUA. The challenges of this venture and the larger developments of which it formed part, are described in more detail below and illustrate the difficulties inherent in promoting public/private cooperation.

Cooperation Challenges: Lebalelo WUA and the Olifants River Water Resources Development Project

The Lebalelo project, which forms part of the larger ORWRDP offers an example of the potential for cooperation between different stakeholders at a local level. Investments were designed to make raw water available as a source for local government to use for the provision of domestic water services as well as to meet mining water requirements. The project was funded and is operated by the Lebalelo Water Users Association of which the mining companies are the primary partners.

The Lebalelo WUA has supported the operation and maintenance of local water schemes. But this has also highlighted the generic problem of local government (in)capacity to plan and coordinate the development of water services since, in many cases, municipalities proved unable to take advantage of this. The local water board (Lepelle) is now helping to build the water treatment works required. But the full potential for cooperative development of water resources for a variety of users in a highly stressed region has not been exploited and the opportunity to take advantage of the local private sector's financial, technical and administrative capacity has been lost.

At a larger scale, the Lebalelo pipeline and canal was part of a larger programme to increase water resource availability in the Olifants catchment. Other investments included the raising of the Flag Boshielo Dam, the construction of a new De Hoop Dam and the construction of bulk pipelines linking the various components of the system to each other and to users. The original intention was for costs to be shared between the mines and government with the TCTA undertaking to manage implementation of key elements of the programme and to raise the required funding. However, disagreements about cost-sharing have bedevilled what started as a cooperative project and much of the investment is now being funded by government.

While the Limpopo / Olifants cooperation started well with cooperation in the use of limited water during a process of augmentation of water supply (through the raising of the Flag Boshielo Dam and the construction of the Lebalelo transfer (a canal and pipeline project). This has now stalled amid a degree of acrimony. Problems have included:-

- Failure of local municipalities to plan to use water provided for domestic uses, resulting in the mines being accused of failure to deliver'
- Reduction in water demand due to mine replanning
- Fall in platinum prices, reducing overall mining investment in the region
- Changes in the expected yield of water from the system
- Changes in the allocation of water between social and industrial uses
- Disagreements over the pricing and funding models to be applied

A review of the process suggests that perhaps the most fundamental problem has been the loss of continuity due to changes of leadership on the government side during the process. Over a period of just 12 years, there were five changes of Minister and six Directors General. This was inevitably going to affect a project who strategic importance and complexity required ongoing high-level attention and direction. It is notable that, over this period, many of the private-sector participants remained the same.

Cooperation and innovation within SADC

There are extensive investment needs in all SADC countries for both water services and water resources infrastructure. However, the limited financial capacity of the sector and the countries means that there are few viable opportunities for commercial development finance. Most sector investment is funded through concessional loans and grants from the donor community.

However, within this broad landscape, there is a range of institutional structures for water service provision, including a number of innovative approaches. Zambia has promoted the use of concessions for service management which are operating on a commercial basis although with limited capacity to finance new infrastructure. Mozambique's FIPAG has successfully combined the management concession with continued ownership of assets and oversight over investment, mostly mobilised from the concessional development finance sector. In both cases, a formal independent regulator has been established.

There are also private sector water related opportunities where the development of a water supply can be undertaken. A new dam was built to supply irrigation water to a large banana plantation in Mozambique's Nampula Province while, in parallel, another was built nearby to supply Nacala town. A coordinated approach might have enabled commercial funding to be blended with grant funding. However, the current downturn in the mining sector has limited such opportunities.

Regional cooperation projects

There has been extensive discussion about the potential for cooperation on SADC's shared rivers. However, aside from a handful of well-known projects such as the various phases of the Lesotho Highlands Water Project there is limited scope for cooperative projects. In SADC's 2012 Regional Infrastructure Development Master Plan, only 3% (US$16 billion) of the total (US$428–558 billion) is proposed for water projects. Power accounts for 68%, transport 23% and ICT 5% and most of the proposed water investment is directed towards dam projects whose primary purpose will be power generation.

The need for cooperation between countries arises when there are proposals at a national level to develop the resources of a shared river. In this context, there needs to be a channel of communication so that countries can ensure that their interests are not negatively affected. These communications are guided by the SADC Protocol on Shared Watercourses which was the first technical protocol approved by the member states (approved in 1995 and revised in 2000). Countries also cooperate on information sharing and planning through River Basin Commissions. These Commissions have limited formal powers and it is notable that, in the case of the Zambezi, Zambia only joined the ZAMCOM in 2013 after the country had completed a number of substantial hydropower and irrigation investments. It is understood that there were fears that these might have been contested under a more activist ZAMCOM regime.[24]

[24] See Water and Regional Integration. The role of water as a driver of regional economic integration in Southern Africa. Muller M, Chikozho C, Hollingworth B, Water Research Commission 2014

4. FINANCING FOR WATER: OPPORTUNITIES AND INSTRUMENTS

4.1 South Africa

4.1.1 Institutions

Water services

As already indicated, the responsibility for water service provision in South Africa rests with municipalities that have been designated as Water Service Authorities (WSAs) The actual provision of services may be undertaken by other organisations acting as Water Service Providers (WSPs) but this is at the discretion of the WSA and subject to a regulatory process in terms of s.78 of the Water Services Act (1997). In a number of cases, municipalities have constituted their water services organisations as more or less autonomous **municipal public entities**, such as Johannesburg Water. There is also a public wastewater treatment utility (ERwAT) serving primarily the Ekurhuleni municipality but whose shareholders include Johannesburg and Lesedi municipalities.

In addition to public institutions, there are also a number of **private water service providers** contracted by WSAs. The largest of these contracts is that of the Mbombela municipality under a 30 year concession contract; the operator has changed over the duration of the contract and is currently the Singaporean owned SEMBCORP, which also operates a concession in the Ballito area of the Ilembe District Municipality, serving approximately 10% of the municipality's population.

