Challenges for Urban Water Security in the 21st Century: London & Cape Town Compared

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Abstract

Water issues are increasingly becoming part of the debate about human security. Definitions of security that have traditionally confined their focus only on the predictability of risks and hydro-climate conditions are now broadening their perspectives to encompass a wide range of threats to security including human security and its achievement through sustainable development. We argue that water must be placed within this broader definition of security and conceptualized as a link across the range of securities, including political, health, economic, personal, food, energy, and the environment.

Mirroring the article by Zeitoun et al. (2016), this paper reviews reports on water security challenges based on case studies of the cities of London and Cape Town. On the one hand, a dominant and policy-friendly reductionist approach "seeks to represent uncertainty through calculable risk, links national GDP tightly to hydro-climatological causes, and underplays diversity and politics in society" (Zeitoun et al., 2016 p.143). Such an approach is readily apparent in both cities through, for example, high-modern solutions such as dam-building and desalinization. In our view, adopting without question an approach such as this may lead often to interventions that reproduce inequalities, or that cannot be easily adaptable to future changes and climate (Zeitoun et al., 2016). Ironically, such an approach may increase water insecurity across the urban landscape rather than alleviate it.

On the other hand, Zeitoun et al. (2016 p. 143), argue in support of an integrative approach that seeks to be flexible enough to "address a range of uncertainties, explicitly recognize diversity in society and the environment, incorporate water resources that are less-easily controlled, and consider adaptive approaches to move beyond conventional supply-side prescriptions." Interventions evoked by such approaches are also diverse and inclusive because often they are more likely to reach the marginalized in society. In this article, we describe the various actors engaged in such approaches to water security. The paper shows that reductionist and integrative approaches operate side-by-side in both cities. It argues that for London and Cape Town to ensure a human security-centred approach to water management, integrative thinking must supplant the dominant, reductionist approach, although where mega-cities are concerned, it is unlikely that large-scale water transfer schemes will ever be fully displaced by closed-loop approaches to water access, use, and management.

Key Words

Water security, reductionist, integrated, environmental complexity, IWRM, and human right

Introduction

Water has been a fundamental precondition for urban development in London and Cape Town, but cities are social, economic, political and environmental spaces where water becomes contextually defined and ascribed to each particular sphere. London and Cape Town are both coastal cities and they share a common colonial past where London was the colonizer and Cape Town the colonized. Cape Town's architecture, institutions and infrastructure mimic London and reflect past relations of domination in their urbanism (Beall and Fox, 2009 p. 50). Today, both cities emerge in a contemporary setting with a similar challenge: To become not only water-secure cities but sustainable water-secure cities framed in the

Sustainable Development Goal 6 (SDG) launched in 2015. The goal for both cities is to "ensure availability and sustainable management of water and sanitation for all" (UN, 2019 p. 34).

However, London and Cape Town have both experienced a water crisis. For Cape Town, the Spring of 2018 nearly brought the city to a potential 'Day Zero' after three years of successive drought starting in 2015 (City of Cape Town, 2019 p. 26) while London has announced a water shortfall of about 100 million litres per day by 2020, and 400 million litres per day by 2040 (GLA, 2018 p. 14). Besides the water crises in London and Cape Town, projections of rapid population growth of ten and five million people respectively by 2035 and climate change will compound the problem (Macrotrends, 2020).

Both cities understand and deal with water differently and their approaches to water reveal the complexity of the water security topic. Privatization dominates the water industry in London compared with a centralized monopoly in Cape Town. For London and Cape Town to fulfill their duties in becoming cities with sustainable water securities they must rethink different ways of designing and performing more integrated water management approaches. The various interests related to water allocation and access pose distinctive challenges for each city that affect decision-making and policies. These are connected to management and governance and are important when the goal is also focused on applying principles that foster equality and conservation.

The focus of this paper is to review the discourses of water security for the cities of London and Cape Town, based on two approaches namely, (i) the dominant conventional reductionist approach to water challenges which undoubtedly is more popular the world over, and (ii) the more pluralistic integrative approach that broadens both the scope of uncertainties and the methods by which to integrate them. Our review is based on the theoretical frameworks of Zeitoun et al. (2016). We structure our argument as follows: conceptualizing water security: reductionist or integrated approaches?; a comparison of the background of the cities of London and Cape Town covering critical issues of their geography, demography, climate, political-socio-economics and so on; key water issues and challenges; efforts to achieve sustainable water securities; and a discussion and conclusion.

Conceptualizing Water Security: Reductionist or Integrated Approaches?

Below are a series of conceptual considerations that were the basis for shaping this paper and that has largely guided the management of water resources globally including the cities of London and Cape Town. In the last decade, the concept of water security has received increasing attention among scholars and practitioners in response to the need to understand water security within the complexities of our cities. For example, Zeitoun and colleagues (2016) have presented an interesting analysis of how developed and developing countries have used varying approaches to water security. They advance two main approaches, namely, reductionist and integrative approaches. The reductionist approach tends to be consistently focused on calculable risk, the interconnection between GDP and hydro-climatology causes, and an oversimplification of 'diversity and politics' (Zeitoun et al. 2016 p. 145). Some strong proponents of this approach include Grey and Sadoff (2007) who argue that "investments in water infrastructure and institutions are almost always needed to achieve water security" (p. 550). Garrick and Hall (2014) have also argued that "the extent to which water-related hazards must be managed varies depending on hydroclimatic characteristics" (p. 617).

The integrative approach, on the other hand, tends to be closely linked to the adoption of the Integrated Water Resource Management (IWRM) (Cook and Bakker, 2012; Zeitoun, 2016). The integrative approach to water security comes from the need for "shared responsibilities," and benefits water-policy makers by

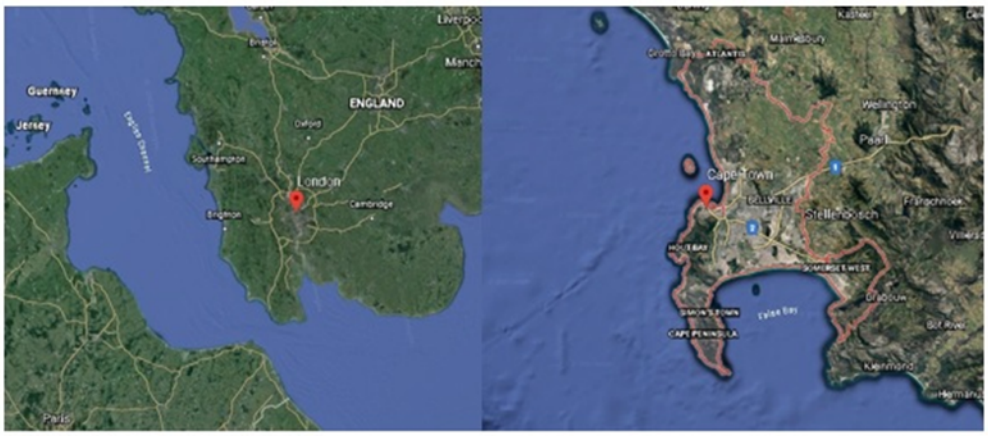
being more “context-specific” (Zeitoun et al. 2016 pp. 148 and 150). It identifies diversity in both society and environment paying attention to those who are marginalized; considers water that lacks immediate visibility, and welcomes alternatives that transform conventional ideas (p. 149). Some scholars have argued in favour of implementing a more integrated water security approach through a broader range of variables such as the IWRM. For example, Swatuk (2005) has argued that “IWRM constitutes both a discursive site and multilateral landscape where various forms of power—political, social, cultural—are exercised in the production of new social practices (p. 874). Jonker (2007) has also stated that “IWRM is a framework within which to manage people’s activities in such a manner that it improves their livelihoods without disrupting the water cycle” (p. 1262). Finally, Conca (2015) has argued that IWRM is a “more complex and interlocking policy mechanisms to manage water more comprehensively: across different user sectors, across different scales, in a more participatory way, with greater attention to the environment, and in a more knowledge-informed manner” (p. 302).

