DETERMINANTS OF WATER INSECURITY IN INFORMAL SETTLEMENTS OF LUSAKA: THE CASE OF GEORGE SETTLEMENT

By

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A Dissertation submitted to the University of Zambia in partial fulfillment of the requirements of the degree of Master of Science in spatial planning.

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DECLARATION

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I hereby, submit this dissertation for examination for the Master of Science in Spatial Planning Degree at the University of Zambia.

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APPROVAL

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DEDICATION

This thesis is dedicated to my husband, Miyanda Kademaunga, for his unyielding encouragement and financial support. Secondly, I dedicate this to my two daughters, Nyasha Grace Kademaunga and Munashe Micheala Kademaunga, for being my source of joy and understanding my absence from home during my studies despite their young age. I love you all.

ABSTRACT

Water insecurity is increasingly becoming a global problem, and African cities are at the coalface of this challenge. The water insecurity challenges in African cities are due in part to an interweave of factors such as rapid and often unplanned urbanisation, poor quality of infrastructure and high levels of urban informality. These limitations make informal settlements in African cities most susceptible to high risks of water insecurity. In Zambia, seventy-two percent of households have access to clean drinking water while seventy-two percent of Lusaka population lives in informal settlements with very poor access to reliable water services. Lusaka has previously recorded fluctuation and reductions in rainfall patterns and this has had a direct bearing on water insecurity in the city and its region. Despite efforts by governments and various stakeholders to deal with rampant water insecurity problems in African cities, including Lusaka, urban water challenges persist. The issue of water insecurity remains unclearly characterized, and interventions are primarily reactive rather than proactive, making failure of interventions eminent. By focusing on George settlement in Lusaka, this study aims to examine determinants of water insecurity and urban resilience in the water sector in informal settlements of Lusaka. Data for this study were collected using semi-structured interviews, observations, grey literature and media sources. Thirty-five community residents and nine key informants from various institutions in the water sector in Lusaka were selected purposively to participate in the study. The data were analysed qualitatively to enable the study drill-down to lived realities through narratives and themes. The findings show that the key drivers of water insecurity in George settlement are centred on water scarcity and long distances to safe water sources (communal water sources), underground water contamination as evidenced by 'deep community stories of dirty' water. In addition to rampant vandalism of scanty water infrastructure and rinsing demand for water in the community, George settlement faces a spiral of interweaved challenges such as physical insecurity, high poverty levels and near complete failure of urban planning. These complex issues interact intensely to shape livelihoods and water use behaviours in a clearly visible water insecure settlement. To survive in such a waterscape, residents deploy a diverse set of strategies that include ensuring multiple water sources for different uses, deployment of extreme water rationing measures and use of innovative and climate-sensitive options such as rainwater harvesting. The study further establishes while George has been upgraded many times, settlement upgrading approaches in the area have not addressed water challenges in the area and that city planning has not deployed an integrated approach. Settlement upgrading efforts and city planning measures have not contributed to resilience building in the water sector in George settlement. Based on the findings, the study recommends effective implementation of the Lusaka Slum Upgrading and Prevention Strategy, increased investments in water infrastructure and establishment of devolved water management systems and processes.

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ABBREVIATIONS AND ACRONYMS

CARE …… Cooperative for Assistance and Relief Everywhere

CSO……..... Central statistics Office

DMMU …… Disaster Management and Mitigation Unit

EU ……. European Union

FAO …….. Food and Agricultural Organisation

GRZ …….. Government of the Republic of Zambia

IWM ……. Integrated Water Management

JICA ……. Japan International Cooperation Agency

LCC …….. Lusaka City Council

LWSC …… Lusaka Water Supply and Sanitation Company

MEWD …….. Ministry of Energy and Water Development

MLGH ……... Ministry of Local Government and Housing

NRW …….. Non-Revenue Water

NWASCO……... National Water Supply and Sanitation Council

NWP …….. National Water Policy

PPHPZ ……. People's Process on Housing and Poverty in Zambia

SDGs ……. Sustainable Development Goals

UN …….. United Nations

UNEP ……... United Nations

URP …….. Urban and Regional Planning Act continue

WARMA ……. Water Resources Management Authority

WHO …… World Health Organisation

WSUP ……. Water and Sanitation for the Urban Poor

ZEMA ……. Zambia Environmental Management Agency

CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter offers the general introduction of this research and the report. It seeks to provide the basis and structure for the entire dissertation. The chapter also provides a broad background to the study, the aim, problem statement to urban water studies in Global South cities, research objectives and questions. The chapter further outlines the significance of the research and the overview of the structure of this research report.

1.1 Background

According to Gupta and Orban (2018), water is life. Water is like energy as it enables activities in all socio-economic sectors of society (Muzondi, 2014). Therefore, it is a crucial asset for socio-economic development at all levels, ranging from the national to the individual level. Access to improved drinking water sources can also ensure better health (Simelane et al., 2020) and improve economic activity. According to the World Health Organization (2003), water is also a human right, and therefore, every human must have the right to sufficient, safe and physically accessible and affordable water.