In some regions, in addition to the municipal service providers, there are **water boards**, a family of regional institutions (National Government Business Enterprises in terms of the PFMA) established by the national DWS where there is a need to provide a bulk supply to a number of different WSAs. The terms of these supplies is established by agreement with the relevant WSAs, regulated by the DWS which also has the nominal power to regulate standards and tariff frameworks for municipal WSAs and WSPs. In addition to bulk supplies, Water Boards are also empowered to provide other services by agreement with a WSA. Aside from their bulk provision functions, the Boards can provide a range of other services to municipalities. While they may have limited capabilities in the management of reticulation, they are generally equipped to address the management of treatment and pumping works as well as larger scale transmission infrastructure.

Water resources

Future perspective. Catchment Management Agencies

The NWA provided for the establishment of 19 Catchment Management Agencies as a second tier group of water resource management institutions. Only 2 of the 19 were established between 1998 and 2015; subsequently, the number of CMAs has been reduced to 9, approximately aligned with provincial boundaries.

According to the Act, "*The purpose of establishing these agencies is to delegate water resource management to the regional or catchment level and to involve local communities, within the framework of the national water resource strategy.***"** In addition, every catchment management agency is expected "*to progressively develop a catchment management strategy for the water resources within its water management area. Catchment management strategies must be in harmony with the national water resource strategy."* In the absence of a catchment management agency, the Minister is expected to take these responsibilities.

In practice the DWS has concentrated on developing 'reconciliation strategies' for key demand centres. These make a range of estimates of possible future demand and consider the actions needed to bring supply and demand into equilibrium. In principle, the planning of interventions is based on the 'high demand' scenarios and implementation is based on the actual evolution of demand.

4.1.2 Projects and Instruments

There are literally hundreds of municipal water service projects at different stages of planning and implementation. It would not be useful to list them here since most are intended to be funded by budgetary grants or, in the case of the metro municipalities, using balance sheet financing. However, the DWS has also identified a set of 'mega-projects' which are included in the 2013 NWRS2 (annexed). This list also includes a range of projects in the water resource domain, at different stages of preparation.

Elements of the financing of water sector projects have already been dealt with above but it is helpful to consider the **overall framework**, since this has become increasingly confused. Internationally, there has been a focus on the "three Ts" of water financing, **tariffs, taxes and transfers**, the latter referring to international sources for developing countries.

A similar approach has been adopted in South Africa. User payments through tariffs are a key source of funding, both for infrastructure investment and operational expenses. Further resources are raised through rates, local taxes, which support the borrowing capability of larger municipalities. Finally, central government transfers to municipalities two streams of funding derived from tax revenue, the equitable share of revenue and conditional grants to municipalities.

The **initial policy intent** of the Reconstruction and Development Programme and subsequent water sector policies was that, for water services at municipal level,

- Infrastructure investment to meet basic needs would be funded by conditional grants where the costs were unaffordable to users;
- Operational costs of basic services would be funded through the equitable share and
- Infrastructure and operation of higher levels of services would be funded through tariffs, with investments supported by loan finance underpinned by tariff and rates income.

Any regional water resource water services infrastructure required would be funded through these mechanisms as would the cost of water resource development. Where water boards required loan funding, this would be raised against the balance sheet capabilities of the utility. Similarly, water resource projects serving large urban and industrial users would be funded either directly by government, with costs recovered through a Trading Account arrangement or through limited recourse funding mobilised by SPVs and backed by the cash flows from the relevant consumers.

This system has been adapted over time with an increasing volume of grant funding now flowing to higher levels of service, as already noted above. This has two effects. The first is to reduce the amount of funding actually applied to address the limited remaining backlog of access to basic services. It has also greatly expanded the **infrastructure for higher levels of service** in communities that do not have the ability to pay for it. The consequence has been to create a **structural deficit in the funding of operation**, maintenance and routine rehabilitation as well as to reduce the cash flows that could support new investments.

It has also become increasingly difficult to obtain an accurate assessment of financial flows for water services. One contributor to this was the introduction of a '**regional bulk infrastructure grant**' (RBIG) which was managed directly by DWS. The availability of the RBIG, which could only be used for 'bulk' infrastructure, encouraged the DWS to promote large regional schemes at the expense of smaller (and often more cost-effective) local schemes. This trend has been reinforced since DWS's mandate (and budget) was expanded to provide such bulk infrastructure directly, rather than including it in municipal grants.

This definition of 'bulk infrastructure' as being outside the scope of municipal infrastructure has led to **inflated estimates of the investment requirements** of the sector. Estimates by DWS that investments of over R500 billion will be required in the next decade have largely been based on the assumption that most services in rural areas would be provided by such schemes. This would see bulk infrastructure for high level services, such as the expansion of wastewater treatment works, funded by national grants and not accounted for as a contribution to municipalities. It will thus substantially **increase the asset base to be operated without increasing the funds available for such operation**.

The 2016 Division of Revenue Act has restructured the original four water grants into two in a bid to rationalise the process[25]. While the RBIG is retained, most will be made available directly to municipalities rather than through DWS. However, DWS continues to be funded for 'bulk' schemes even where these serve single municipalities at high levels of service. While the DoRA allocation for 2016/7 is R5.4 billion in 2016, the DWS budget for 'mega-projects' is R7.7 billion, with little indication of how the operation of these projects is to be funded.

One consequence of this evolution is that **potential 'off-budget' funding opportunities have been lost** for elements of water services. This could be done

[25] MFMA Circular No 79 - Municipal Budget Circular for the 2016/17 MTREF 07 March 2016

either by regional water utilities such as water boards or by contracting private sector operators to build and operate facilities such as treatment works on a BOTT basis. However, this will only be feasible if there are adequate and reliable cash flows to fund the service providers.