However, IWRM has not escaped the sphere of contestation as “it problematically employs the river basin as a unit of analysis and avoids the politics that can serve to manage trade-offs” (Zeitoun et al, 2016 p.148). Furthermore, scholars such as Biswas (2008) have argued that given the complexity of water, IWRM is “difficult to achieve because of extensive inter and intra-ministerial turf wars and bureaucratic infighting” (p. 19). To conclude this section and before navigating the terrain of water security for London and Cape Town, we draw further attention to what Zeitoun et al. (2016) has said about both approaches’ tendency to guide water security in developed and developing countries and is used toward “increased reliability of supply as a key component to water security” (p. 148) without exploring other variables of water security such as water demand.

Background: London and Cape Town Compared

The need to understand the complexity of the water landscape in London and Cape Town is necessary to contextualize water. It emerges as an important element to grasp the dynamics happening between humans and the environment and rooted in social, economic, political and environmental issues. This local context for both cities provides a sense of water interaction in those places. Cape Town is the legislative capital and second-most populous city in South Africa (SA), and London is the capital and largest city in the United Kingdom (UK); two coastal cities whose climate presents a few differences. While Cape Town presents a Mediterranean climate, with wet, cool winters and warm dry summers (Parks et al, 2019), London enjoys a near Continental climate that is most pronounced in the Thames Valley region sheltered from the influence of mid-latitude depressions (London Climate Change Partnership, 2002 p. 9) (see Figure 1). Moreover, Cape Town is governed by the City of Cape Town (CCT) and 231- member city council elected in a system of mixed-member proportional representation while the Greater London Authority (GLA) and its 25-member London Assembly is the regional authority to oversees London.

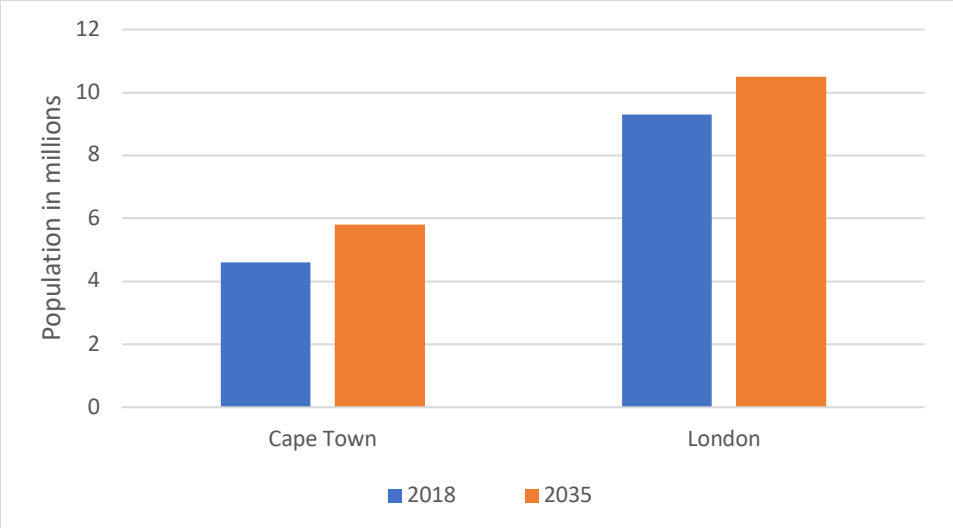
Figure 1. Aerial View of London and Cape Town



Source: Google Earth website. London on the left and Cape Town on the right side (2020)

Furthermore, rapid urban growth has been constant for both cities. In Cape Town, the rapid growth of informal settlements has greatly impacted the city's population. Cape Town's urban population of 4,618,000 is almost half of London's population of 9,304,000 inhabitants as of 2020. Cape Town's population is projected to grow to 5,845,000 by 2035 while London's population is expected to grow to 10,556,000 by 2035 (Macrotrends 2020) (see Figure. 2). According to the 2011 Census, 21.6% of people in Cape Town were living in informal dwellings or backyards (CCT, 2012). For example, the Khayelitsha settlement is one of the fifth largest slums in the world, with a population of about 400,000 inhabitants and where 99 percent of its dwellers were black as of 2011 (WEF, 2016). Economically, both cities are dominated by services industries, but they present differences in scales. For example, the Gross Domestic Product (GDP) of Cape Town accounted for 70% of Western Cape province in 2019, R436,463 million (approximately US$23 billion) (CCT, 2019a). While London's GDP in 2018 was £487,145 million (approximately US$610 billion) (ONS, 2019). London, unlike Cape Town, is expected to rank fourth in the list of global economies with an expected GDP of $1.3 trillion under the label of 'megacity' in 2035 (World Economic Forum 2019). Likewise, the Human Development Report of 2019 revealed that SA and UK are located both in the high and very high human development index positioned as 113 (0.625) and 15 (0.775) among countries, however, their respective Gini indexes of 63.0 and 33.2 respectively still reflects a vast income and wealth distribution disparity in SA (UNDP 2019). According to the World Bank in SA, "poverty is consistently highest among black South Africans, the less educated, the unemployed, female-households, large families and children" (2019:1) The global financial institution reveals that 55.5% of the country's population, 30.3 million, were living under the national poverty line in 2014.