Water insecurity is a complex concept but refers to the lack of sufficient water to meet all requisite water needs and the ability to adapt to significant water disasters (Norins, 2011). Water insecurity is becoming a global urban problem such that Gleick and Palaniappan (2010) argue that we could be at a water peak. In contrast, the global urban population grew to 4.3 billion in 2018, the UN-Habitat (2014), project that 66 percent of the worldwide population will be at 9.8 billion by 2050 and will be living in urban areas, with Africa having the highest urbanization rates in the world at 1.4 percent (United Nations, 2018). The population increase in Cities will thus, over the next two to three decades, inevitably put pressure on the supply of basic services, particularly the potable water and the excessive pressure on freshwater sources (Adams, 2015).

Currently, nearly 80 percent of the world's population is exposed to high levels of water insecurity and 1.1 billion people are said to be living in areas under severe water shortage (Falkenmark, 2008). The statistics point to increased demand and pressure on water resources globally. African cities are most affected by water insecurity due to unplanned urbanization and limited water infrastructure (Adams, 2018; UN-Habitat, 2014), resulting in high proportions of urban informality and poverty.

Studies further indicate that the causes of informal settlements often originate from rapid urbanization or failure of urban systems, population growth, poverty, rural Urban migration, lack of access to land or ownership and weak governance with regards to policy, planning and land or urban

management (Munshifwa,2019; Marutlulle, 2017; Habitat,2014). For Sub Saharan Africa, access to water remains one of the pressing issues and drivers of many socio-economic pressures and informal settlements are most affected due to various complex factors (Muller, 2018). Forty-two percent of Sub-Saharan Africa are without basic water supply while only thirty percent of the population in Sub Saharan Africa uses a safely managed drinking water service, with most of this population situated in urban areas. Water insecurity is a significant issue for many urban residents, especially those in informal settlements, as water provision tends to be unsustainable in these areas with adverse effects on the standards and conditions of living.

In global South cities, various strategies are employed to cope with instances of water insecurity. Literature refers to coping strategies that vary from individual to community and finally to national levels. The choice of strategies is influenced by factors such as income, level of education, land tenure and the extent of unreliability (Majuru et al., 2016). These mechanisms make certain that households survive the pressures associated with water insecurity, among them an inadequate supply of potable water, floods and challenges in accessing clean water. While strategies may vary from place to place, coping mechanisms assist in averting disaster and, in this case, some water-related disasters such as diarrhoeal diseases. At the individual and household level, households cope with floods by bailing water out of houses with buckets. In addition to the aforementioned, Adelekan (2010) notes that households in Kenya relocate to higher parts of dwellings and use sandbags to prevent water entry. Pasakhala et al., (2013) note that the use of grey water, ample water tank storage, purchasing water from water vendors, rainwater harvesting and water consumption reduction are common coping practices to water insecurity in Nepal while South Africa makes use of pricing, water user associations and efficient use of water. Informal settlements commonly utilize unconventional water sources such as unprotected shallow wells to supplement their already insufficient water supply. At the national level, countries cope with water insecurity by investing in water management and, more specifically, Integrated Water Management (IWM) and settlement upgrading.

There exists a link between urban water security and planning. Hoekstra et al., (2018) argued that urban water security requires both integrated analysis and planning, considering all aspects and functions of the water system. Similarly, Neuman and Smith (2010) state that city planning has historically been deeply rooted in infrastructure and physical planning, and the links between infrastructure and city planning are numerous. City planning, therefore, ensures that activities are organized in space employing development control (Lekwot and Balasom, 2013) taking into account various factors and infrastructure such as the siting of settlements, water infrastructure, and drainages. Land use developments and overutilization of groundwater threaten water security (Bruins, 2000), hence the need for city planning to place developments in inappropriate places

without compromising future water resources. Goldin (2010) further postulates that Africa has the least water and sanitation coverage, mainly attributed to weak institutional arrangements. With the projected increase in the population of about a nine-point eight (9.8) million by 2050, planning plays a role in ensuring that this rapid urbanization is met with the matching development and services and the provision of water security.

Zambia has formulated several reforms in the water sector concerning how water is managed and supplied. Namely, the Water Act of 2011, the National Water Policy of 1994 and the Water Supply and Sanitation Act of 1997. These reforms mandate the Lusaka Water Supply and Sanitation Company, a semi quasi entity under the Ministry of Local Government, to coordinate the provision of water to the urban and peri-urban areas of Lusaka. Much progress has been made about management and operation. Still, little success has been recorded in expanding the water supply network, site coverage, hours of service and reducing the affordability associated problems among households, especially the lower-income urban households in informal settlements (Chitonge, 2011). Therefore, access to safe and clean water in informal settlements remains a daunting policy and intellectual challenge for many global South cities and towns.

With the initiation of the Sustainable Development Goals (SDGs), especially goals six (6) and eleven (11), the New Urban Agenda and the Sendai framework coupled with the formulation of the Zambia 7th National Development Plan, urban water insecurity questions have been raised to a very prominent development issue (Morton et al., (2017). Cook and Bakker (2016) have argued that water insecurity has lagged as a development issue for much of the developing world, leaving millions subjected to the miseries of rationed and unavailable water. While urban water security is acquiring a new impetus, it quickly acquires its own identity and demands serious attention (Pegram, 2010:2). However, the emerging picture of water insecurity is a process that is more complicated and strongly influenced by various and interlinked factors, hence the need to get a more specific understanding of the subject.