The focus on promoting regional bulk infrastructure may also **complicate the promotion of wastewater reuse and desalination** projects since it creates incentives for municipalities to seek 'bulk infrastructure' grants rather than to mobilise their own resources to create opportunities for partnership arrangements.

4.2 Southern Africa

4.2.1 Institutions

The responsibility for water service provision in SADC countries beyond South Africa is dispersed, as indicated in Table 8 above. While central government continues to play an important role, there is a trend to decentralise responsibility for the operation of water services to municipalities or other more local agencies. However, the limited financial capacity of the communities concerned usually means that they continue to be dependent on grant funding to support infrastructure investment. Central governments generally still play the leading role, either providing funding from national budgets or negotiating and directing donor funding.

At an operational level, in addition to the local government level, there is a range of water utilities, constituted on a national or regional basis, in countries such as Malawi, Botswana, Swaziland and Lesotho. There is a growing number of private water service providers, with operating concessions. While these also have limited financial capacity and are generally not yet able to fund investment costs, some are successfully covering their operational costs and able to undertake small rehabilitation and refurbishment activities. In future, their structures may enable them to enter the financial markets at an earlier stage than municipalities; the Zambian utilities had been an example of this potential opportunity until the economic downturn.

National governments and their agencies continue to dominate the (limited) investment in water resource development. Investments in infrastructure to underpin major urban supplies may be promoted by water services utilities but this is invariably supported if not led by national governments. Similarly, Zambia's hydropower developments have been promoted by the national electricity utility. There have also been a limited number of developments promoted by private sector actors in support of mining, agriculture and tourism development; these sometimes offer opportunities for multi-sector collaboration with local public authorities. However, the ability of the latter to participate is often constrained by limited financial and institutional capacity. It is thus usually left to national government and donor agencies to promote multi-purpose projects.

4.2.2 Projects and instruments

SADC has regularly produced a list of strategic water projects. While these are primarily intended to be presented to donor audiences, they often include components that might be amenable to loan finance and where the availability of loan finance might unlock complementary donor grant funds. A current list is annexed (Annex 2), together with a list produced by the AfDB based PIDA/AIFF facility.

A common feature of these lists is the continued inclusion of the same projects over periods of a decade or more. This illustrates that such sets of project proposals are often simply 'wishlists' rather than serious opportunities for finance. Nevertheless, some do graduate and the challenge is to evaluate which have the potential to move forward.

One set of projects that appeared to have the potential to proceed to implementation are the large hydropower projects on the Zambezi river. Despite the evident merits of these projects in what remains a power deficit region, it has not proved possible to promote a coherent and workable approach to their implementation. The challenge has been to design an approach that meets the needs and specific interests of the actors and interests in the countries concerned. Reticence about involvement in the promotion of still-controversial large dams discouraged many donors from funding the necessary preparation. There were thus limited resources to facilitate the complex interactions between the different actors, in particular to negotiate power purchase and connection agreements to underpin the infrastructure investments.

In a growing number of SADC countries, some operational water resource activities are funded through water charges. While tariffs and collection rates have not yet reached the point where they can contribute to significant investments, they do already contribute to the preparation of investment projects, particularly where large urban or industrial users are abstract water from regulated sources. However, there is a concern that too rapid a move towards water pricing may discourage water use in agriculture particularly among small scale producers; Zimbabwe has recently reduced water charges for this reason.

5. DBSA SPECIFIC IMPLICATIONS

5.1 Opportunities for DBSA and actions required

This review has demonstrated that the substantial need for investments in water infrastructure does not easily translate into lending opportunities for a development finance institution such as DBSA. The situation is aggravated by a series of policy weaknesses that further limit the prospects.

In South Africa, the central role of municipalities in the provision of water services is a particular constraint. The majority of municipalities are not credit-worthy in terms of their balance sheets and credit records. Meanwhile the major metropolitan municipalities have a range of options to raise finance and tend to borrow against their balance sheets rather than on a project basis.

Four possible funding instruments can be identified for municipal lending:-

- Traditional project based loans for direct implementation by the Client;
- Short-term bridging finance;
- Performance based lending for revenue-enhancing development activities; and
- Financing of private sector partners for BOTT and similar projects.

Each of these instruments and opportunities is reviewed in more detail below. Beyond these instruments, there is a range of further opportunities that could be mobilised, subject to the necessary policy changes.

Traditional project lending is unattractive given the weak financial status of the majority of municipalities and their inability to provide adequate security for loans. Where municipalities are funded primarily through inter-governmental transfers (the equitable share of revenue and conditional grants), it is not generally possible for lenders to gain access to those transfers as collateral. They cannot routinely be pledged and paid directly at source; such processes are generally only considered as a last resort to remedy a default.

Short term bridging finance is one instrument that DBSA could make available to support the sector. Since water service projects, particularly those that involve treatment or transmission infrastructure are often large and 'lumpy', it is sometimes difficult to finance them using single year grant flows. This is often remedied by programming implementation on a multi-year basis, but this can lead to inefficiencies. To avoid this, multi-year funding can be packaged, earmarked and used in a single year. National Treasury has specifically approved this approach[26], subject to their oversight, but it appears to be little used.