Figure 2. Cape Town and London's Population in 2020 and Projected Population in 2035

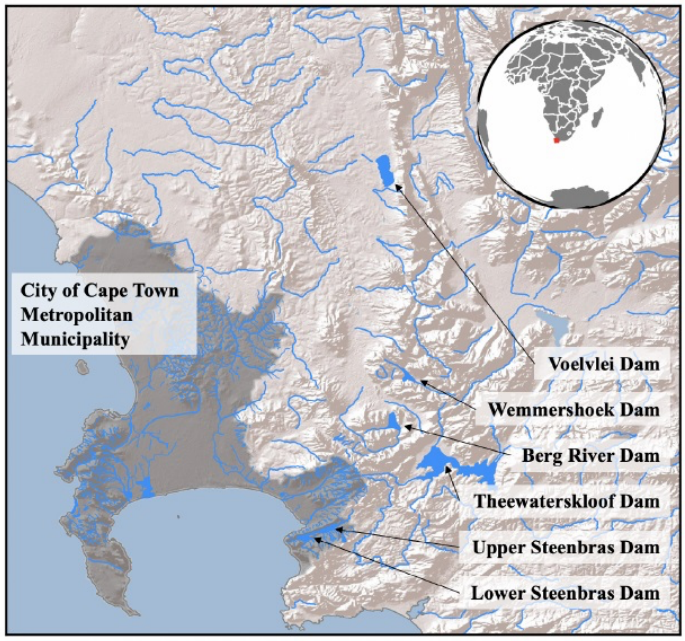


Source: Morales and Sithole (2020). Cape Town and London Population in 2020 and 2035. Source: Macrotrends.

Water in Context

Water supply for each city comes from different sources. Ninety-eight percent of Cape Town's water comes from rain-fed dams, captured and stored in 14 dams with a collective capacity of roughly 900,000 Ml (900,000,000,000 litres) provided mostly by six large dams located at the margins of the city (CCT, 2018a pp. 8-9) (see Figure 3). A comparison table prepared for this paper shows specific findings of this section below (see Table 1). While about 70% of London's water supplies come from the River Thames and River Lee and the remaining 30% comes from groundwater abstracted from the aquifer underneath London. (GLA, 2011 p. 12). In Cape Town, water protection and management are regulated primarily at the national level through the Water Act 36 of 1998 that provides power over water resources to the State of SA embodied by the Minister of Water Affairs and the Department of Water and Sanitation (DWS) as its main regulatory body (Beck et al, 2016). The Greater Cape Town Region receives its water from sub-catchments of the Breede, Berg, and Olifants Water Management Areas (WMAs) through the Western Cape Water Supply System (WCWSS). The WCWSS is made up of 14 dams, of which six are regarded as major dams and three aquifers connected by an 11,600 km pipeline network, several storage reservoirs, pumping stations, and canals The Nature Conservancy, 2018). The City of Cape Town shares its water resources with the neighbouring district and local municipalities. The current unrestricted daily demand for water in the WCWSS is 1.35 billion litres per day (1.35 million cubic meters per day- Mm^3) shared by the City of Cape Town, agriculture and smaller neighbouring municipalities (Ibid.). The new legislation was designed as a mechanism to avoid "discriminatory laws and practices of the past that have prevented equal access to water" – allocating human rights at the centre and to introduce a more integrated approach to water (Government Gazette, 1998, p. 3).

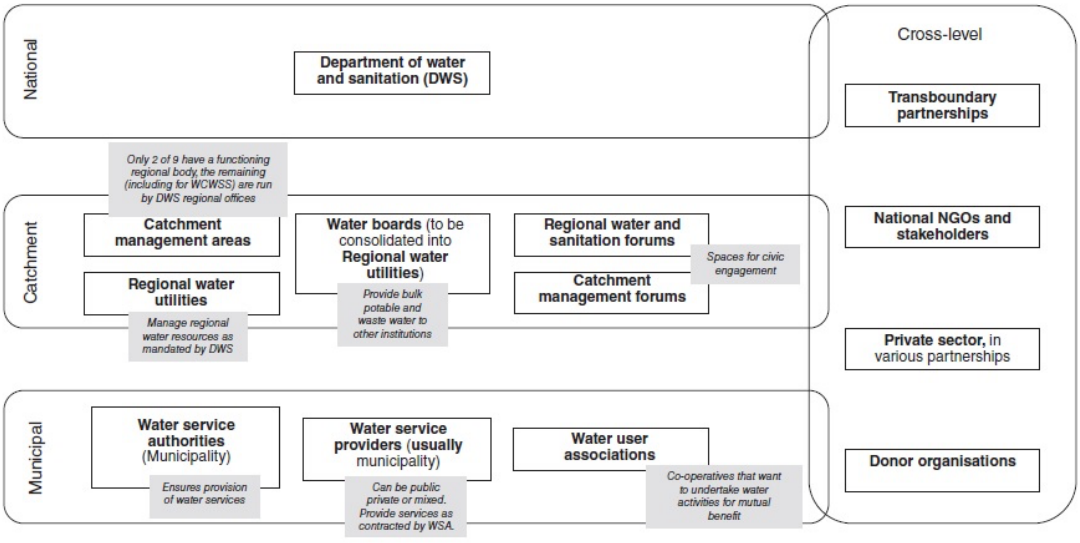
Figure 3. WCWSS Network of Water in Cape Town



Source: Enqvist and Ziervogel (2019)

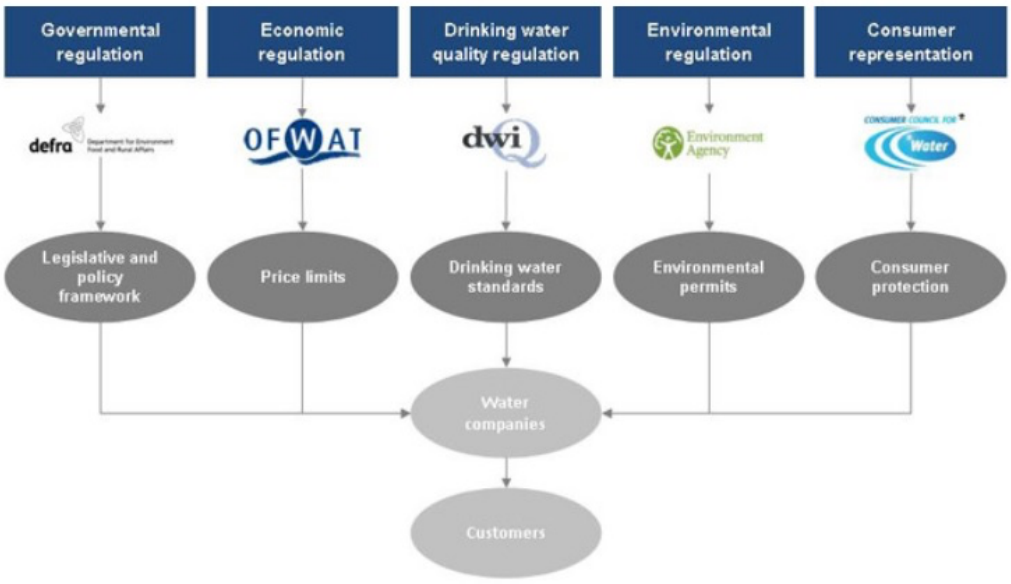
By contrast, the Water Act of 1989 was introduced to allow water moves from the public to the private sphere in the UK and with it a multidimensional level of responsibilities from the central government to regulators and inspectors (Ofwat 2006). With London's recent Water Act of 2014 greater competition for non-household customers has been allowed. Water provisioning and protection is one of the most contrasting aspects of the two cities. In South Africa municipalities are mandated to provide clean drinking water and stakeholders are at the national, catchment and municipal level (see Figure 4). While in the UK the provision of water is the responsibility of companies, but they are oversighted by the government and other entities (see Figure 5) for the various organizations involved in the water industry in that country.

