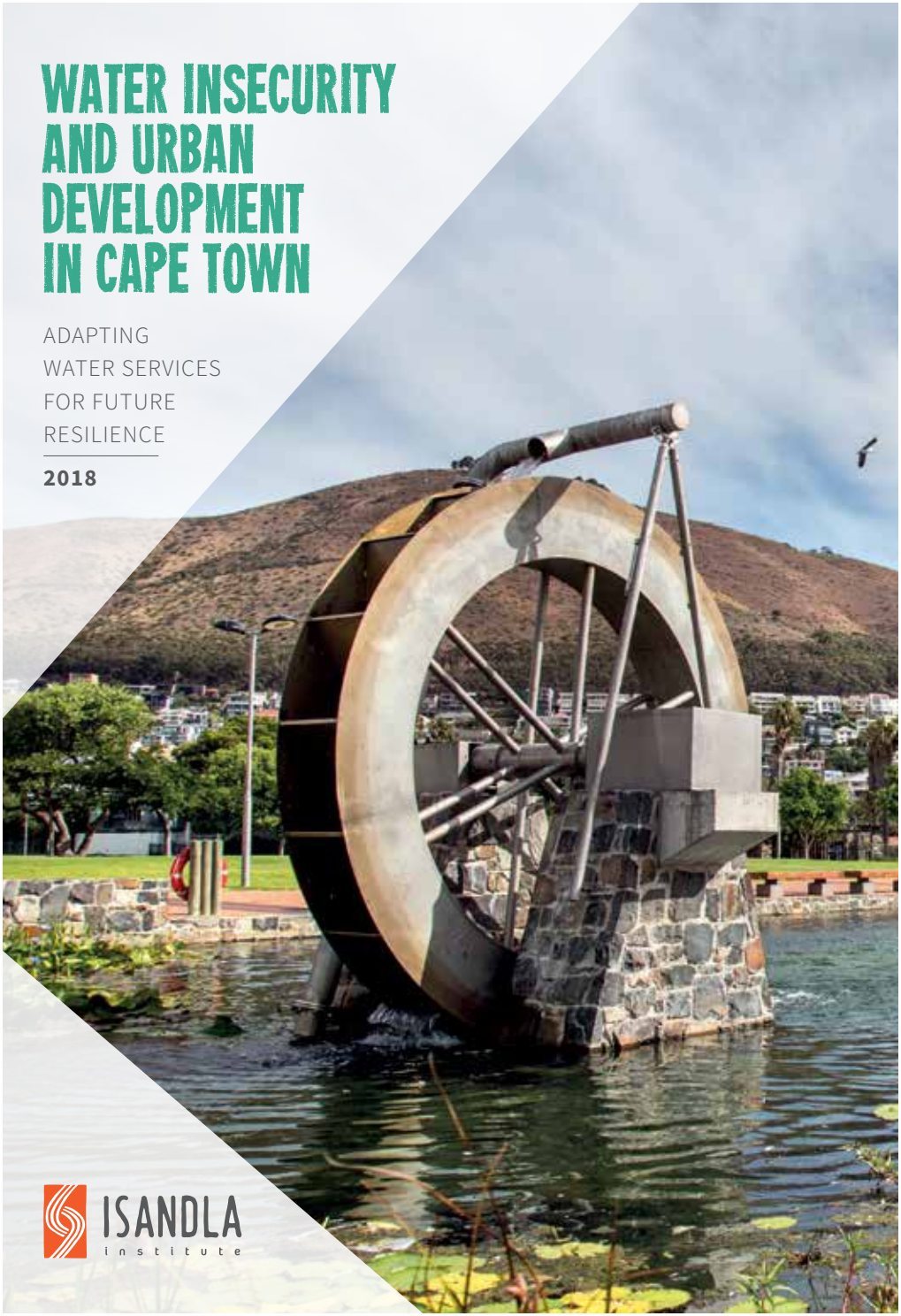
WATER INSECURITY AND URBAN DEVELOPMENT IN CAPE TOWN

ADAPTING
WATER SERVICES
FOR FUTURE
RESILIENCE

2018



ISANDLA
institute

This document was produced by Isandla Institute as part of the Collaborative Initiative (formerly known as the Khayalethu Initiative), a project supported by Comic Relief.

The aim of the Collaborative Initiative is to advance models for participatory informal settlement upgrading through knowledge sharing, collaboration and experimentation. Isandla Institute's role in the Initiative is to inspire and inform communities of practice through research and the facilitation of engagement between practitioners in the field of informal settlement upgrading. One of these engagements takes the shape of a Cape Town-based Community of Practice. This document distils the knowledge emerging from the local community of practice engagements, and offers lessons from both theory and practice.