The major approaches to studying and addressing water insecurity in the global South have however, focused more on universalization of water standards, focusing on the quality of the water accessible to individuals without giving much detail on the individual practices. However, household views and actions regarding disasters can yield essential insights for restructuring water insecurity (Wamsler, 2007). Wamsler (2007) also argues that most approaches to water insecurity have focused on rural areas. Goldhar et al. (2013) stated that approaches to understanding water security commonly emphasize elements of access, availability, and safety.

1.2 Statement of the Problem

The concept of water insecurity remains unclearly characterized in African cities (Amoako, 2012). As a matter of fact, the literature shows that water insecurity is increasing (Webb and Iskandarani, 1998) globally, and there is a limited and generalized understanding of the complex subject of water insecurity. Accordingly, there has been a tendency by both policy and intellectual proponents to generalize the conceptualization of water security with limited critical literature debunking the myth of universal knowledge and water standards on water insecurity in conditions of rapid urban change, often unplanned, high urban poverty, and a constrained water sector. There is additionally a generalized appreciation of community practices by actors in addressing uncertain urban water conditions (Smith, 2008) and the thresholds. Based on the World Health Organization's (WHO) (2006), and National Water and Sanitation Council regulations on water services, urban water standards are foreign-inspired (World Health Organization, 2021), and these standards tend to ignore contextual urban factors such as water use needs and behaviours, household size, water purification capabilities, urban poverty, among others.

The response to water insecurity seems to be informed by limited in-depth knowledge about the daily urban water dynamics in informal settlements in Southern cities, rendering most interventions reactional, generalized and failure becomes imminent (Idris and Dharmasiri, 2015). Thus, this research seeks to generate in-depth information andabout people's encounters with water challenges in informal settlements in George. The data generated from the research will be used to generate concepts and ideas about resilience in the urban water sector in informal settlements in Lusaka particular and in the global South in general. Finally, the study further seeks to analyze the role of city planning in structuring water insecurity dynamics and water insecurity preparedness for millions living and working in informal settlements.

1.3 Aim

To examine determinants of water insecurity and urban resilience in the water sector in George.

1.3.1 Objectives

The objectives of the study were to

- **i.** To characterize water insecurity in George's informal settlement**.**
- ii. To examine the coping strategies of George residents to water insecurity, and
- iii. To analyze the role of Lusaka city planning in achieving water resilience in informal settlements.

1.3.2 Research Questions

The research answered the following questions:

i. What is water insecurity for people living in George Settlement?

ii. How do residents of George settlement survive water insecurity incidences?

iii. How does city planning facilitate or inhibit the attainment of water resilience in Lusaka?

1.4 Significance of the study

The significance of this research lies in its ability to generate information to increase context inspired understanding of drivers, processes and decision-making systems that underlie water insecurity in southern cities. The study may offer intellectual contribution to urban resilience studies using urban water systems as a lens. Furthermore, the study will generate policy recommendations for actors in the water and climate sectors given the evidence collected in the informal settlement. Therefore, this research will benefit the policymakers in the water sector, water provision institutions and companies, city planners and the residents of George settlement.

1.5 Organization of the dissertation

This dissertation is organized into seven chapters. Chapter one presented the background of the study, the research problem, research objectives, and questions and the significance of the research. Chapter two reviews the existing literature on urban water insecurity, thus providing a framework that holds up this research. Chapter three describes the study area selected for the research. Chapter four discusses the research method, research design, data collection, and analysis methods. Chapter five presents the findings of the research as collected in the field. Chapter Six will then be used to interpret the results alluded to in the preceding chapter in line with the existing and reviewed literature using methods highlighted in Chapter Four. Finally, Chapter seven will draw a conclusion of the research and offer the final reflections on the entire research process and later give recommendations.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of literature on the concept of water insecurity and the discourses on urban water insecurity. In this chapter, the overarching argument is that while African cities are well vested in water resources, they experience water scarcity due to dry taps and hence flooded but thirsty. Accordingly, the chapter endeavors to provide a critical review of the discourses that typify the study of urban water insecurity. The literature reviewed will further have particular reference to informal settlements of African cities.

The remainder of the chapter is structured into four sections. Firstly, a review of the concept of water insecurity and how it manifests in informal settlements of Global South cities. Secondly, a discussion on community coping strategies as practiced in various informal settlements of global South cities. Thirdly, the section evaluates the role of planning in ensuring water security and resilience in informal settlements. Finally, the last section offers a summary of the chapter and introduces the next chapter.

2.1 The concept of water insecurity: Characterizing water insecurity in global South Cities

According to Siame (2018:2), global South implies a "history of colonialism, neo-imperialism, and differential economic and social change through which large inequalities in living standards, life expectancy and access to resources are maintained". Moreover, Schindler (2017) highlights those southern cities have increasing inequality, poor infrastructure, services, and are hit with environmental impacts. Water entered the domain of security studies when it reached a verge that was seen as impacting the people's lives, political security of a particular country or signaling conflict between the countries, thereby affecting its socio-economic, political and environmental security (Thapliyal, 2011). Debates have arisen over what constitutes water insecurity and what drives it and it is these debates that serve as a base on which this study anchors.

Over the past decade to present, there have been increasing concerns concerning the sustainability and security of freshwater availability. The literature shows that population growth, changing lifestyles, increasing pollution and accelerating urbanization will continue to widen the gap between the demand for water and available supply. Especially in urban areas, and unreasonably affect informal settlements, where most of Sub-Saharan Africa's urban population reside (Dos Santos et al., 2017; Webb and Iskandarani, 1998). Thereby giving the rise to increasing water insecurity, a concept whose complexity cannot be defined by one word as it involves various aspects expressed by different scholars.