Figure 4. Key Agencies and Organizations Involved at Different levels of Water Governance in South Africa



Source: Enqvist and Ziervogel (2019)

Figure 5. Key Agencies and Organizations Involved at Different Levels of Water Governance in the United Kingdom

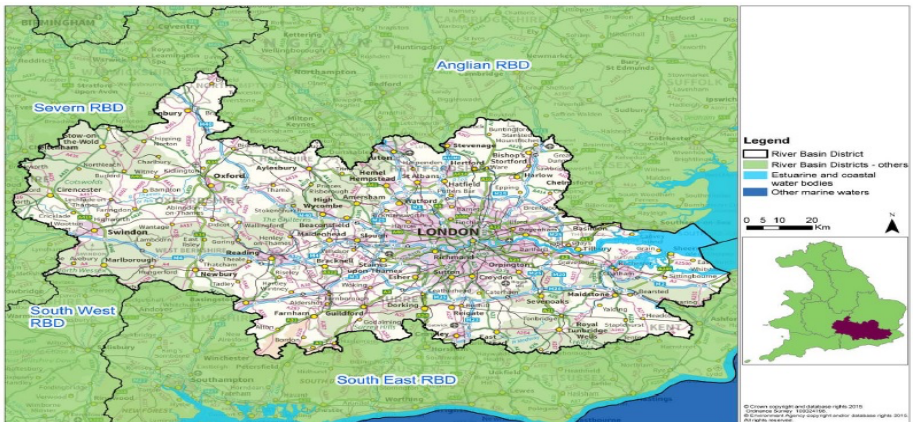


Source: Affinity Water (2020).

Furthermore, water precipitation in both cities presents a few similarities and differences as the total annual rainfall in Cape Town averages 500mm (19.7 inches) with most rain falling during winter (May-August) (Parks et al, 2019) whereas London's annual precipitation is about 583mm (23 inches) (GLA, 2015)

both average annual precipitations falling below the 990 mm (39 inches) global average annual precipitation (Henkel 2015 p. 289). For instance, in Cape Town, waterfalls more intensively in the catchment areas located in the mountainous areas exceeding 2000 mm per year most of the time unlike the city (CCT, 2018a p. 6). In London's case, the average rainfall for the Thames catchment is 739mm^2 in a year – less than the average for UK 919mm^3 and the basin of 16,200 km^2 provides 2,100 Ml/d of water in London and another 780 Ml/d for the Thames Valley in a dry year (Thames Water, 2019a:3-4) (see Figure 6). In the year 2014/2015, water was distributed as follows in Cape Town: 158Mm3 (29%), agriculture; 345Mm3 (64%) for the city use, and other municipalities 37Mm3 (7%) (CCT, 2019b:34) totalling 540Mm3 (540 billion litres) per that year. While in London the main difference is that out of the 2.6 billion litres per day needed by London or 949 billion litres per year totalling 949Mm3, agricultural water use does not feature as a driver for demand due to the relatively small volume of water that is used for this purpose within the Thames Water supply area – an estimated of 0.7% (Thames Water, 2019a). The two cities have adopted the catchment-based approach; however, some catchment boundaries do not coincide with political and administrative boundaries and the effects of any decision made outside the boundaries of both cities affect their capacity to supply water.

Figure 6. Thames River Basin



Source: River Basin Management Plan DEFRA and EA (2015)

Also, other different uses of water in the city of Cape Town were in 2017/2018 which were as follows: houses (51%) flats and complexes (9%) domestic other (2%) informal settlements (5%) retail and offices (15%) Industry (5%) city-owned facilities (6%) government (2%) and other (6%) in 2017-2018 (CCT, 2018a:31). While for London, food and drink manufacturer (6.6%), transport and manufacturer of transport equipment (3.3%) other manufacturing (3.1%), education and health (17.6%) wholesale and retail (6.1%), hotels, bars and restaurants (16%), agriculture, horticulture, forestry and fishing (1.4%) and other services (45.9%) in 2011. Moreover, according to the International Benchmarking Network (IBNET), water tariffs referenced on July 2019 for both cities were in the case of Cape Town: 1 m^3 cost $2.04 (1m^3-15m^3), and the price increases to discourage water consumption $3.21 (16 m^3 to 50m^3) and $4.30 (51m^3 to 100 m^3). For London based on Thames Water tariffs, 1 m^3 cost $1.84 (1-15m^3), $1.75 (16-50 m^3) and $1.73 (51-100 m^3). The price decreased when consumption increased (see IBNET, 2019).

Table 1. Water Background Comparison Table between Cape Town and London

Water Background	**Cape Town**	**London**
Water Legislation	Water Act 36 of 1998 framed equal water for all	Water Act of 1989 introduced privatization
Authority Responsible for water	Government Municipality – City of Cape Town	Government as regulator Water Companies – Thames Water (water supply and sewage), Veolia Water Central, Essex & Suffolk Water and Sutton & East Surrey Water
Stakeholders	National Government Department of Water and Sanitation (DWS) Catchment Management Agencies (CMAs) DWS regional City of Cape Town (CCT) Private organizations Non-for-profit organizations (NGOs) Water user associations (WUAs)	Department for Environment Food & Rural Affairs (DEFRA) The Environment Agency (EA) Municipal level, the Greater London Authority or City Ofwat Drinking-Water Inspectorate (DWI) Consumer Council for Water or CC Water Waterwise
Annual Precipitation	500mm (19.7 inches)	583mm (23 inches)
Source of Water	98% water comes from 6 main dams fed by precipitation: 1) the Theewaterskloof, 2) Voevvlei; 3) Berg River, 4) Wemmershoek, and 5-6) the Steenbras Upper and Lower dams	70% of water is surface water primordially coming from Thames River and 30% is groundwater. The Thames river basin over 16,200 km^2 (over 600 km of rivers and streams, most of which are tributaries of the Thames)
Water in the Catchment Areas	2000mm per year	739mm^2 per year
Water for Agriculture Use	29% (158Mm^3)	Less than 1%
Water per person	135 litres (2018)	167 litres (2009/2010) compared to the national average of 146 litres per person per day
Water Price	\$2.04 1m^3	\$1.84 1m^3
Water Needed for the City per Year	540Mm^3	949Mm^3

Furthermore, in Cape Town water use had been reduced from 330 litres per person per day in 1998 to 220 litres per person per day in 2014. In 2018, water use was restricted to below 135 litres per person per day, which was a reduction of nearly 60% compared to 1998 (CCT, 2019b p. 18). Meanwhile, London water use was an average of 167 litres per person per day of water a day 2009/10 compared to the national average of 146 litres per person per day (Greater London 2011, p.34). According to the local authorities, 99.8 % Access to safe potable water - households with access to piped water inside the dwelling or yard

or within 200 metres from the yard and an estimated 94.3 % of Cape Town's population has access to sanitation, according to government figures (Western Cape Government, 2017 p. 17). By contrast, in London, 100% of the population has access to both potable water and improved sanitation. Water companies charge in two ways. The first is unmetered and calculates a set rate that is decided upon by the homeowner's rateable value. The rateable value is based on the local authority's assessment of the rental value of one's property. The second method is metered, where one is billed for the amount of water that is used. If one's water bill is unmetered and they feel that the bills are too high, they can ask the supplier to change to a metered bill. As such one's water usage may not have much correlation with the water bill as in the case of charges with no water meter.