While generic bridging finance may make only a limited developmental contribution, short and medium term **performance based lending** offers some opportunities in

[26] National Treasury, Municipal Budget Circular for the 2010/11 MTREF, MFMA Circular No. 51

the water sector. An example of this is provided by the challenges of reducing non-revenue water. Many of the interventions required in this area can be implemented in a period of 2-5 years and should generate rapid return which, in many cases, should rapidly cover the costs of intervention. Successful performance-based contracts projects have already been implemented, as in Emfuleni (see below). Appropriate short term finance, which would ideally be performance linked to ensure effectiveness, could make a valuable contribution. DBSA is supporting a project in Ekurhuleni where the goal of reducing losses will be addressed by a holistic intervention to strengthen network and customer management generally. This will in turn generate further lending opportunities. Such opportunities will, once again, depend on establishing acceptable arrangements with the municipality concerned. However, there is some potential for 'ring-fencing' savings and earmarking them for performance-based fees and the funding of further infrastructural interventions.

Finance for BOTT projects is an emerging opportunity as municipalities come under pressure to maintain standards of potable water purification and wastewater treatment. An obvious response would be to contract service providers, which could be private contractors or regional public utilities, to build and operate such works. Such a response could be triggered by regulatory action. If such action were to be successful, it would necessarily need not just DWS to require that certain standards had to be achieved but also the establishment of a supportive financial framework by National Treasury and COGTA. Since the Constitution only allows borrowing for current expenditure if it is repaid within twelve months, the balance between investment and operating costs would need to be carefully defined.

Beyond municipal lending, further opportunities may arise in the area of **water resources.** DBSA has already participated in opportunities created by TCTA's role as a vehicle to raise limited recourse project finance and there are a number of other projects in prospect which would allow for a similar approach, notably the further development of both Acid Mine Drainage management and the Mokolo pipeline to meet the emerging needs of the Waterberg energy complex.

A number of other resource development projects are currently intended to be financed on government's budget, primarily through the Department of Water and Sanitation, even when part of the off-take is intended for commercial use. Notable amongst these are the various phases of the Olifants River Development Project; the proposed Mzimvubu development is another. In some cases, budget support is proposed for projects where it is considered to be too difficult to negotiate an appropriate division of costs between commercial and social applications

The long-standing policy intention has been to establish a **National Water Resource Infrastructure Agency** by combining the construction and infrastructure division of the DWS with the TCTA. This would create a structure through which with opportunities for mixed grant/loan financing approaches could be promoted but it has not yet been implemented.

Emfuleni's water conservation and leak reduction PPP[27]

A public-private partnership to save water in Emfuleni Municipality in the south of Gauteng illustrated the potential for targeted action supported by development finance to improve the water use efficiency and strengthen water security.

Sebokeng and Evaton townships consist mostly of low cost housing with, with a population of approximately 460 000 people living in approximately 84 000 properties. Most of the area is provided with on-site water and water borne sanitation services. This represents a high level of service to a low income community and experienced problems of nonpayment, affordability, sustainability and wastage of water. Water loss in the area is high and the local municipality was losing millions of Rands annually through leakage and wastage. As a first phase of intervention, a project was initiated to reduce leakage and water demand through advanced pressure management.

Starting in 2005, the entire project was funded by the contractor under a shared savings contract with the municipality. In terms of this contract, the company received 20% of the water savings over a five year period and the municipality 80%.

The project was extremely successful.

- Project cost was R5 million and the savings achieved during the first 60 months of operation were more than R152 million ($20 million)
- Sewer flows entering the treatment plant reduced from 2500 m3/h (July 2003) to 1800 m3/h (July 2005), contributing to better performance and fewer incidents of pollution of the Vaal river.
- Annual energy savings achieved were in excess of 14 000 MWh, equivalent to reduced CO2 emissions of 12 000 Tons per annum.
- The reduced pressures also significantly reduced the number of pipe bursts experienced in the area.
- A portion of the savings was reinvested in new infrastructure and upgrades of old infrastructure which is the first major investment in new infrastructure for many years

On the basis of this success, a second phase of the project targeted leak reduction both in the network and in individual households. This was financed by grant funds, conditional on the savings realised being ring-fenced and used for infrastructure maintenance and upgrades.

The Emfuleni experience demonstrates that medium term (<5 year) loan finance can, if used in a performance-based framework, achieve substantial reductions in water loss and improve water security.

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[27] See project data sheet at :- http://www.wrp.co.za/sites/default/files/project_attachments/WRPPS0043_Project%20Boloka%20Metsi%20Phase%201%26%202.pdf

In **Southern Africa**, the generalised **dependence on grant or concessional finance** from development partners continues to be an important constraint for DBSA's participation in the region's water sector. The region and associated agencies such as the PIDA/AIFF of the AfDB have regularly produced 'investment portfolios' (see Annex 2) but the majority of the projects included are not bankable and could only be implemented if funded through concessional finance channels. Where commercial opportunities arise, as in the hydropower sector, the preparation of a bankable project would be a complex and lengthy process.

5.2 Risks and responses

In **water services,** the risks and obstacles to greater participation by DBSA in the financing of the sector are obvious. From a lending perspective, the primary obstacle to is the inability of local government beyond the metro municipalities to secure a cash flow from their water services. This reflects poor municipal management in general and a specific failure to reverse the downward trend in the proportion of households who pay anything for their services (see Table 9).

Aside from the metros, it is arguably the incoherence of the current financial support framework for water services that is the major contributor to this situation. National Treasury has recently been restated that "Spending of grant funds on refurbishment should be focused on infrastructure serving the poor and does not remove the responsibility of municipalities to fund routine maintenance from the equitable share and own revenues"[28]. But this policy has not been put into practice.

The option of using **'indirect grants'** has been considered. In these, 'a national sector department or public entity performs a function on behalf of a municipality or province. Thus no funds are transferred to the province or municipality concerned, but any infrastructure developed becomes the responsibility of the relevant subnational government'. This assumes that the national entity will perform better than the municipality, which is not always the case; (this has been seen with the application of the regional bulk infrastructure grant). As a result, the Fiscal and Financial Commission has recommended that "National Treasury and line departments consider the use of indirect grants as a measure of last resort while continuing to build capacity in provinces and municipalities."[29]

The failure to discipline the use of conditional grants in favour of providing basic levels of service has allowed and encouraged the provision of higher levels of service to proliferate and become the norm. Although this has inevitably increased the operating costs of systems, there have been limited efforts to fund these costs through user charges – indeed, the rate of non-payment has been increasing steadily.