ISANDLA institute

EXECUTIVE SUMMARY

Water relates to all aspects of urban development, and is a key determinant in the resilience and continuity of urban life. With thisbeing said it is important to recognise that Cape Town is experiencing the reality of water scarcity and is facing climatic change overall. Therefore, drought or not the City of Cape Town along with the rest of country will have to adapt and innovate around this new normal and governance will have to play a critical role in building sustainable and resilient urban communities. Developing an understanding around water governance and implementing appropriate governance systems will help facilitate development and an evolution towards a better and more inclusive water services sector, which will have a profound impact on the liveability and livelihood of greater Cape Town as well as vulnerable communities within the City.

In this practice brief, we describe the case of the 2017/2018 Cape Town water crisis and the conditions of water insecurity, which should propel a move towards more sustainable water resources. The practice brief also explores the principles of good water governance and suggests the water service sector can incorporate these principles in to a framework to support future resilience.

Isandla Institute acknowledges the contributions made by representatives from Community Organisation Resource Centre, Development Action Group, GreenCape, Habitat for Humanity South Africa, People's Environmental Planning, Social Justice Coalition, The City of Cape Town Urban Resilience Unit, Ubuhle Bakha Ubuhle and University of Cape Town during the local Community of Practice held on 27 March 2018.

INTRODUCTION

"Water runs through our every aspiration as a society." - *Kader Asmal (2012)*

It is no secret that the accessibility and availability of water forms the backbone of urban development. The liveability of any human settlement is fundamentally determined by the adequate provision of water.

Water Services:

The water services sector is the system that is in place to supply water and sanitation across a city.

The current context of water scarcity in the Western Cape, particularly in the City of Cape Town, provides an important opportunity to start challenging conventional systems and institutions to innovate around improved water management and provision measures. Globally, urban areas are facing water scarcity and this is often due to unsustainable urban development in conjunction with climatic pressures. In a Global South city such as Cape Town, socio-economic realities exacerbate water challenges, and these challenges will continue to grow more critical as urban populations expand rapidly. Therefore, it is pertinent now more than ever for water management strategies to focus on measures that use this vital and limited resource more efficiently, and feed into a progressive agenda for equitable and sustainable provision with regard to consumption and development.

It is important to recognise urban realities when designing and implementing measures that will appropriately address water provision and consumption, in order to reduce the risk of further perpetuating inequality, as well as possibly restricting growth and development.

The issue of water scarcity in Cape Town has and will undoubtedly continue to affect vulnerable communities, sustainable urban development, and economic activity within the City to a greater degree than anticipated.

The purpose of this practice brief is therefore to explore the effects of water insecurity in an urban context such as Cape Town, what it means for local government, informal settlement communities and urban development. The practice brief will provide a review of Cape Town's experience with the current water crisis, the strategies employed by local government as well as the opportunities to mitigate negative impacts, in order to build towards future resilience. It will also explore the principles of good water governance and its importance in achieving a resilient, effective and appropriate water services sector.

POLICY PROVISIONS

The objective of water policy is to manage "the quantity, quality and reliability of the nation's water resources to achieve optimum, long-term, environmentally sustainable social and economic benefit for society from their use" (Department of Water Affairs 1997: 19). The national policy provisions related to water services are highlighted below. It must be noted that the City of Cape Town operationalises these policies through Council by-laws.

By-laws:
regulate the affairs and services within a municipality's jurisdiction.

Water Services Act (No. 108 of 1997)

The Water Services Act (No. 108 of 1997) provides the mechanisms for ensuring basic water supply for all South Africans in a manner that is just, sustainable and efficient. It legislates the municipal function of providing water and sanitation services, and sets out the institutional arrangements for water services.

Under the Act, water services authorities are required to ensure access to water services for all, establish by-laws for water services, prepare a water services development plan, and decide an appropriate mechanism for providing water services.

National Water Act (No. 36 of 1998)

The National Water Act (No. 36 of 1998) for South Africa recognises that water is central to development and that there are limited water resources in South Africa, making it a national asset that should be properly managed in order to bring maximum benefit to the country as a whole.

Water and water management legislation in South Africa is underpinned by the Constitution, in order to create a more just and equitable society as well as encourage appropriate and sustainable use of natural resources. This is motivated by the duty to realise the right to access to sufficient water.

Strategic Framework for Water Services (2003)

The Strategic Framework for Water Services lays out the national framework for the water services sector (water supply, sanitation, water schemes and collection and treatment of wastewater). The strategic framework informs the development of comprehensive strategies. The purpose of this framework is to put forward a vision for South Africa's water services sector and create an umbrella framework to address the full spectrum of water supply and sanitation.

Roles and Responsibilities

The Department of Water Affairs (DWA) is the custodian of water resources and is tasked with ensuring the availability and supply of water on a national level. The DWA is in charge of formulating and implementing policy, as well as the development of strategies.