Climate Change

Both London and Cape Town are far from immune from the impacts of climate change. For example, according to Miranda and colleagues (2011), "the UK is already experiencing the effects of climate change in the form of increased sea-surface temperature and rising sea levels [and] if global GHG emissions continue unabated, the UK is expected to experience progressively warmer and drier summers, wetter and milder winters and more frequent extreme weather" (p. 9). These scholars go further to state that London, in particular, will be vulnerable to floods and heatwaves. Insofar as Cape Town is concerned, the University of Cape Town's Climate Systems Analysis Group (CSAG) developed downscaled climate change scenarios in 2010 that was used to interpret some of the expected changes. Interpretations from these scenarios indicated that the impacts of climate change on water sources in the Cape looked unfavourable, although some of these changes were said to also provide opportunities, such as increased civic participation, responses that reduced water wastage and collaboration between government departments (Ziervogel et al. 2010, p. 100). Another scenario suggested that after accounting for increasing temperatures and allocations of water to meet the ecological reserve, the WCWSS would decrease dramatically. In such a scenario, supply-side interventions would have to be implemented. For example, raising dam walls, treated wastewater reuse and groundwater exploitation, as well as restrictions on water use, might need to be imposed. Another study illustrated that traditional supply-driven water management responses need to be complemented by demand-driven management (Ibid.) These scenarios were all fulfilled during the 2015-2017 drought in Cape Town and raising dam walls would have been to no effect with drought conditions prevailing.

Main Challenges in the 21st Century: London and Cape Town Contrasted

Cities are not all the same, they face different kinds of challenges depending on the so-called first demographic transition like in the case of London which was fostered by the industrial revolution and is prone to face significant challenges related to ageing infrastructure such as the frequent bursting of water pipes. And, cities like Cape Town that have risen out of postcolonial second demographic transition (Beall and Fox, 2009). Our paper focused on the three main challenges faced by London and Cape Town. These pressing issues are not experienced in isolation but rather, interwoven with other issues reflecting the complexity of achieving long-term sustainable water security for satisfying water needs to everyone.

Cape Town

Cape Town is currently facing a dam-water dependency that challenges all actors as stakeholders – government, Departments of Water and Sanitation (DWS) national and regional, Catchment Management Areas (CMAs), regional water utilities, NGOs, water user associations and the City of Cape Town. All these are involved in managing and supervising adequate water provision. Few people are thinking about other

water sources without continuing the trend of high capital-intensive solutions that started with the construction of the Woodhead Dam in 1897 (CCT, 2018a p. 9). The challenge for Cape Town is to shift from a history of dam projects toward alternative solutions that contribute to more balanced equality and fairness for both locals and the environment at the same time. Ninety-eight percent of the city's water supply comes from water captured in a network of fourteen dams 'trusting' that mother nature will supply abundant water (CCT, 2018a p. 8). However, the drought period that started in 2015 and continued for three years in a row revealed that climate cannot be relied upon. The period was considered one that had received the lowest rainfall in 90 years (CCT, 2019b p. 26), proving that "current rainfall models were unable to predict the severity, timing or duration of the drought" (Taing et al., 2019 p. 531). Cape Town was able to emerge from its drought event because of an improvement in a close to average rainfall in 2018, and a series of water restriction regimes in both urban and agriculture.

A second pressing issue in water security is the equitable water allocation that is closely related to poverty alleviation. The 14 dams surrounding the City of Cape Town can collect 900,000 Ml of water (900,000,000,000 litres) (CCT, 2018a p. 9). The Water Act of 1998 was written to transform a legacy of many years of apartheid that separated people by racial lines. Cape Town currently supplies free water to approximately half a million people living in informal settlements such as Khayelitsha, and to around one million people in formal households living in properties with a municipal value of R400,000 (US$21,000) or less (CCT, 2019b p. 21). However, women and girls living in informal settlements such as Khayelitsha are responsible to carry water over long distances showing a high level of exclusion that limits their capacities to be free from poverty. Therefore, water security is not only about distributing water more equitably but also about understanding the full complexity of water management and poverty vulnerabilities that disrupt people's livelihoods and opportunities to flourish as human beings. The important thing to note is that total usage in informal settlements, including all types of use and losses, is about 50 litres per person per day- constituting only 5% of total usage in Cape Town (CCT, 2017). Therefore, despite the noble intention of South Africa, the challenge is how it will fulfill its promise about equitable water access as stated above.

The final important pressing water security challenge faced by Cape Town concerns the role of the State as the final water-decision-making authority embroiled in elected governments and thus, making water a very politicized issue. For the city to secure its water security it has to find mechanisms of expanding public participation (women, minorities) and bring civil society together. Water security is an issue that concerns not only environmental experts but organizations that are well-informed and can widen the water security context and advocate for integrating better policies. The government; representing political parties, and as the central authority that decides how, when and where to create an increased water supply and what water demand, there should be no separation between politics and efficient water governance.

London

In the case of London, one of the main three challenges is the replacement of an ageing water network of 32,000 km^2 of pipes that is constantly leaking and bursting resulting in 589Ml of water lost per day and 177 litres per property (GLA, 2011) and an outdated sewage system more than 100 years old. Water leakage is still a pressing issue for London. For instance, Thames Water (2019b) reported that 690 Ml were lost a day in 2017/2018. The challenge for the city has been to move away from neoliberal ideas embedded in the national infrastructure decision-making governance that calls for great capital-intensive solutions coming from the private sector based on the premise of 'efficiency' and 'expertise' (Bakker, 2013 p. 254). However, the fragmentation of water governance in the UK presents many limits to water security efforts locally. For instance, the four water companies in London responsible to provide water have been

replacing old mains in the city, however, large-scale decisions that will impact the city are approved by Ofwat, the economic regulator of the water sector in the United Kingdom and Wales, such as the construction of the Thames Tideway Tunnel (TTT) that will run beneath the River Thames (GLA, 2015 p. 9). The project has been more expensive than estimated. Therefore, the challenge, in this case, is about water governance.