[28] MFMA Circular No 79 Municipal Budget Circular for the 2016/17 MTREF 07 March 2016

[29] FFC 2016, Submission for the 2016/17 Division of Revenue

The *de facto* adoption of waterborne sewerage as a basic level of service has not only required the provision of additional water. It has also generated a requirement for investment in wastewater treatment – and its operation. In many municipalities, this function, in particular, is failing.

For these reasons, the present municipal finance system for water services is unsustainable and has to be reviewed. The present arrangement creates little incentive for municipalities to manage their customers to generate the tariff income required to support capacity expansion or to constrain their consumption.

Approaches such as regionalisation have been proposed to address service failure. But, while **regionalisation offers opportunities, it also poses specific risks.** DWS is seeking to expand the mandate of the water boards and use them to mitigate problems at municipal level (ref DWS Policy Positions 2014). While regionalisation of water services is a well-established alternative to municipal supply and has been widely adopted elsewhere as both a public and private option (for instance in the Netherlands and UK), its success depends on the ability to recover costs from users or through a predictable supplementary grant.

The challenges experienced in electricity, where it is easier and more credible to threaten municipalities with supply restrictions if they fail to pay for services, illustrates the risk. This is greater since individual water boards are generally more dependent on municipal revenues than ESKOM. Thus regionalisation may simply increase the risk of lending to water boards. Already, the inability of water boards (and the DWS water trading entity) to collect debts from municipalities for services provided is one of their greatest operational challenges.

Table 9: South Africa – households that pay for water

Pay for water		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Yes	Number	5 794	5 991	6 375	6 417	5 471	5 483	5 601	5 586	5 720	5 742
	Percentage	61,9	65,0	64,2	67,3	49,3	46,8	47,2	45,3	44,5	43,7
No	Number	3 569	3 221	3 560	3 113	5 616	6 220	6 266	6 745	7 124	7 404
	Percentage	38,1	35,0	35,8	32,7	50,7	53,2	52,8	54,7	55,5	56,3
Subtotal	Number	9 363	9 212	9 935	9 530	11 087	11 703	11 867	12 331	12 844	13 146
	Percentage	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Unspecified	Number	7	42	41	88	12	21	65	41	14	84
Total	Number	9 370	9 254	9 976	9 618	11 099	11 724	11 932	12 372	12 858	13 230

(Source: StatsSA, Household Survey 2014)

Meanwhile, the **water resource sector** is dependent on an unpredictable, imperfectly regulated natural resource and often requires large and lumpy investments with long preparation and implementation timeframes. This makes it difficult for development finance institutions to engage effectively. Over previous decades, the World Bank had largely withdrawn from water resource development lending due to the contentious and complex nature of projects in the sector which made it difficult for both bank officials and the institution to achieve their investment performance targets.

In the AfDB's case, it was found that the Bank was usually a member of a larger team and had limited leverage or strategic contribution to offer. This was in part due to the fact that it did not have the resources to undertake the water sector work necessary to inform such contributions. This involves complex hydrological issues, national regulatory frameworks as well as what have been characterised (often unfairly) as the difficult institutional dynamics of development on shared rivers. A final challenge has been that many water resource related investments were initiated by other sectors, primarily agriculture and energy and the potential for multi-purpose resource development was often given little attention if not actively resisted as an obstacle to project closure.

The implication for DBSA is that, if it wishes to become an active player in the water resource sector, it will require a long term perspective. Significant financial and high-level human resources will have to be allocated for sector work and to enable active engagement in and facilitation of complex processes.

Mitigating systemic risk

Beyond these specific risks, there is a broader, more systemic risk for DBSA. As an example, the quality of water administration can have a significant impact on investment climate. While, at present, there is considerable attention given to the delays in issuing water use licences (which also cover such activities as the disposal of wastewater), little attention is given to the quality of such licences.

There are complaints from industrial water users that the quality of licences (in terms of the regulatory requirements) are often deficient and sometimes unimplementable. This is often a serious business obstacle for large, publicly-listed, business entities which have to consider reputational implications. Their choice is to contest licence conditions (which may cause lengthy delays) or to accept and risk being penalised for non-compliance.

The other common failure of licensing systems is that water allocations are approved even when the resource is fully utilised. The result is the creation of what are known, colloquially as 'empty' or 'dry' licences. In both cases, the consequence is to reduce the water security of all users of a system.

One risk is simply that municipal service failure either adds to enterprise costs or provokes costly delays. An example of this was provided by the efforts of a large

agri-food business to implement a major expansion in a rural municipality. The municipality could not guarantee effective wastewater treatment and disposal, a serious hurdle for the investor who needed to demonstrate compliance with environmental regulations to shareholders and the wider stakeholder group. When the company offered to fund the expansion of the wastewater works, the inability to negotiate an acceptable agreement resulted in project deadlines being missed, additional costs being incurred and the investment being put at risk.

This example demonstrates how failures in water management, whether in services or resources, may impact on DBSA's clients and their credit quality. The nature of such risks is difficult to forecast given the diverse and local nature of many water systems. However, **a worst-case scenario** can be imagined (see Table 10) in which failures in the management of water services and resources effectively combine with a climate-related risk to trigger a series of systemic water-related impacts. It might be advisable for DBSA to consider **how such a portfolio of risk events might impact** on its business.