The National Water Act (No. 36 of 1998) outlines the delegation of functions to appropriate institutions. The National Water Resources Strategy 2 (NWRS2) lays out the institutional structure of the water sector and highlights the key stakeholders and their roles. Key authorities/stakeholders include:

- Catchment Management Authorities (CMAs);
- Water Service Authorities (WSAs);
- Regional Water Utilities; and
- Water Users Associations.

The current Medium-Term Strategic Framework for the 2014-2019 electoral term outlines the actions and associated targets required to achieve the commitments set out in the National Development Plan, with regards to municipal water, sanitation and bulk infrastructure.

Any municipality that has executive authority for water services within its area of jurisdiction is recognised as the water service authority under the National Water Act. They are responsible for ensuring that infrastructure is developed, operated and maintained to enable the collection and treatment of sewage, wastewater and effluent.

FACTORS INFLUENCING WATER INSECURITY IN SOUTH AFRICA

Low Rainfall

South Africa is characterised as a semi-arid country with rainwater being the primary input to national water resources. The country experiences a rainfall average of 490 mm per year, which is half the global average with rainfall varying from less than 100 mm per annum in western parts of the country to more than 1500 mm per annum in the eastern parts (WWF-SA 2016). Rainfall in South Africa is highly seasonal and variable. Given the low annual rainfall and a comparatively large population, South Africa is characterised as water scarce.

High Demand for Water

In 2017, the total consumption of water in South Africa measured at 194.14 litres per person per day (IBNet 2018). The national demand for water is projected to increase by 17.7 billion m^3 (32%) by 2030 based on estimated population growth and industrial development. The country's population is currently at 54.4 million and is projected to grow to approximately 65.5 million by 2050 (BusinessTech 2015).

Climate Change

Climate change is evidenced by more frequent extreme climatic events and changing rainfall seasonality. Over the past five decades, extreme rainfall events across the country have increased in frequency, and the mean annual temperature by has increased 1.5 times in comparison to the observed global average of 0.65 °C (Ziervogel et al. 2014). It is expected that the effects of climate change will exacerbate pressures on water resources, which will result in severe ecological and socio-economic consequences. The rate at which climate change is occurring will undoubtedly create new water-related issues.

In terms of the geographical distribution of rainfall across South Africa, experts predict that runoff/rainfall will increase along the eastern seaboard and central interior and will likely decrease in the Northern and Western Cape region (WWF-SA 2016). Future projections up to 2050 (unmitigated emissions scenario) predict that the temperature in the interior region of the country will increase by 5 °C, and slightly less in coastal regions. The general predicted pattern is that the country will experience drier conditions in the West and wetter conditions in the South (South African National Biodiversity Institute 2013).

Water Security:

The capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (UN Water 2013).

WATER SERVICES IN CAPE TOWN, WESTERN CAPE

Historically, the Western Cape's urban water consumption has been closely linked to population growth and the economy. However, since 2000 water demand began to outstrip available water supplies (Basholo 2016).

Water Supply

The Western Cape is characterised as a water stressed and water scarce province, and Cape Town forms a part of the Western Cape Water Supply System (WCWSS) that receives its water from a network of dams. Raw water storage and a conveyance infrastructure supplies water to surrounding agricultural and urban areas. This network is currently completely reliant on rainfall. The WCWSS comprises several dams, mostly located in the upper regions of the Berg River and Breede River catchments. The system supplies raw water to the CCT, the West Coast District Municipality (DM) for domestic supply to Swartland Local Municipality (LM), Saldanha Bay LM and Bergrivier LM, the Stellenbosch LM to augment the supply to Stellenbosch, and to agricultural users downstream of the Berg River Dam, Voëlvlei Dam and Theewaterskloof Dam. Treated water from the CCT'streatment works is provided to several towns close to the treatment works and bulk transfer pipelines (Department of Water and Sanitation 2014).

Water Demand Management

The City of Cape Town's (CoCT) strategic objective has been to manage water demand by implementing a series of progressive water demand management interventions, including:

- **Water pressure management;**
- **Leakage repair programme;**
- **Public awareness and education;**
- **Metering and tariffs controls; and,**
- **Promotion of greywater use and the use of private boreholes** (City of Cape Town 2018)

However, over the past few years Cape Town and the rest of the Western Cape has been experiencing severe drought conditions – with the worst period in 2017/2018. Considered the worst drought in over a century, CoCT implemented a countdown to Day Zero, when taps were predicted to run dry. If Day Zero occurs, the CoCT will turn off most of the taps across the City whilst retaining access for vital services. It is important to note that Day Zero is a moving target and is dependent on rainfall events, drought/disaster strategies and demand management.

Therefore, the CoCT has, in addition to demand management interventions, begun to investigate potential opportunities and alternatives for sustainably harvesting new water resources to augment the water supply in the face of climate change and the reality of water insecurity. Alternatives include water extracted from underground reserves and managed aquifer recharge from treated wastewater, water re-use, and desalination (CoCT 2018). Though more expensive than rainfall-dependent dams, these allow for the diversification of supply sources. The augmentation programme was initiated through the establishment of the Water Resilience programme in May 2017.