Second, another pressing challenge to achieve water security is to deal with the existing tension between land use for development and green spaces that keep the Thames river basin healthy. An average of 311 reported housing developments per annum occurred on private garden land each year. On average, 500 gardens or part gardens were lost to development per year (London Wildlife Trust, 2010 p. 4). The big challenge is about how to provide adequate housing to more people without stressing the Thames River Basin. London has been growing faster than the local authorities had projected. The 2011 census showed that instead of an average 51,000 people increment per year since 2001, London had grown by an average of 87,000 people per year situating the city with 8.2 million people in 2011 instead of the projected 7.8 (GLA, 2016). The challenge that arises to achieve water security is how the city will accommodate 1.2 million more people expected by 2035 (Macrotrends, 2020) when there are already 1.25 million residents currently at risk from flooding in the event of 'exceptional' tidal flow in the city (London Assembly, 2014).

Third, the last challenge is related to pollution. Water bodies in the basin are already facing pollution from sources such as physical modifications (44 percent); wastewater (45 percent); households and transportations (17 percent); and pollution from rural areas (27 percent) (DEFRA, 2015, pp. 10-11). Pollution is another pressing issue in London challenging the quality of water. In 1957, the Natural History Museum categorized the Thames as biologically dead (Mallet, 2017) and therefore, keeping the basin healthy is a big challenge as it is pumping water to every single sector and individual in London not to mention the non-human ecosystems. The Thames river basin supplies water not only for the city dwellers but for 15 million people from neighbouring places (DEFRA, 2015).

Efforts toward Sustainability: London and Cape London Compared

Despite the main challenges specified above to adopt sustainable water security practices in Cape Town and London, efforts toward that 'desire' sustainability have come in the form of adopting Integrated Water Resource Management (IWRM). For Cape Town, IWRM has attempted to bridge complex levels of national, provincial and municipal water authorities since the Water Indaba of 2009. However the journey started since 1998 with the National Water Act and it has been an effort to moved toward a different water approach based on elements such as democracy, decentralization, bottom-up decision making, water users sharing model, people aspiration, and it based on a master plan (Malaza and Mabuda, 2019). IWRM emerged from the National Water Policy, version 1 – rested in the National Water Act of 1998 and Water Services Act of 1997 – that states that "must promote the management of catchments within a water management area in a holistic and integrated manner" (Goldin, 2010 p. 196). In the case of London, IWRM reflects both things, one the influence of communal decisions made in the European Union (EU) before officially disaggregation of England in January 2020 and also a complicated history of fragmentation reflected in the UK and the existence of more than 1,000 to 1,400 entities involved in water supply and sewage disposal after World War II (Ofwat, 2006 pp. 1-3). The IWRM rests on the Water Environment Regulations 2003 – Water Framework Directive – conferring responsibilities for policy implementation to the Environment Agency under the control of the Department for Environment, Food and Rural Affairs (Defra) (Fisher, 2013 p. 272). The following outlines a few examples of attempts toward sustainability.

Supply Management

Even though Cape Town and London present challenges in supplementing water due to their approaches that are highly dependent on great financial investment, the following efforts represent attempts to find alternatives that benefit both the environment and humans. With regards to Cape Town, after the recent water shortages mainly caused by an alteration of the expected rainfall, the local government launched its water strategy "*Our Shared Water Future*" in 2019 and announced as a recognition of the city's vulnerability due to a dam water supply system that will include a decrease in water supply from about 96% to 75% and also an increase in other alternative water sources such as groundwater from 7% to 11%, and 11% in desalinization and 7% in water reuse by 2040 (CCT, 2019b p. 30). The strategy is not a 'perfect document' but it reflects two things the municipal intention to increase reused water and it has shown can continue generating benefits for the city as "Cape Town increasingly sells treated wastewater for irrigation, industrial and construction purposes. For long-term transformation, the City could recycle all its treated wastewater for potable or non-potable reuse" (Taing et al, 2019 p. 533). According to Taing and her colleague, as an example of this less expensive and energy-consuming approach than desalinization "the thirteen largest wastewater treatment works (WWTWs) could supply 161.8 Mℓ/d of effluent for reuse" (533).

Cape Town is also improving water supply by removing the alien vegetation that affects the stream water flow into the main supply dams such as Steenbras and Wemmershoek Dams and in the mountainous catchment areas (CCT, 2018a). According to the Nature Conservancy, "over two-thirds of the sub-catchments supplying the WCWSS are affected by alien plant invasions, reducing the amount of water that reaches the rivers and dams that feed the region by 55 billion litres (55 Mm^3) per year" (p. 8). With regards to London, the Thames River Basin Management shows the needed connection of different perspectives coming together to ensure the benefit of the basin and humans. It has the collaboration of regulator, operator, influencer and project undertakers (DEFRA, 2015). However, there is a role overlapping in the initiative. It includes the 17 management catchments areas.

Demand Management

Water management has been one of the main challenges identified for both cities as Cape Town is failing to allocate water equally for all its dwellers while London is experiencing a considerate among water leakage due to outdated water infrastructure. The Water Demand Management Strategy in Cape Town updated in 2015/2016, "a progressive" initiative for its "achievement of nearly universal access to water" (Rodina, 2019 p. 11). The strategy is framed in the existing Water and Sanitation Master Plan to determine future water demand requirements in the city. Water demand management has included improvements in long-term objectives set out in the policy include equity; sustainability; affordability (Frame and Killick, 2007). In the case of London, water demand sustainable efforts can be identified in the implementation of sustainable drainage systems (SUDS) introduced by the Flood and Water Management Act of 2010 that no longer allows the automatic right to connect to storm sewers needed to be considered for the design, construction, maintenance and new housing developments constructed after 2007 (Fewkes, 2012). How to manage the location of new homes has been a crucial driver for managing future domestic water demand. For instance, the Old Oak Common and Park Royal's IWRM, included in its drafting proposal for the development of 25,000 new houses the inclusion of storm rainwater for later use, the use of infiltration techniques such as porous surfaces, attenuation of rainwater in ponds or open water features for further release, among others aiming to reach the target of water consumption to 105 litres or less per day (Aekom, 2017). Other IWRM strategies were adopted for development projects such as Charlton

to Crayford, Vauxhall Nine Elms Battersea, Charlton to Bexley, Old Kent Road, and Old Oak Common and Park Royal.

Water Governance

Woodhouse and Muller (2016) argued that the quest for addressing adequately the complexity of water security often is compounded by such factors as the failure to understand that "water governance remains a scene of contestation between local and global criteria and developmental and environmental goals" (p. 225). According to these authors, this contestation reflects how water governance prioritizes its resolution on questions such as: "How is water governed?" "Who should participate in decision-making?" "At what geographical and political scales should governance institutions operate?" "And what is the appropriate role of market or non-market criteria in allocation of water?" (p. 226).