Table 10: Pro-forma worst case water risk portfolio for South Africa

Risk event	Extent	Potential impact
Under-investment in urban supply leads to systemic supply interruptions over a period of five years	One third of metro municipalities (one inland, one coastal)	Economic activities interrupted in towns, affecting municipal cash flow. Water restrictions lead to further consumer resistance to service payments.
Failure of wastewater treatment leads to large-scale water pollution	One third of sub-metropolitan municipalities	Cost and complexity of water treatment rises for downstream users and increases health risks. Marine pollution leads to closure of beaches and reduced tourism
Major multi-year drought combined with failure to follow operational protocols	Two of six metropolitan areas One third of agricultural areas	Severe restrictions on all water use, including commercial resulting in curtailed industrial production. Reduction in municipal cash flow Drought reduces output from both rain-fed and irrigated agriculture
Administrative failure in:- - water allocation and abstraction; - wastewater disposal and water resource quality management	One third of water management areas	Reduced reliability of large water supply systems leads to supply restrictions Additional treatment costs for downstream users Investment climate uncertainty Environmental penalties or sanctions imposed by trade partners

Given its developmental mandate, the primary response for DBSA to these risks should be to engage, where possible, to support action to address them.

In water services, it is not possible for a development finance institution such as DBSA to address these issues directly. But, to the extent that it is mandated to contribute to the development of water services and the water sector more broadly, it is important to communicate the constraints to the relevant authorities and encourage them to take appropriate action.

In this regard, the aim should be to create a policy framework which enables the adoption of project finance mechanisms for the provision of higher levels of service while ensuring that adequate funding is available for the operation and maintenance of the services. As part of such a framework, an instrument would be required that offers some security to lenders as well as incentives for municipalities, perhaps in the form of municipal guarantees underwritten by national government. But the detailed design of such instruments can only be undertaken once the policy foundation has been laid. If this is not done, it is likely that dysfunction will increase.

In the field of water resources, there is an urgent need to complete the rationalisation of the sector through the establishment of a National Water Resource Infrastructure Agency and the catchment management agencies. Strategic interventions must address water allocation (and re-allocation) as well as improvements to the quality of water use licences rather than the current focus on the time taken for their finalisation.

There are opportunities for engagement through a variety of consultative instruments and institutions. The preparation of the quinquennial National Water Resource Strategy provides agencies such as DBSA with an opportunity to engage in identifying problem areas and prioritising responses. As and when Catchment Management Agencies are established, DBSA will be able to engage directly, or can encourage its clients to become involved, in the planning and prioritisation of interventions, including investments as well as operations.

Such engagements will require the mobilisation and deployment of the necessary high level human resources. This will be costly and will not generate immediate lending business. However, the systemic risk of not getting involved is that water resource constraints and service failures will increasingly impact on the water security of other sectors to which DBSA is exposed. This will affect their performance and increase their vulnerability, as well as that of DBSA. In the absence of an engagement in the sector, DBSA may not be able to identify and mitigate these water-related risk.

ANNEXES

Annex 1: South African Water Resource projects ex NWRS2

Table 5: Mega Projects (over R400 million per year for a minimum of three years, or at least R1 billion total project cost)

No	Project Name	Location	Current project stage	Project Descriptions	Outputs	Projects total Projects cost	Project completion date
Mega projects (over R400 million per year for a minimum of three years, or at least R1 billion total project cost)							
1	Mzimvubu Water Project	Eastern Cape	Feasibility study	Construction of the Ntabelanga Dam on the Itsitsa River, tributary of the Mzimvubu River, for multi-purpose development of, inter alia, irrigation, hydropower stations and possible inter-basin transfers for domestic and industrial use.	Dam, water treatment plant, pipelines, reservoirs	R20 billion	2019
2	Mkomazi Water Project: Smithfield Dam	KwaZulu-Natal	Feasibility study	To augment the water supply to eThekwini, uMgungundlovu and the surrounding areas.	Dam and water delivery tunnel	R10 billion	2022
3	Mvoti River - iSithundu Dam or Welverdiend Dam	KwaZulu-Natal	Feasibility study to start in 2014	To secure water supply to domestic and industrial users in the Lower Mvoti basin area (Stanger area, KZN).	Dam, pump station, diversion weir	R1 billion	2023
4	Lower Orange River - Vioolsdrift Dam	Northern Cape	Pre-feasibility study completed	To increase the yield of the Orange River to cater for increasing demand in the area	Dam	R561 million	2020
5	Western Cape Water Supply System Augmentation Project: Voëlvlei Supplement Scheme	Western Cape	Feasibility study	To augment the water supply to the City of Cape Town and the surrounding areas.	Dam, abstraction works, pipelines, pump station	R500 million	2020
6	Lusikisiki Regional Water Supply Scheme: Zalu Dam on the Xura River	Eastern Cape	Feasibility study	To secure water supply for domestic and small scale irrigation in Lusikisiki and surrounding areas.	Dam, water treatment plant, pipelines, reservoirs	R500 million	2018