Other scholars (Cook and Bakker, 2012; Gleick, 1994; Grey and Sadoff, 2007) have brought forward debates to unpack the concept of water insecurity. In particular, the concept of water security can be taken to mean the reliable availability of an acceptable quantity and quality of water for health, livelihoods, and production, coupled with an acceptable level of water-related risks (Grey and Sadoff, 2007; Hoekstra et al., 2018). However, in the definition of Grey and Sadoff (ibid), the word acceptability is a contentious word and is context-dependent, varying across the scale., Therefore, putting forward the argument that the presence of sufficient and good quality water, free of contaminants, including industrial effluent and faecal matter from onsite sanitation, as is the case in informal settlements in the cities of the global South, is necessary for any development.

In the absence of these salient factors, water insecurity begins to set in. Grey and Sadoff (2007) further define water insecurity as instances where the level of water-related risk is not tolerable. These include those related to access to water, those associated with water-related shocks such as droughts, floods, and contamination and vandalism events. In the peri-urban contexts, water insecurity could be seen as being shaped by the parallel processes of climate change and urbanization (Narain, 2010 Thapliyal, 2011). Similarly, Abedin et al., (2013) further view water insecurity as a social dilemma due to salinity in surface and underground water, presence of arsenic in groundwater and instances of drought. This relates to water quality and quantity, which are significantly essential for human survival as water drives all sectors that ensure man's continued existence. While that may be the case, Norins (2011) defines water insecurity as the lack of sufficient water to meet all requisite water needs and the ability to adapt to significant water disasters, as is the case in the majority of African cities. Water is a resource that is required for most activities social and economic alike therefore, this implies that a lack of it or an inadequate supply of it will undoubtedly affect the development of any entity and render community water insecure.

On the contrary, Webb and Ishkardani (1998) argue that water insecurity is a problem in developing countries and define it as access by all individuals at all times to sufficient, safe water for a healthy and productive life. Although the usage of the term safe potentially implies more than one standard, the implications of this are that the water sector can significantly reduce sanitation and hygiene-related diseases, essential for the overall health of the people. The opposite is also true, as Bisung and Elliot (2016) argue that lack of access to safe water and sanitation has implications for individuals and households' psychosocial well-being. The two scholars bring in the aspect of water not only for domestic use but also for health which is an aspect that the earlier characterizations neglect to emphasize. The concept of safe water requires more than just one standard, and getting to achieve these standards is the biggest challenge hence the experience of water scarcity in many parts of the world.

Water insecurity in the global South is characterized by scarcity of drinking water, floods, droughts, poor infrastructure for water access and the contamination of water sources which all contribute to inadequate access to water (Stevenson et al, 2012). The debates on the concept of water insecurity indicate that the term water insecurity is broad and not merely about diminishing supplies. It is rather a more complex one, going further beyond that to encompass other aspects that relate to but not limited to water availability and quantity and quality, water-related risks such as flooding and drought. Unreliable water supply to meet demands will therefore constitute a water insecure community. The growing awareness of matters of water insecurity has increased familiarization between water and its relationship with other sectors. Hence the need to build resilience against droughts and dry spells, which is fundamental for water security.

Therefore, this study adopts the definition of Norins that water insecurity refers to a lack of sufficient water to meet all required needs and the inability to cope with major water disasters (Norins, 2011). This definition is useful as it merges main aspects of the other definitions that focus on climate, water scarcity, and water quality. According to the context, water insecurity comes in multiple forms, with water stress being the extreme form of water insecurity.

2.2 Conceptual Debates on Water Insecurity and its Drivers

Globally, the concern about the increase in water security has become recognizable, and this has consequently evolved from mere rhetoric to a real issue requiring developmental attention. Thereby, requiring a deeper understanding and framing of water insecurity to enhance targeted solutions. Literature suggests that water insecurity is driven by several factors that may be natural, human and financially induced (Webb and Iskandarani, 1998; Thapliyal, 2011; Narain, 2010). The subsequent paragraphs discuss the drivers of water insecurity as hitherto characterized.

2.2.1 Natural Factors for water insecurity

2.2.1.1 Droughts as drivers of water insecurity

Emerging discourses indicate that water scarcity, an aspect of water insecurity, is mainly attributed to droughts. However, the impact of drought on water security, particularly groundwater, has received less attention (Calow et al., 2010). Droughts can cause the underground and surface water resources levels to drop, making it difficult for water abstraction. Water scarcity could be conceptualized as a condition of uncertainty in the availability of water. For example, Pereira et al. (2009) define water scarcity as a situation when water availability in a country or a region is below 1000 m^3 per person per year, which translates to approximately 2739 litres per person per day. Further, water scarcity refers to long term water imbalances, combining low water availability with

a level of water demand exceeding the supply capacity of the natural system (European Union [EU], 2007; United Nations Environment Programm [UNEP], 2011).