Cape Town's inter-catchment water transfer initiatives have made stakeholders' participation possible in the form of Catchment Management Partnerships have been established to actively involve communities. For instance, the Berg River Partnership (BRP) comprises more than 30 stakeholders – government and non-government working together to improve water quality along the Berg River approximately 285km in length that forms part of the Berg River catchment an area of approximately 8 980 km^2 and located in the Western Cape province (Locke, 2016). These catchments are also used extensively for irrigation. The Berg River is the main source of domestic water supply and agricultural crop production with approximately 600 farm units providing employment (Western Cape Government, 2012). Another initiative is the Breede-Gouritz Catchment Management Agency (BGCMA) established in 2014 by extending the boundary and area of operation of what was known as the Breede-Overberg Catchment Management Agency (BGCMA, 2018). The BGCMA features a focus on decentralization and an emphasis on stakeholder consultation in water resources management-related decision-making processes. London, IWRM strategies have allowed the convergence of different groups as it is the case of housing development. For instance, for the Old Oak and Park Royal Development Corporation (OPDC), Thames Water; the Environment Agency, the boroughs of Brent, Hammersmith and Fulham, Ealing, and Kensington and Chelsea and workshops with other stakeholders were held.

Discussion

Our case studies of the cities of London and Cape Town described in detail above, open an opportunity in which we can objectively as well as subjectively discuss the debate on water security. For this paper's argument, we adopt a comprehensive and broad definition of water security which was advanced by Bakker et al. (2010): "sustainable access, on a watershed basis, to adequate quantities of water, of acceptable quality, to ensure human and ecosystem health" (p. 14). Several definitions of water security have been suggested. However, this definition seems to suggest that the stressors of water security and/or insecurity "stem from a combination of the built environment, the biophysical environment, and human governance" (Ibid.). In our experience with the cities of London and Cape Town, we feel that this definition fits well because it is holistic in the sense that it alludes to ideas that emphasize sustainability or sustainable development, which aims to balance environmental, economic, social, cultural, health and political needs (CCA 2009).

Bakker and her colleagues (2010) have also shown us how water security has been defined by others in noncomprehensive ways with a single-discipline focus. For example, some have focused their understanding of water security in terms of clean and available drinking water and have exploited the knowledge of engineering in building massive municipal infrastructure to secure potable water supplies.

Others like the U.S. water engineering and Department of Homeland Security have conceptualized water security as counter-terrorism measures to ensure the security of drinking water. Many more have perceived water security as the availability of reliable basic water services and gone on to make sure such services are developed in full. And still, others like those in political science have regarded water security as a basis for environmental security to reduce conflict and national security concerns.

In this discussion, we compare the cities of London and Cape Town regarding what we have learned about their perception and understanding of water security. To help us unpack our findings we adopt a theoretical framework propounded by Zeitoun et al. 2016). As noted above, Zeitoun and colleagues argue about two prominent approaches toward water security that may be used by cities around the world. We use this framework to find how the city of London compares with Cape Town in the other part of the world.

Complexity and water security

The concept of water security can be conceptualized as "either narrow and discipline-specific, or broad and integrative" Zeitoun et al. 2016, p. 143). When water security is perceived in one or the other of these ways, policies and practices that ensue will reflect or demonstrate such perceptions. For example, if the subject of water challenges is taken as a simple issue the solutions that will be crafted will follow a simplistic and usually linear path of dealing with it. On the contrary, if water security is regarded as a complex regime the ways to deal with such a situation will be likely nonlinear and multidimensional and will probably include political, technological, and biophysical processes (Zeitoun et al. 2016).

We argue that most large cities, in particular, those located in the Global North were founded and grew as a result of the Enlightenment that witnessed the rapid advancement of scientific knowledge. The city of London is certainly one such city. This is one of the reasons why London is beleaguered by problems of bursting water pipes. Cities in Western nations are more or less built using the scientific model of superiority over nature. We argue that when the city of Cape Town was founded by the Dutch and later colonized by Britain, its entire infrastructure mimicked London and other European cities. The colonizers imagined that they could simply build a city in Africa modelled after their Western technologies and everything will work out well regardless of the many differences between the two cities such as the weather, geography, biophysical processes, climate and so on. We consider such kind of thinking and planning as simplistic. Some problems such as flooding or other water challenges that Cape Town faces are reflections of the problems the city of London inherently has. We support the claim by Zeitoun and colleagues that one "source of the complexity of water-society challenges comes from the uncertainty of future water availability and demand, which are themselves driven by inter-woven and constantly changing geopolitical, economic, demographic, and climatic processes" (Zeitoun et al. 2016, p. 144).

Reductionist Approach

Zeitoun et al. (2016) defined the reductionist approach as "seeking water security through certainty" (p. 145). This approach envisages the reduction of uncertainty through risk framing and analysis. Again, science and technology often like to deal with something that can be predicted and controlled using formulas or the scientific method. In our case study of the city of Cape Town, we found much evidence about the use of the reductionist approach. For example, the WCWSS runs a complex network of dams, canals, reservoirs, pipes and other infrastructure all set as risk-management strategies. Despite all the heavy investment involved in water security infrastructure, Cape Town almost ground to Day Zero in 2018

after a long drought spell. London very much exhibits the similar characteristics of using the reductionist approach in its water security strategies. They buy into the idea that the higher the investment to reduce or manage water-related risk the greater the city's GDP will be even if they have more hydrological variability. The dominant discourse therefore and one that is readily favourable to policymakers and bankers is the correlation between water management and the growth and strength of economies. Such theories appear to have worked well in developed nations who naturally also happen to have stronger economies than what is happening in Cape Town where inequality is epic.

The reductionist approach also seeks to reduce diversity and politics in society. For example, those who define water security as a tolerable risk; "water security is a tolerable level of water-related risk to society" (Zeitoun et al. 2016, p. 147) may seem to convey inclusiveness. In Cape Town and other cities from less developed nations, the idea that every member of society bears the same risk is fallacious. The majority of the people who were hard hit by the 2015-2017 drought in Cape Town were people from informal settlements or marginalized communities. It will always be the women, the unemployed, street kids, the marginalized or oppressed who will "remain water insecure so long as the cultural biases and political exclusions that in large part prevent them from accessing water on equal terms with others continue to be downplayed" (Zeitoun et al. 2016, p. 148).