No	Project Name	Location	Current project stage	Project Descriptions	Outputs	Projects total Projects cost	Project completion date
7	Mzimkulu River-Ncwabeni Off-Channel Storage	KwaZulu-Natal	Feasibility study	Ensure a reliable water supply to the northern part of the Lower KZN South Coast during dry periods.	Dam, pump station, pipeline	R650 million	2018
8	Acid Mine Drainage (Phase 1) The implementation of emergency works in the Witwatersrand gold fields to protect the environment	Gauteng	Under construction	Refurbishment of an existing treatment plant in the Western Basin and construction of new pump stations and treatment plants in the Central and Eastern Basins to protect the environment.	Pump stations and treatment plant	R2.2 billion	2014
9	Acid Mine Drainage (Phase 2) The implementation of the long-Term solution in the Witwatersrand gold fields	Gauteng	Feasibility study	Long-Term Solution to address the Acid Mine Drainage associated with the East, Central and West Rand underground mining basins.	Treatment works, pipelines, and waste disposal facilities	R6.4 billion	2019
10	Lesotho Highlands Water Project Phase 2	International	Pre-design	To augment the Vaal River System which supplies water to Gauteng and surrounding areas.	Dam, tunnel and associated works	R9 billion	2020
11	ORWRDP (Phase 2A) - De Hoop Dam	Limpopo SIP 1: Unlocking the northern mineral belt with Waterberg as catalyst	Construction	Water supply to new mining developments, augmentation of domestic water supplies to urban and rural users in the middle Olifants RiverCatchment area including Polokwane, Mokopane, Lebowakgomo and to various communities on the Nebo Plateau and Sekhukhune.	Dam	R3.1 billion	2012
12	ORWRDP (Phase 2B-H) - Bulk distribution (Sub-Phase2C) 2D not yet under construction	Limpopo SIP 1: Unlocking the northern mineral belt with Waterberg as catalyst	Construction	Phase 2B: Pipeline from Flag Boshielo to Mokopane, Phase 2C: De Hoop to Steelpoort link Phase 2D: 2nd pipeline Steelpoort to Mooihoek, Phases 2E to 2H: Under consideration.	Pumping stations, pipelines, balancing dams, operational infrastructure and appurtenant structures	2C: R2,2 billion; 2D: R600 million	2014

No	Project Name	Location	Current project stage	Project Descriptions	Outputs	Projects total Projects cost	Project completion date
13	Groot Letaba Water Develoment Project (GLeWAP) : Phase 2	Limpopo SIP 1: near Tzaneen	Feasibility study	Construction of Nwamitwa Dam in the Groot Letaba River to meet the projected growing primary requirements to the year 2025, to improve the water availability for the riverine ecosystem and to make provision for new resource-poor farmers.	Dam, water treatment plant, pipelines, reservoirs	R1.7 billion	2020
14	Dam Safety Rehabilitation Programme	Country wide	Construction	Rehabilitation of assets and dam safety work - continuous projects	Dam	R2.8 billion	
15	Raising of Clanwilliam Dam	Western Cape SIP 5: Saldanha-Northern Cape Development Corridor	Designs	Upgrading of the existing dam to improvestability and to augment agricultural water supplies to meet increasing demands.	Dam	R1.8 billion	2017
16	Mokolo/ Crocodile Water Augmentation Project (Phase 1)	Limpopo SIP 1: Unlocking the northern mineral belt with Waterberg as catalyst	Construction	Augmentation of domestic and industrial water supplies to the new Eskom/IPP power station(s), extension of associated mining activities and fast growing population in the Lephalale area.	Pumping station, pipelines, balancing dams, operational and national key point	R2.1 billion	2014
17	Mokolo/ Crocodile Water Augmentation Project (Phase 2)	Limpopo SIP 1: Unlocking the northern mineral belt with Waterberg as catalyst	Feasibility	Augmentation of domestic and industrial water supplies to the new Eskom/IPP power station(s), extension of associated mining activities and fast growing population in the Lephalale area. River management system.	Water conveyance infrastructure and appurtenant structures	R13.9 billion	2019

Annex 2: SADC Project Schedules

SADC – PIDA / AIFF project pipeline 2013

Programme for Infrastructure Development in Africa (PIDA)/
Africa Infrastructure Finance Facility (AIFF)

"The PIDA/AIFF identified and prioritized projects for action in the water sector, selected because they were judged to be viable and ready for implementation."

Project deal immediate term pipeline (2013)
WATER RESOURCE RELATED PROJECTS (INCLUDING HYDROPOWER)
(water focus; power focus)

Project	Description	Project Cost (US$ million)	Country	Status
Mpanda Nkuwa	Hydroelectric power plant with a capacity of 1,500 MW for export on the SAPP market	2,400.00	Mozambique for local and SAPP market	PPP structured, Strategic Developer identified; Ready for financing. Anchor project for STE.
Lesotho HWP Phase II – hydropower component	Hydropower program for power supply to Lesotho and power export to South Africa	800.00	Lesotho for SA/SAPP market	To be developed by two managed by two commercially managed entities of S. Africa and Lesotho
Batoka power	Hydroelectric plant with a capacity of 1,600 MW to enable export of electricity	2,800.00	Zimbabwe and Zambia for local and SAPP market	Ready for Financing
Inga III	4,200 MW capacity run of river hydropower station on the Congo river with eight turbines	6,000.00	DRC for local SA and SAPP market	Ready for financing
Lunzua hydro	Hydroelectric power plant with a capacity of 220 MW for export on the SAPP	500.00	Zambia for local and SAPP market	Ready for financing
Lesotho HWP Phase II - water transfer component	Water transfer program supplying water to Gauteng Province in South Africa from Lesotho	1,100.00	Lesotho & SA	First phase has been very successful. This is an expansion. Strong SA offtake
Mokolo crocodile water	Water augmentation program Phase 2	1,200.00	SA	Feasibility available
Songwe dam multipurpose	Multipurpose Dam (Hydro+ flood control+ Irrigation/Power) in Malawi and Tanzania	190.00	Malawi & Tanzania	Feasibility update +tender underway.