Water scarcity occurs where there are insufficient water resources to satisfy long-term average requirements. Water scarcity can be human or naturally induced. Natural water scarcity results from drought whereas man-made scarcity is associated with desertification and water management (Pereira et al., 2009:3). In all, Nairizi (2017) argues the water demand does not equal the amount of water available for abstraction during water scarcity. On the one hand drought, is defined as a sustained and spatially extensive period of below-average natural water availability (Tallaksen and Van Lanen, 2004). The European Union [EU] (2007) defines droughts as a temporal decrease in the average water availability due to rainfall deficiency. Drought is a large-scale hazard caused by large-scale variability and cannot be prevented by local water management. On the other hand, water scarcity refers to the long-term unsustainable use of natural resources, which water managers can influence. The conceptual definitions refer to the imbalance between water availability, supply, and demand. However, while the primary cause of drought may be insufficient rainfall, human influence can also contribute vis-a-vis increased human demand.

Droughts that are naturally affected by climatic conditions consequently affect water availability and access that determine household water insecurity (Calow et al., 2006). This implies that a decrease in rainfall causes a reduction in ground and surface water recharge, thereby reducing water availability and increasing water scarcity; this leads to water insecurity. This notion is supported by Brock (2012) and Webb and Ishkandarani (1998). They argue that climate change factors induce droughts in that less and unreliable rainfall influence the availability of water that will be recharged to the groundwater aquifers causing decreased levels of underground water and overexploitation of confidential sources that worsen the water situation in the cities. Thereby further causing an aggressive cycle of reducing water supply where self-supply from wells, boreholes increase and cause further depletion of underground water resources. Several droughts can consequently affect water security even in countries with ample water resources, and more so can become more frequent in many regions due to changing climate. Most areas that have suffered droughts such as Kenya and Cape Town have more insecure access to water. Webb and Iskandarani (1998) further assert that droughts remain one of the biggest threats to water insecurity worldwide.

2.2.2.2 Flooding as a driver of water insecurity

According to Webb and Iskandarani (1998), flooding is one the most significant threats to water insecurity. The origins of flooding ultimately lie in atmospheric processes that create intense precipitation that overflows onto usually dry land. Furthermore, the cases of flooding are being increased by changing rainfall patterns and urbanization. In particular, Climate change is altering

rainfall patterns, tending to increase storm frequency and intensity, thus increasing the potential for floods (Douglas et al., 2008; Suleiman, 2012; Benebere, 2017). The Global South countries are documented to be suffering from adverse effects of climate change that leads to poor and even negative growth in the agricultural sector and subsequent degradation of the environment as rural households try and meet their livelihoods (Falkenmark and Lundqvist, 1989).

Literature indicates that the City of Lusaka continues to get warmer, and rainfall patterns will be intense. These changes can lead to floods and droughts, which in either case threaten water supplies (Thapliyal, 2011). The occurrence of localized flooding causes the floodwaters, which are a mixture of various contaminants, to make their way into sources of water, thus polluting them and consequently making them unusable. Mendel (2006) additionally argues that floodwaters are capable of carrying all sorts of organic waste into homes. As well as water sources, especially shallow wells and rivers, thus causing reduced water quality, making it unsuitable for consumption and further deterioration of sanitation. This could cause water stress, an extreme form of water insecurity that is likely to induce conflict in some water scare regions and further affect the marginalized populations.

Flood risk is one of the most devastating natural hazards that cause damage to resources and environmental degradation in urban areas (Idris and Dharmasiri, 2015). Flood events are expected to rise due to climate change, steady demographic growth and urbanization. Floods also cause shortages of clean water as was the case in Burma. They contaminate water sources, leading to scarcity of drinking water because of the debris or rather the damage of freshwater sources, thereby affecting residents. Lastly, according to Sun et al. (2016), the most severe consequence of flooding is large-scale contamination of drinking water that includes surface, underground and distribution. He further argues that understanding drinking water quality is essential given that it is the main factor that determines its suitability for drinking. Matchaya et al. (2019:7) argue that “the greatest climate change impacts in Southern Africa are being felt through water resources and are manifesting through rationed water supplies as well as through water insecurity."

2.2.2 Human-induced drivers of water insecurity

2.2.2.1 Infrastructure

In as much as water insecurity is driven by natural factors discussed, it is further driven by certain human-induced factors. Man has an essential and indispensable role to play in curbing water insecurity. One paradoxical debate surrounding water insecurity is that despite having abundant water resources that can be abstracted and utilized in all human activities, millions of people in African cities are thirsty (Ahopelto et al.,2019). This can be attributed to factors such as limited to inadequate water infrastructure.

Moreover, the World Health Organisation (1993) argues that in many parts of the world, lack of infrastructure limits access to suitable quantities of water, which seems to be the norm. In most global south countries such as Zambia, which are well endowed with water resources via its numerous surface rivers and underground aquifers. Communities, however, continue to grapple with water insecurity and have to resort to unsafe means of water collection, making the situation insecure. Another good case study in the Capital city of Ghana has been documented as having the advantage of receiving a lot of rainfall but still faces widespread water insecurity, especially, in poorly serviced informal settlements of the city (Nsiah-Gyabaah, 2001). Nevertheless, despite abundant water resources in the city, of Accra's informal settlements experience chronic water shortages and households and businesses in these informal settlements resort to all manner of alternatives (Tutu, and Stoler, 2016). This is a result of uneven distribution of rainfall, prolonged drought, and poor water resource management (Nsiah-Gyabaah, 2001) that essentially has to do with planning the optimal use of water resources. Nairizi (2017) further argues that water insecurity is also a function of economic water scarcity, which refers to the lack of infrastructure development that controls storage, distribution, and access.