To be more exact, Cape Town imported industrialization solutions to achieve water security by building dam infrastructures promoted by scholars such as Grey and Sadoff who argue that "poverty demands that many developing countries will need to make large investments in water management and infrastructure at all levels" (2007, p. 546). And Garrick and Hall who in the same line of thought assert that "pathways to water security capture the sequence of investments in institutions and infrastructure to reduce water-related risks and manage trade-offs" (2014, p. 611). However, water security as noted by Zeitoun et al. (2016) goes beyond the limits of hydrological issues, but link water security with what is referred to as human security as described in the 1994 Human Development Report that "all citizens should be entitled to both civil and political, as well as social and economic rights, including the capacity to exercise these rights. This concept thus includes rights to water" (2011, p 156). Khayelitsha is an example of what it means to lack human security when women and girls have to use toilets placed outside their homes in the middle of the night or have the physical burden to carry water, but when we watch the news about Cape Town's water crisis we get the impression that the water crisis is a new thing for the people in that city without realizing that citizens in Khayelitsha have been battling a water crisis for decades. Zeitoun and his colleagues indicate that "reservoir storage and GDP also incorrectly assume a linear and equitable share of GDP for marginalized and poor people" (2016, p. 146). Therefore, dam investment under the premise of 'reaping' benefits for 'all' in Cape Town does not coincide with equitable water access and sewage system but it is more complex than implying that it is "a result of political priorities which have historically often catered to the interests of rural, commercial, white farmers" (Enqvist and Ziervogel, 2019 p. 9).

In our view, even though Cape Town started its process of encountering with a new paradigm called IWRM during the Water Indaba of 2009, the adoption of this new approach has been somehow lost in what Swatuk called 'localization' in which those who have authority over water are trying to make sense of what it is prescribed and what is local knowledge and practices – how we do things around here (2005, p. 874). In our view, this concept can be used to understand Cape Town's struggle to translate what IWRM envisioned in a Westernized cosmology and how local authorities make sense of their contextual realities to adapt to the concept. It brings to the surface the need to see IWRM as a flexible framework rather than a prescribed process as stated by Jonker a framework that "assists us to focus on the goals in water

resources management whilst allowing us to identify the appropriate tools available to achieve these goals" (2007, p. 1262).

The Integrative Approach

Zeitoun et al. (2016) have defined this approach as one that tends "to approach the complexity of the water-society challenges either by invoking more comprehensive analysis of the underlying processes or by being socially driven and adaptive in the face of a broadened set of uncertainties that are considered" (p. 148). This approach closely resembles the Integrated Water Resource Management (IWRM) that aims to move away the classic view dominated by scientists and experts. The integrative approach most notably embraces or acknowledges the complexity of water-society challenges by "recognizing diversity in society and the environment, while maintaining focus on the most marginalized; and incorporating water resources that are less-easily controlled; as well as welcoming innovative and adaptive approaches to move beyond supply-side prescriptions" (Zeitoun et al. 2016, p. 148).

Using this approach entails becoming aware that water is intrinsically related to other dynamics such as politics, power, marginalization and injustice in society. For example, water security for the residents of London becomes acutely aware that the grapes and wine they consume comes with a price for the people in Cape Town who face water scarcity and yet South Africa is a net exporter of virtual water to the UK.

The national and provincial governments initiated an IWRM action plan for the Western Province during the Water Indaba in 2009. The government structures developed an Integrated Water Resource Management Plan for Western Cape Province with an overall aim of guiding water resources-related activities towards meeting the growth and development needs of the region as well as to protect water resources from environmental degradation. We believe that since this was a long-term action plan for the region, it took the right route in our view.

Furthermore, For Zeitoun and his colleagues, an integrated approach recognizes "water as an intrinsically relational, political and multiple-scale issue of both water access and control" (2016:149). It means that it acknowledges the different levels of complexity in which water affects us and we affect it. For instance, dwellers of London and rich people in Cape Town suffer from water affluenza – understood as "unsustainable addiction to overconsumption and materialism exhibited in the lifestyle of affluent consumers" (Miller and Hackett, 2008:15). IWRM allows flexibility in water management that focuses on moving to "learning, adapting and consumption patterns" and the recognition of shared responsibilities" (Zeitoun 2016:150).

In the case of London, Integrated Water Management Strategies have been implemented for several developments – Vauxhall Nine Elms Battersea, Old Oak Common and Park Royal, Charlton to Bexley, and Old Kent Road as a need to the vision and to think collectively about the Thames basin, flood risks management, water infrastructure, green infrastructure and improvement of water quality in rivers and canals (GLA:2018). These are successful stories of what it means to think before developing housing and building developments. For the Old Oak and Park Royal, many levels of stakeholders were present: Greater London Authority (GLA), the Old Oak and Park Royal Development Corporation (OPDC), Thames Water Utilities Ltd, the Environment Agency, the London Borough of Brent, the London Borough of Hammersmith and Fulham (LBHF), the London Borough of Ealing; and the London Borough Kensington and Chelsea.

The route to Effective Water Security

What we have learned about water security from our case study of London and Cape Town has led us to agree with much of the theories of Zeitoun and colleagues about water security approaches. London and Cape Town are heavily invested within the reductionist approach to water security. There is a need to see, feel, listen, taste and touch water differently. IWRM brings, at the core, one element that, in our opinion, rescues this water paradigm from any failure: that is, it propels analysts toward human dignity and the need to think about the other in a way that encompasses not only human fellows but our environment. We believe, however, that the integrated approach which is closely aligned to the Integrated Water Resource Management should be the route cities in the 21st century should be following. We believe that water security should be a multidisciplinary project for all stakeholders and should be bottom-up

Conclusion

In conclusion, we have illustrated the similarities and differences between the cities of London and Cape Town. The cities share a colonial background, one as colonizer and the other as the colonized. London has highly developed infrastructure and is currently water sufficient and contrasted by Cape Town's very high inequality and economically weaker. London's population is currently almost twice the population of Cape Town. Cape Town has faced serious water shortages due to the drought and many other factors such as poor management and the centralized water policies of the government of South Africa. Both cities have adopted water approaches that favour the reductionist approach. We have argued in favour of the integrated approach toward water security because of its inclusive nature, its' bottom-up approach and its flexibility to acknowledge the complexity of water issues. We have argued that water security is more than just supplying sufficient water but rather, water is in everything, economics, social, environment, eco-systems, employment, justice and so on.

Our struggle to use water wisely can be seen in the many attempts to conceptualize what water security means and how it can be achieved. Even though the term is subjected to ambiguity due to the two lines of thoughts in which it is debated – reductionist and integrated, it highlights the need to move forward and use failure to see water differently. Integrated Water Resource Management (IWRM) must be seen as an opportunity to secure the needs of the basin and our own needs grounded on respect for the environment and solidarity among us particularly important for people who suffered from exclusion and are forced to live in the margins of society. What about if the basin becomes our platform of encounter and building relationships. In Cape Town, water's decision is made by the State and it failed to adequately fulfill its legal water mandate of water for all while in London, water is the combination of different levels of authorities which makes it fall in the danger of seeing it only as a commodity. An imperative in achieving water security is to understand the complexity of each city and the reality faced by its dwellers – rich and poor alike. If water is our place of convergence, then water is also our place of building relationships and attempt to do something better. Yes, water cost money but the 21st century abounds in examples of our capacity to find solutions and overcome problems.

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