Water availability is and will continue to be under immense pressure due to the realities of climate change, urbanisation, population growth and increased water demand. With climate change, Cape Town will experience changes and variability in the seasonality/intensity of rainfall events, which will potentially have a negative impact on agriculture, water-intensive industries and the greater Cape Town community.

The key challenge that the City's Department of Water and Sanitation faces operationally, is maintaining a high level of water services, whilst providing a high standard of services to a growing number of households in a sustainable, inclusive and resilient manner.

Day Zero:

The point at which the City's big six dams reach a storage level of 13.5%, leaving just enough water supply for critical services. The water supply would include distribution to collection sites across the city, but all residential taps would run dry.

Public Perception and Experiences: Cape Town's Water Crisis

The Department of Co-operative Governance and Traditional Affairs officially declared the 2017/2018 water crisis in Cape Town a national disaster. The City of Cape Town's primary response has been to firmly restrict water consumption through city-wide rationing, whilst seeking to implement alternative sources of water supply.

A large part of the public experience of the drought has been queuing for water at natural springs, in order to reduce municipal water usage and to supplement the 50 litres per person per day (pppd) quota under the Level 6b restriction, in anticipation for the looming Day Zero (Nkanjeni 2018).

The crisis has put significant pressure on local government and greater public scrutiny, especially concerning the notion of Day Zero. Day Zero and the confusion around its meaning resulted in panicked reactions. Eventually mistrust of the City's Day Zero campaign grew, and left some people questioning the severity of the drought, as the date was continually shifted from initial predictions. This was a result of the City not communicating clearly that Day Zero is a moving target. The involvement of politics in the City's communication incited fear that Day Zero is a political stunt to commodify water. This further raised fears about how the most vulnerable communities would fare in such a scenario. The involvement of party politics in the matter created city versus state tensions, highlighting the lack of an integrated approach to the crisis (Dougan 2018).

The naming and shaming of water wasters spearheaded by political figures placed emphasis on domestic water usage (Jordan 2018), rather than highlighting the need for water intensive industries to begin moving towards water-sensitive operational models. This approach reinforced concerns about the commodification of water. The city missed an opportunity to frame a debate around a fundamental right to access water and the conservation of water resources in this moment.

Concerning informal settlement residents, the CoCT continues to provide water through communal standpipe taps (Bratton 2017). This has been the City's 'standard' approach to water provision in informal settlements. The CoCT has not used the crisis as an opportunity to increase or improve water and sanitation services to informal settlements, or create awareness of the reality faced by residents living in informal settlements. The significant focus on water and water services during this crisis provides the government with the opportunity to iron out a number of the constraints affecting delivery of water and sanitation services, as well as innovate around water services.

The drought has highlighted the lack of an integrated and coordinated effort towards water management and the City's failure to communicate appropriately and transparently with the public concerning the crisis and mitigation strategies. This exposes deeper institutional flaws and issues of water governance.

However, with the drought there has been a heightened public awareness of water insecurity and the need for joint citizen action to reduce domestic consumption of potable water. There has been a great deal of interest in mitigating the effects of the drought and planning for more sustainable use, so much so that various faith-based, corporate, neighbourhood and domestic initiatives have emerged. People's ability to halve their water consumption within a year illustrates the power of working cooperatively together as a city and what can be achieved with citizen action (Jones 2018).


CHEMETALL
CHEMETALL (PTY) LIMITED

URBAN DEVELOPMENT IN THE FACE OF A WATER CRISIS

South Africa's 1991/1992 drought resulted in not only significant job losses nationwide, but also decreased development across the country (Ukwandu 2009).

This shows that water is a key component in improving the living environments of citizens and in combating poverty. Water is a significant input in the construction industry. This use predominately includes the construction of roads and the manufacture of materials such as precast concrete, ready-mix, concrete piles, and other building materials involving large quantities of water usage in their manufacture. Since the construction industry consumes significant water resources in several ways, it is important that the industry plays a key role in water conservation and innovation around water usage in urban development.

Water insecurity poses a considerable threat to present and future urban development and therefore cannot be neglected when designing, planning and implementing informal settlement upgrading projects and programmes.

Water insecurity poses a considerable threat to present and future urban development and therefore cannot be neglected when designing, planning and implementing informal settlement upgrading projects and programmes. There is an acute need to increase access to basic services, stimulate economic activity, promote densification and scale up affordable and effective housing solutions that are suitable to a local context. Therefore, effective access to and utilization of water is significant in stabilising and augmenting urban development, especially in low income areas, along with meeting the water needs of vulnerable groups throughout the city.

Water insecurity, drought events and climate change have the ability to cascade into unexpected areas, carrying unforeseen and unplanned for consequences. According to Damania et al. (2017), droughts often have poorly understood consequences within cities, causing major disruptions in urban development, economic activity and the water services sector. These impacts include significant reductions in worker productivity and labour income, higher incidences of diarrheal diseases, health impacts on young children, and an increased frequency of power outages (ibid).