The Food and Agricultural Organisation estimates that more than 1.6 billion people face economic water scarcity as there is usually sufficient water to meet human needs but limited access. Countries that are water insecure such as Malawi face difficulties because they lack infrastructure stocks to manage and deliver water (Grey and Sadoff, 2007). Deficits driving water insecurity in informal settlements in African cities include production, capacity, and distribution infrastructure limitations. Other deficits are characterized by inadequate user connectivity manifesting in the form of over-dependence on water kiosks. The kiosks are a means through which formal water providers deliver safe and reliable water at affordable prices to residents of low-income areas[1] instead of individual water connections. However, it has been argued by proponents of individual connections that having separate taps may not necessarily solve the problem as deficits are production, distributive, and connection limited.

In many developing countries, insufficient infrastructure constrains the provision of water and sanitation services to the poorest communities (Chan, 2012). Despite having abundant water resources, sufficient infrastructure to get this water distributed is required in the absence of water insecurity. Adequate water infrastructure in the form of supply, reticulation, distributive and storage and types such as piped water infrastructure, water kiosks and boreholes are vital in ensuring that water insecurity is addressed. Despite advancements in technology over the years, millions of people, especially in peri-urban areas of the Global South cities, continue to grapple with water insecurity

[1] https://www.joinforwater.ngo/sites/default/files/library_assets/W_URB_E35_case_study.pdf

posing a potential threat to development. The increase in the human population coupled with climate change factors, among others, has inevitably led to the increased demand for water, thereby increasing its risk of scarcity. Hence, with the growing population and its consumption pattern, agriculture and industrialization, the need for water increased (Thapliyal, 2011). Hope et al. (2012) additionally state that the failure to achieve water security in terms of improved services is heightened for low income and vulnerable groups. Accordingly, Frone and Frone (2015) argue that water security can be achieved with the creation or acquisition by creating or acquiring an appropriate level of a mix of infrastructure and water management capacity

2.2.2.2 Geographical distance and time

Water access, considers two key aspects of accessibility. These include the quantity of water available in the domestic environment and the distance to the water point. Thus, water access is determined by distances that are covered in accessing this water and the waiting time and transportation storage. In particular, the World Health Organization (WHO) (1993) states that drinking water that lies more than 30 minutes away from a dwelling place is considered inaccessible. In Global South cities, walks of more than 30 minutes to water sources are common in certain times of the year. This enhances the need to use nearby but unsafe sources of water or stored water which turns into breeding grounds for bacteria, affecting the water quality and eventually affecting the water security. In addition to the 30 minutes walking time, an average of 15 minutes is spent waiting at the source. Hence negatively affecting productive time. Thus, piped water is placed in strategic locations to reduce this distance to a bare minimum as it is considered most accessible.

This is the prevailing picture in most Global South cities where peri-urban communities' water supply is provided through communal taps or kiosks largely, mainly due to the haphazard nature of the built-up areas within the settlements. The nature of built-up areas does not allow for the laying of water infrastructure such as water pipes. However, water insecurity arises, among other things, from overdependence on these communal water kiosks, which are insufficient in number, have high non-functional rates are prone to vandalism and provide water irregularity. Equally important is the lack of alternative improved water sources and a significant time burden due to long waiting times and multiple trips to water sources (Adams, 2018). According to UN-Habitat (2007), the urban poor get their water by queuing for hours to collect water from standpipes or illegal connections. Others buy their water from vendors who often charge up to twenty times more for water than the price paid by the higher income earners. This has an effect not only on the poor people's finances but also their health as a result of using unsafe water and poor sanitation facilities.

Access to water supply in informal or unplanned settlements is grossly inadequate. Emerging water trends point to worsening availability and quality in urban areas due to changes in freshwater

resources. The trends are as a result of climatic changes, land-use change, increasing demand owing to population growth, poor sanitation and lack of water treatment facilities, as well as mismanagement (Muller, 2018). Ribeiro (2015) also states that the relationship between distance and water sources can have an impact on the quality of life of many poor households. Besides, the amount of water per capita declines to between 5 and 10 litres per day, where people spend more than 30 minutes for a total water collection time.

2.2.3 The financial aspect of water insecurity: Cost of water and pricing

Safe and reliable water access requires financial input. Laying of infrastructure and the maintenance of it thereof requires that finances are present. In as much as this is the case, residents of informal settlements are disabled, given that they are housed mainly by the low-income generating households. According to Rios et al. (2018), both developed and developing economies face a water supply and demand imbalance that potentially influences their water pricing structures**.** There is a general perception that water is readily available and water services are inexpensive. Water pricing and practices and tariff mechanisms play an essential role in improving water security (Pinto et al., 2018; Dinar et al., 2015). Improving service delivery requires inherent costs and prices, and user fees ideally generate funds for daily operation and maintenance, high-quality water and long term investments. Therefore, water tariffs are considered a critical management tool for sustainable supply as they provide a possible link between supply and demand.