Table 8: SADC 23 PRIORITY PROJECTS (2013)

P#	PROJECT TYPE AND NAME	COUNTRIES	KEY SECTOR	STATUS NOW	PROJECT TOTAL [USD M]
RG	REGIONAL PROJECTS				
RG-1	Inga 3 Hydropower	DRC-shared Regional Electricity	HE	Pre-FS done	7 600 to 10 000
RG-2	Lesotho Highlands, Phase 2	Lesotho, South Africa	HE WS	Agreement reached between SOA and LES to commence Phase 2	2,000
RG-3	Batoka Gorge Hydropower	Zambia, Zimbabwe	HE	EIS and FS done	3,500
RG-4	Songwe River Basin Development Programme	Malawi, Tanzania	HE WS AG	FS and DD being done 2013	329
XB	CROSS BORDER PROJECTS				
XB-1	Food Security - Upper Okavango	Angola, Namibia	AGRI	Pre-FS done	66
XB-2	Vaal-Gamagara Water Supply	Botswana, South Africa	WS	Concept Note	Not specified
XB-3	Ressano Garcia Weir - Water Supply	Mozambique, South Africa	WR	Preliminary DD and EIA done	6
XB-4	Lomahasha/Namaacha Water Supply	Swaziland, Mozambique	WS	SWA - Pre-FS done	13 plus cost for MOZ side
XB-5	12 Border Locations - Water Supply & Sanitation	Zambia, Angola, Botswana, DRC, Malawi, Mozambique, Tanzania, Zimbabwe	WSS	Concept supported; some Pre-FS done.	30 plus costs for cross border infrastructure.
P1	MEMBER STATE PRIORITY #1 PROJECTS				
P1-1	Lubango - Phase 2: Water Supply & Sanitation	Angola	WSS	Phase 1 funded and work underway	126
P1-2	Limpopo Basin Joint Water Monitoring	Botswana, Mozambique, South Africa, Zimbabwe	WR	Parties agreed on doing project	0.7
P1-3	Kinshasa - Water Supply & Sanitation	DRC	WSS	Pre-FS partially done	220
P1-4	Lesotho Lowlands Water Supply Scheme Zone 1	Lesotho	WS	Tender to be prepared	78
P1-6	Mombezi Dam - Multipurpose	Malawi	WS AG	FS done; Pre-design underway	209
P1-7	13 Housing Estates - Water Supply	Mauritius	WS	Complete through FS	10
P1-8	Movene Dam - Multipurpose	Mozambique	WS AG	Concept note done	10
P1-9	Windhoek - Managed Aquifer Recharge	Namibia	WS	Artificial Recharge (MAR) infrastructure & most wells – in place	55
P1-10	Non Revenue Water and Use Efficiency	Seychelles	WS	Master Development Plan Done	69
P1-11	Water Demand Management	South Africa	WR	Examples in place. Expansion of scope is needed.	
P1-12	Nondvo Dam - Multipurpose	Swaziland	HE WS	Pre FS done	143
P1-13	Ruhuhu Valley Irrigation	Tanzania	AGRI	Concept Note done	12.3
P1-14	Climate Change Adaptation AER 1	Zambia	AGRI	Project planned	13
P1-15	Bulawayo Water Supply from Zambezi River	Zimbabwe	WS	FS and EIS completed	1,250
Note: [1]	Projects for Madagascar are expected to be added in the future.				

SADC Top 10 Macro Strategic Water Infrastructure Projects

Project No. Status	Country	Description	Estimated Cost (US$) 2005 (million)	Funding Gap (US$) million	Project Implementation
INF1:2.1	Zambia	Kafue Gorge Dam Lower Project	1,800	1,800	Detailed feasibility studies done. Need for project appraisal.
INF1:2.2	Mozambique	Construction of Moamba-Major dam	500	500	Feasibility studies carried out. Need to detail the Environmental Assessment Studies.
INF1:2.3	Malawi	National Water Infrastructure Project development	5 *	5 *	Feasibility studies done. Awaiting National Water Master Plan Studies.
INF1:2.4	Zimbabwe	Batoka Gorge Hydroelectric Scheme	2,500	2,500	Detailed feasibility studies done. Need for project appraisal.
INF1:2.5	Lesotho	Metolong Dam Detailed Design and Construction	285	240	Detailed design carried out. Investor's conference held. Part funding received.
INF1:2.6	Lesotho	Lowlands Water Supply Scheme	430	430	Detailed design done. Part funding received.
INF1:2.7	Zimbabwe	Gwayi-Shangani Dam	40	28	Implementation ongoing
INF1:2.8	Mozambique	Construction of the Large Bue Maria Dam	400	400	Detailed design done. Need project appraisal and funding.
INF1:2.9	Tanzania	Ruhudi Hydropower Project	408	408	Detailed feasibility studies done. Need for detailed design.
		Total	**6,368**	**6,311**	

PROCEEDING

PROCEEDING

PROCEEDING

**Feasibility Studies only*

Some other potential projects in SADC

- A n extension of Nambia's Eastern National Water Carrier to draw on the Okavango River has been proposed. Although controversial, it is projected to abstract at a maximum less than 2% of the available resource. In order to protect the Okavango Delta, some storage, possibly combined with hydropower, may be proposed in the upper catchment which would require cooperation between Angola and Nambia.

- The further development of the Orange river will put some pressure on downstream irrigation users in Namibia and South Africa. To address this, further storage infrastructure is proposed (at a site known as Vioolsdrift) on the river.

- Mozambique's Pungue river is used for commercial irrigation and water supply to Mozambique's second city of Beira and in Zimbabwe, to supply the border town of Mutare. River flows are highly seasonal and there is no significant storage to maintain low flows and prevent seawater intrusion into the estuary, which impacts Beira's water supply and sugar producers. Growth in abstraction will require the construction of a dam in the system which, given the nature of the users, has the potential for a financially feasible multi-purpose development. The proposed multipurpose Bue Maria dam has been on the country's infrastructure development agenda for over 30 years.

- Water is allocated for future water supply to Maputo from the Komati river, in the Incomaputo water sharing agreement of 2002. To make this water available in the medium term, further storage will have to be built in an already extensively developed system. It is likely that the optimal site for such development will be in South Africa or Swaziland.