Hence, it is important to deeply understand issues that surround urban water, to invest in further research and technologies to address the issue of water insecurity (as it is a global, national and local reality) and develop mechanisms that allow for appropriate water resource development and management (Ukwandu 2009).

There is a need to be proactive in alleviating the adverse effects of the water crisis experienced in Cape Town. It is important to invest in building citizen and government ability to cope with environmental conditions, in order to meet existing and future societal demands.

It is also important to note that the CoCT along with other institutions have embarked on reforms of water management in the city that include research, and the development of planning tools and policy that aim to address inequality, promote development and alleviate poverty through access to water, good water governance and water-sensitive urban design. For further reading consult the list below (Note: This list is not exhaustive):

- **Water-sensitive Urban Design for South Africa: Frameworks and guidelines (2014);**
- **Urban Design Policy (2013); and,**
- **City of Cape Town Draft Water Amendment By-Law (2017).**

GOOD WATER GOVERNANCE AND MANAGEMENT

With fast growing cities, meeting water needs has been extremely difficult and alternative ways of responding to rapid change to create sustainable urban environments are being explored through good water governance and improved management around the world.

Crises in governance systems are often a key factor in the failure to implement sustainable development, whilst balancing the socio-economic needs of a city.

There is a need for governance principles that encourage bottom up, multi-stakeholder processes that strengthen economic growth, social inclusiveness, urban development and environmental sustainability.

Good water governance involves social, political and economic processes along with relevant institutions in government, the private sector and civil society involved in making decisions about the most effective way to develop, use, and manage water resources within a city or country (United National Development Programme 2004).

In coping with existing and future water challenges and resource management, it is vital that there are robust public policies put in place. For effective water governance, it is also important to incorporate the following in to management systems:

- **Appropriate engagements with stakeholders;**
- **Appropriate and accessible information;**
- **Well-designed regulatory and management frameworks;**
- **Integrity;**
- **Transparency; and,**
- **Adequate capacity of stakeholders/officials (Akmouch, Clavreul and Glas 2017).**

Good water governance can significantly contribute to the development and implementation of Integrated Water Resource Management (IWRM) strategies, water sensitive design, and improved urban development and service delivery. It requires the realisation of shared responsibilities across government spheres, civil society and a range of stakeholders who play a critical role in environmental, economic and social aspects of water governance. In other words, a robust multi-level, multi-stakeholder and multi-sector approach.

Water governance and corresponding policy is inherently complex and linked to urban development, spatial planning, regional planning, agriculture and poverty alleviation, and is resource-intensive across all spheres of government. Therefore, there is a need for governance principles that encourage bottom up, multi-stakeholder processes that strengthen economic growth, social inclusiveness, urban development and environmental sustainability.

OECD Good Water Governance Principles

The Organisation for Economic Cooperation and Development (OECD) good water governance principles were developed to help guide the design and implementation of effective, efficient, and inclusive water policies for all spheres of government and a range of stakeholders (OECD 2015).

Effectiveness

- Clear and realistic sustainable policy goals and targets at all levels of government;
- Clear allocation of roles and responsibilities;
- Management of water at appropriate scales; and,
- Adapting the capacity of stakeholders to the complexities and context of water challenges experienced.

Efficiency

- Government strategies must contribute maximum benefits to water management and governance at the lowest cost (socio-economically) to society;
- Transparency and sharing of data as well as information;
- Mobilising water finance;
- Enforcing regulatory frameworks; and,
- Encouraging good water governance practices across a city.

Inclusivity, Trust and Engagement

- Develop public confidence in the governance of water;
- Promote inclusiveness across stakeholders through democratic legitimacy;
- Mainstream transparency and integrity;
- Manage trade-offs across water-users; and,
- Regular monitoring and evaluation to adjust and adapt appropriately to changes.

The creation of a secondary or alternative land use framework specifically for the incremental upgrading of informal settlement is useful in order to drive faster and more effective basic service delivery in informal settlements.

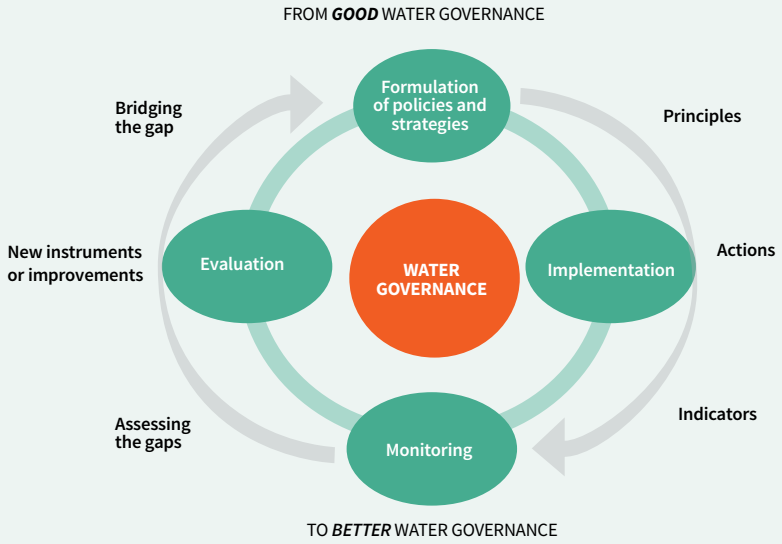


FIGURE 1: OECD Water Governance Cycle (OECD 2015)