However, governments face challenges in water pricing and tariff establishment when selecting a tariff structure that is responsive to the objectives of the utility and its community. Some researchers, (Whittington, 2003; Pinto and Marques, 2017) further argue that a poorly designed water tariff structure could result in the abundant use of limited water resources or unjust water security that will marginalize the poorest. While fees should be high enough to ensure cost recovery, they must at the same time be low enough to allow affordable access to the service. This implies that water pricing that does not consider the financial standing of the poor could cause them to experience water insecurity as a result of their failure to pay the user fees. However, if prices are too low, there will be misuse and too high, the low-income households suffer (Beecher and Shanaghan, 1999; Pinto et al., 2018). Further, the rise in water prices can contribute to deterioration in the quality of life for low-income utilities. Overall, context is critical in consideration of pricing policies. That is to say, the design must consider the country or area, taking into account financial sustainability. Pricing policies are also closely linked to affordability. The affordability of water services may not be distributed equally across income groups; lower-income households will inevitably pay a higher proportion than higher-income households (Herrington et al., 2003). This is in conformity with Shomar et al., (2014)'s views that the absence of water tariffs and a pricing system and a lack of conservation awareness

makes Qatar one of the highest water consuming countries in the world. Additional literature by Grafton (2017) states how water pricing can be used to respond to water insecurity. Pricing as a driver of insecurity is, therefore, on two levels. On the one hand, communities must pay to facilitate the supply and distribution of water and maintenance of infrastructure. However, low-income households that are unable to pay high tariffs in areas where the pricing system is weak may resort to cheap yet unsafe water sources.

On the other hand, low tariffs or the lack thereof necessitates the very misuse of the resource rendering it unsustainable. Increasingly, the poor have less access to water for food production or domestic use (Barker and Kappen, 1999). Barker and Kappen further argue that while an average urban household uses water for drinking and sanitation, the poor use the water for a wide range of purposes. Water scarcity is exemplified by situations such as the need to carry heavy pots several kilometres every day to meet household needs, loss of wetlands, increasing health problems due to water pollution, and a rise in the incidence of water-borne diseases. Low water quantity leads to the poor water quality of water. Many of the poorest people in the world are affected and are forced to drink water that is unfit for human consumption, thereby suffering from some skin and health-related problems. Many poor urban dwellers have to pay very high water prices to informal water vendors or without water (Connor, 2015).

2.2.4 Power supply and Water insecurity

According to UN-Water (2013), water and energy are highly interconnected and essential in supporting the transportation and availability. Hamiche et al., (2016) similarly note that water and electricity are fundamentally linked as at a basic level, electricity generation requires water and water treatment, and transportation needs electricity. An understanding of this nexus is critical in achieving sustainable resource management.

2.2.5 The limitations of international and national water standards: Context as a factor

The World Health Organization (WHO) and the United Nations (UN) recommend that individuals require 20-50 litres of water per day to ensure that basic needs of drinking, cooking and washing are met (Rheingans and Moe, 2006). However, uncertainties still arise as to whether this is enough in practice in the cities of the global South and more significantly, in informal settlements.

However, the UN stipulated standards are context-driven and vary across scale uninspired by what happens on the ground despite being used, therefore creating a deviation between reality and policy. It is further argued that this water provision, if met, would constitute water security in African cities. However, unsustainable water provision and services in informal settlements have meant that inhabitants do not have access to potable water pipes within households. Instead, they utilize

temporary communal taps that are often inconveniently constructed at least 200 meters away from homesteads. Various researchers (Rheingans and Moe, 2006; Ahkbar et al, 2007; Messinge, 2012) contend that individuals in African cities are estimated to require about 20-50 litres of water for their basic needs of drinking, washing and cooking. However, these standards fail to consider the various other daily uses such as bathing, cleaning and watering vegetable gardens, flushing toilets and brushing teeth that make water an essential thing and are therefore discredited. Water standards ought to be context-based because what may work for one country may not work for another due to geographical location, water use and economic status. Despite this debate on water standards, international guidelines by the United Nations on minimum water quantities that domestic water supplies should remain largely lacking. They do not specify what such amount of water should be supplied.

According to Gowing (2003), the most immediate and obvious uses of water are drinking, cooking, bathing, and cleaning but this domestic consumption is only a small part of the total demand. Water, as earlier alluded, is also widely utilized in various economic activities. For this reason, coming up with an exhaustive water standard that is universally accepted and adopted may be difficult hence the need to define water insecurity at a local level. Additionally, most policies in developing countries tend to be mere design philosophies instead of being based on evidence and often fail to address the need (Goldin, 2010). Water policies, for instance, tend to be based on global perspectives, which may not be context-based. Problems experienced in the global north may be alien to global south cities. Therefore, one standard is impractical, rendering policies based on this to fail because they do not fully address the actual problems that pertain to the ground. Evidence-based policies are therefore more likely to target the specific issue. Furthermore, infrastructural standards are vital in addressing water insecurity. Fulong et al, (2016) argues that water and infrastructure requirements need to be included in development plans. Standardized infrastructure such as water supply and distribution, drainages and roads are vital in ensuring that there is better water supply and better averting of infrastructure.

2.3 Coping strategies to water insecurity in Global South cities

Despite the realization that water insecurity is a looming and pertinent issue, there is limited documentation in academic literature to suggest how communities survive in the face of various instances of water insecurity in the global south cities. In light of growing awareness of water insecurity, coping strategies must be identified to reduce the water insecurity risk faced by various community groups. Coping strategies or mechanisms are remedial actions undertaken by people whose survival and livelihood are compromised or threatened.