Good Water Governance in Informal Settlements

The way cities govern their water affairs and resources has a profound impact on liveability and the livelihoods of citizens, particularly for the most vulnerable (Tropp 2007). However, good water governance in informal settlement upgrading projects has not received the appropriate level of attention and consideration as infrastructure development.

This is largely because upgrading in South African cities has mostly focused on technical/infrastructural aspects in relation to service delivery rather than the participation of communities in water planning decision-making processes . In addition, public access to information has been limited.

Public participation in water governance and resource management within upgrading processes provides the potential to increase efficiency in providing urban infrastructure and services that are designed to build the capacity of local communities and meet their needs through participatory local governance (United National Development Programme 2004). For example in Porto Alegre, Brazil the water utilities and governance system has been successful in major part due to the participation of communities (see box on following page).

Participatory Management of Water in Porto Alegre, Brazil

Porto Alegre has served as an example of both successful participatory democracy and water governance. The case study of Porto Alegre illustrates a public water sector and governance system that offers an innovative approach to participatory management, which has been challenged by financial restrictions but still continues to be successful.

Porto Alegre has Brazil's most successful public municipal water utilities. The Department of Water and Sewerage (DMAE) forms a part of an integral deliberative council that encourages citizens to participate and exercise influence in the functioning of the public water system. This also includes a social audit (citizen involvement and oversight of budgeting for water services and works). Along with a social audit, the DMAE incorporates a social tariff system that cross-subsidises water services for the urban poor.

Since the inclusion of participatory management of public water utilities, DMAE has overseen the expansion of water connections to households by 23%, and there has been a 40% increase in sewage services over the period of 1994-2004. Approximately, 99% of Porto Alegre's residents have access to treated drinking water.

DMAE has been a centre for initiating resistance and developing alternatives in the face of the privatisation of water utilities across Brazilian cities in 2000, as well as equitable and inclusive water governance and management.

(Our Water Commons 2018)

It is important that advocacy focused on water reforms, particularly with regard to informal settlements should include:

- Facilitating dialogue and engagements with communities and other relevant stakeholders;
- Establishing tools for empowering residents/users to identify problems in their community/settlement related to service delivery, water quality and other significant issues;
- Dissemination of information to the public about the cost of water sector infrastructure and service delivery;
- Building the capacity of policy and regulatory implementers; and
- Depoliticising water reforms and improving service delivery (World Bank Institute 2010)

OPPORTUNITIES AND INNOVATION IN THE WATER SECTOR, CAPE TOWN

In 2016, the global water crisis was ranked by the World Economic Forum as the greatest risk to development, economies, environments and people.

Climatologists have predicted that the Western Cape is moving towards a much drier climate with less frequent rainfall events, however the intensity of the rainfall events will increase. Therefore, drought or no drought, the City along with industries will have to adapt to the "new normal of water scarcity" (GreenCape 2017). Cape Town has the opportunity to move towards resilience and water-sensitive practices by moving away from municipal potable water towards alternative water resources.

...drought or no drought, the City along with industries will have to adapt to the "new normal of water scarcity" (GreenCape 2017).

According to the GreenCape Market Intelligence Report (2017), there are various opportunities for water resources development, which are detailed below:

Water Reuse, Recycling and Recovery

This is increasingly being adopted by water-intensive industry and commercial users in Cape Town and is a viable option for local government to implement at a much larger scale. These involve advanced treatment technologies such as treating effluent and potable water reuse to specific standards. Recycled water has the advantage of being a constant and reliable source of water for heavy industry. It allows for the optimisation of water costs and minimises the environmental stress of water-intensive industry and footprint. The Goreangab Water Reclamation Plant and Durban Recycling Water Project are examples of successful water recycling plants and schemes on both a large and smaller scale:

Goreangab Water Reclamation Plant: Windhoek, Namibia

This reclamation plant has been recycling the City of Windhoek's wastewater since 2001. It is a high-tech wastewater treatment and processing plant used to recycle wastewater and semi-purified sewage to a standard of 100% that is safe for human consumption, as well as potable water for industrial use.

This plant is unique and globally renowned, providing access to potable water at a large scale of approximately of 21 000 m^3 per day, which makes up a third of the City's potable water supply.

Durban Recycling Water Project: Durban, South Africa

The Durban Recycling Water Project is a significant achievement of sustainable water use for South African cities. This plant has been processing approximately 47.5 Ml per day of industrial and domestic wastewater to close to potable standard for industrial use and processes.

Consequently, the project has alleviated a large amount of stress from of current water supply infrastructure in Durban and has proactively decreased pollution on marine systems and environments.

Challenges:

- The limited number of government incentives promoting the building of treatment plants;
- Large amounts of initial capital required upfront;
- Technical capacity;
- Negative perceptions of reusing/recycling water; and,
- Policy and regulations concerning the implementation of projects

Desalination

Desalinisation:

is the method used to remove salt and excess minerals from sea water to produce water that is suitable for human consumption and agricultural use.

Desalination can provide opportunities at both large and small scales. Desalination components can be implemented in small scale on-site developments, as well as in manufacturing and water services companies for an array of applications such as using desalinated brackish groundwater in the construction of housing developments and in industry. Large-scale desalination is often city-wide and is used for the treatment and reuse of industrial water. Desalination offers the CoCT the opportunity to desalinate seawater which can then be stored in large quantities to meet the City's water demand.

Desalination for many cities provides a resilience strategy, addressing some effects of climate change on water supply and offering greater certainty of supply. Small-scale desalination plants can also be used to generate renewable energy, reducing both industrial water and energy costs.

Challenges:

- Brine discharge is still a major environmental hurdle; and
- Desalination as a drought emergency mitigation response often tends to have unintended financial and political repercussions.

Groundwater Extraction and Managed Aquifer Recharge

Managed Aquifer Recharge:

is an intentional process of replenishing water into an underground layer of rock (aquifer).

The interest to move towards groundwater supplies has increased considerably especially in the heavy-industry and agricultural sector. Groundwater extraction and managed aquifer recharge is a promising alternative in reducing vulnerability to hydrological variability and climate change. This allows for the potential of storage and treatment of various water sources both natural (surface water and groundwater) and recycled (storm water, wastewater and desalination). Groundwater extraction and managed aquifer recharge can be implemented on both small and large scales, and is cost-effective in comparison to alternatives such as desalination.

Challenge:

- Primary concerns of contamination with regard to managing aquifer recharge.


Sirajah

CONCLUSION

In a state of crisis and for future sustainable supply of water for both consumption and industry, it is essential to follow integrated water management. Water is a crucial driver in socio-economic development, the functioning of society and the environment, hence it is critical that there is a deep understanding of urban water issues.

The City of Cape Town's water crisis has highlighted the need for more robust forward planning and mitigation strategies to be put in place along with better transparency, in case of a national disaster such as the current drought. The water crisis has also presented itself as an opportunity for innovation towards a resilient water services sector and improved water management strategies.

However, it is important to note that the realisation of a resilient water services sector, appropriate water management systems and a re-imagining of the current water services sector is impossible without implementing good water governance. For these mechanisms, innovations and strategies to be realised and their full potential to be reached it is important that good water governance principles be employed during planning, implementation and management phases.

Participation and citizen action incorporated into decision-making processes will help to create viable, localised and appropriate policy, plans and strategies to effectively deal with urban water problems and climate change in both formal and informal settings. The active involvement of citizen voice and feedback allows local government and other water services sector institutions to address the divergent needs of users, water suppliers and regulators.

REFERENCES

Akhmouch, A., Clavreul, D. and Glas, P. 2017. Introducing the OECD Principles on Water Governance. *Water International, 43(1), 5-12.*

Basholo, Z. 2016. *Overview of Water Demand Management Initiatives: A City of Cape Town Approach, City of Cape Town* [Online] Available at: https://www.greencape.co.za/assets/Water-Sector-Desk-Content/CoCT-WCWDM-presentation-Z-Basholo-Western-Cape-Water-Forum-160204-2016.pdf [Accessed 12 Dec 2018].

Bratton, L. 2018. *Water crisis: it makes no difference to us, say residents of informal settlements.* [online] GroundUp News. Available at: https://www.groundup.org.za/article/water-restrictions-its-nothing-new-us-say-residents-informal-settlements/ [Accessed 10 Aug. 2018].

BusinessTech 2015. *What South Africa's population will look like in 2050.* [online] BusinessTech Available at: https://businesstech.co.za/news/general/95607/what-south-africas-population-will-look-like-in-2050/ [Accessed 28 Aug. 2018].

City of Cape Town. 2018. *Water Outlook 2018 Report: Revision 25 - updated 20 May 2018.* Cape Town: Department of Water and Sanitation, 1-6.

Damania, R., Desbureaux, S., Hyland, M., Islam, A., Moore, S., Rodella, A., Russ, J. and Zaveri, E. 2017. Uncharted Water: The new economics of water scarcity and variability. International Bank for Reconstruction and Development / The World Bank, 1-61.

Department of Water Affairs. 1997. *White Paper on a National Water Policy for South Africa.* Republic of South Africa, 1-64.

Department of Water and Sanitation, 2014. *WC WSS Reconciliation Strategy Status Report.* Available at: http://www.dwa.gov.za/Projects/RS_WC_WSS/Docs/WCWSS%20Status%20Report%20Oct2014%20Final.pdf [Accessed 12 Dec. 2018]

Dougan, L. 2018. *Day Zero is called off for now, but restrictions retained | Daily Maverick.* [online] Daily Maverick. Available at: https://www.dailymaverick.co.za/article/2018-06-28-day-zero-is-called-off-for-now-but-restrictions-retained/ [Accessed 15 Aug. 2018].

Government of Western Australia, Department of Water and Environmental Regulation. n.a. *Managed Aquifer Recharge* [Online] Available at: http://www.water.wa.gov.au/urban-water/water-recycling-efficiencies/managed-aquifer-recharge [Accessed 30 Nov. 2018].

GreenCape. 2017. *Water: Market intelligence report.* Cape Town: GreenCape, 14-70.

IBNet. 2018. Standard Country Report, 26 Utilities in South Africa [Online] Available at: https://database.ib-net.org/countries_results?ctry=24&years=2017,2016,2015,2014,2013&type=report&ent=country&mult=false&report=1&table=true&chart=false&chartType=column&lang=EN&exch=1 [Accessed 28 Nov. 2018].

Jordan, B. 2018. *Useful water-saving tool? Or has Cape Town gone dotty?.* [online] Available at: https://www.timeslive.co.za/news/south-africa/2018-01-15-useful-water-saving-tool-or-has-cape-town-gone-dotty/ [Accessed 10 Aug. 2018].

Nkanjeni, U. 2018. *Cape Water Crisis collection points as Level 6b water restrictions announced.* [online] Traveller24. Available at: https://www.traveller24.com/Explore/Green/cape-water-crisis-level-6b-water-restrictions-announced-as-day-zero-reality-inches-closer-20180118 [Accessed 14 Jul. 2018].

Organisation for Economic Co-operation and Development (OECD). 2015. *OECD Principles on Water Governance.* (OECD), 1-20.

Our Water Commons. 2018. Case 10: Public Management of Water in Porto Alegre, Brazil | Our Water Commons. [online] Ourwatercommons.org. Available at: http://ourwatercommons.org/water-solutions/case-10-public-management-water-porto-alegre-brazil [Accessed 17 Aug. 2018].

Rand Water. 2005. *Water Wise - Water Situation in South Africa*. [online] Waterwise.co.za. Available at: http://www.waterwise.co.za/site/water/environment/situation.html [Accessed 25 Aug. 2018].

Republic of South Africa. 1998. *National Water Act.* Cape Town: Office of Presidency, 1-45.

South African National Biodiversity Institute. 2013. *Climate Trends and Scenarios*. [pdf] 1-2. Available at: https://www.sanbi.org/wp-content/uploads/2018/03/ltas-factsheetclimate-trends-and-scenarios2013.pdf [Accessed 27 Aug. 2018].

Tropp, H. 2007. Water governance: trends and needs for new capacity development. *Water Policy*, 9(S2), 19-30.

Ukwandu, D. 2009. *Water use and sustainable development in South Africa*. Master. University of South Africa.

United Nations Development Programme. 2004. *Water Governance for Poverty Reduction: Key Issues and the UNDP Response to Millenium Development Goals*. Water Governance Programme. New York: United Nations Development Programme, 1-92.

UN Water. 2013. What is Water Security? Infographic [Online] Available at: http://www.unwater.org/publications/water-security-infographic/ [Accessed 29 Nov. 2018].

Veolia Water Technologies. 2017. *Water Reuse*. [online] Veoliawatertechnologies.co.za. Available at: http://www.veoliawatertechnologies.co.za/water-solutions/water-solutions-overview/water-reuse/ [Accessed 15 Aug. 2018].

World Bank Institute. 2010. A*dvocacy by the Office of the Ombudsman*: *Enabling water reforms based on citizens' feedback in Peru*. Social Accountability Notes. World Bank Institute, 1-8.

WWF-SA. 2016. *Water: Facts and futures rethinking South Africa's water future*. Cape Town: WWF-SA, 2-82.

Ziervogel, G., New, M., Archer van Garderen, E., Midgley, G., Taylor, A., Hamann, R., Stuart-Hill, S., Myers, J. and Warburton, M. 2014. Climate change impacts and adaptation in South Africa. *Wiley Interdisciplinary Reviews: Climate Change*, 5(5), 605-620.

Isandla Institute
70 Rosmead Avenue
Kenilworth, 7708
Tel: +27 21 683 7903
Fax: +27 21 683 7956
Email: admin@isandla.org.za
www.isandla.org.za