2.3.1 Concept of coping strategies

According to the WHO (1999), coping strategies are remedial actions undertaken by people whose survival and livelihood are compromised. Ghorpade (2012:5) considers coping strategies as ways in which households seek to protect their survival and sustainability in times of risks or shocks such as water-related shocks". Daramola et al., (2016) refer to coping strategies as an alternative solution to mitigate disasters and hence help in the aftermath of disasters. Coping strategies are used to address adverse impacts brought on people by natural disasters and other traumatic factors such as poverty, climate change and environmental hazards (Israel and Briones 2014). All the conceptual definitions refer to the fact that coping strategies are meant to avert a particular disaster. Thus, in line with Daramola et al. (2016), residents in slums of the global South find a myriad of alternative solutions to survive shocks. Similarly, Ofoegbu et al. (2016) argue that coping strategies are short term actions engaged to avoid immediate risks, which are not often applicable for mitigating future risks. So while the term coping strategies may have different connotations in some fields, this study will adopt the term to refer to household responses to instances of water insecurity. In the absence of coping strategies, populations suffer the effects of a calamity. The preceding section will discuss the coping strategies engaged in the various settlements.

2.3.2 Coping Strategies: Case studies from the global South cities and around the world

Household water insecurity continues to be a pressing problem in developing countries, as evidenced by the poor portable water accessed by poor communities and dwindling amounts received (Webb and Iskandarani, 1998). Despite the many challenges and threats to water security in settlements of the Global South, communities continue to survive under the harsh conditions through strategies that they have employed. Water insecurity coping strategies vary from individual to household, community to national and transnational levels. Majuru et al. (2016) argue that the choice of coping strategies employed by communities is influenced by income, level of education, land tenure and extent of unreliability. Some communities of Nairobi cope with incidences of water insecurity such as floods by bailing water out of houses to curb damage of their belongings and digging trenches around their houses before and during the floods. Additionally, the households construct temporary trenches to divert water away from the house, secure structures with waterproof recycled materials, relocate to higher parts of the dwelling, and use sandbags to prevent water entry (Adelekan: 2010).

Similarly, residents in the peri-urban settlement of Ashaiman, Ghana, forge a diversity of flexible, informal connections with resellers and rainwater for washing and cooking and other networks such as vendors and neighbours to survive instances of water insecurity. Adank et al., (2011) also state that certain households, especially the high-income earning households, use poly tanks, which are huge plastic tanks for water storage to survive water access problems. Peloso and Morinville (2014)

further state that some people in the settlement use sachet water which refers to locally produced bags of 500 millilitres of water. The water is generally treated before packaging in polypropylene sleeves heat-sealed at both ends. Sachets are available for immediate consumption or in bulk packages for home consumption throughout the capital and other major cities, offering an alternative to the limited supply of untreated water.

Existing work on peri-urban Burkina Faso and Ghana has shown that dependence on multiple water sources from non-state providers may offer flexibility and security (Dos Santos, 2017; Peloso and Morinville, 2014; Olajuyigbe et al., 2012), such as grey water. Accordingly, Phasakala (2013) notes that among the common strategies grey water (untreated household wastewater, which has not been contaminated by toilet waste), large water tank storage, purchasing water from water vendors, rainwater harvesting, water consumption reduction(especially for bathing and laundry), groundwater extraction and water-efficient retrofit (installation of water-efficient showerheads and dual flush toilets), are common in the Kathmandu valley of Nepal to cope with water shortages. Dessalegn et el., (2013) state that, in Ethiopia, some instances of water insecurity require that people move from their dwelling places (out-migration) to areas with better water supply to access water. Similarly, in the case of Kebele, people harvest rainwater as wells as store some in the concrete-lined tanks called *Birka.* People also borrow water from their neighbours and resort to using unsafe sources, risking their health and well-being (Dessalegn et al., 2013). Furthermore, he argues that the social capital of households where water sharing is common may thus be as crucial in ensuring water security as an ability to mobilize labour or financial resources. This takes the form of more formal lending or borrowing where households lend each other 10 litres of water that has to be repaid, failure to which affects the household's ability to borrow in the future and could, in some cases, lead to conflicts.

Southern Africa faces acute water scarcity challenges due to drought recurrence, degradation of water resources and the increasing demand for water from agriculture (Matchaya et al., 2019) climate. South Africa has been identified as one of the countries with areas that are severely water-stressed. Particularly, the Food and Agriculture Organization (FAO) (2012) puts forward South Africa in addressing matters of water scarcity. Through employing various strategies. Namely, the promotion of water user associations, licensing reforms, encouragement, of efficient use of water, the control of invasive alien vegetation and water pricing. More contemporary discourse alludes to water markets as a form of coping with water insecurity. Water markets refer to the voluntary trading of water in some measurable form, a temporary or long term water exchange or the right to use water from one user to another by any means of exchange or lease (Parks et al., 2019). Over the period 2017-2018, Cape Town experienced a drought that exposed the fragility of the water system that relied primarily on rainfall. This forced the town to employ a myriad of coping strategies including technology-based

approaches such as desalinization, water reuse, and use of grey water, water restrictions, tariffs, city-wide pressure reductions, intelligent water meters and overall impact of water demand initiatives (Burls et al., 2019).

Other studies also show that water needs of the urban poor are not satisfactorily met by conventional means such as the expansion of networked public utilities., Therefore, to survive instances of water insecurity, the "populations rely on a range of provisions that include private operators, wells or concealed connections" (Aguilar and Lopez, 2009:3). And this appears to be the norm in global south cities. The local community mechanisms that are applied, for instance, in the case of the community of Makurdi, Nigeria, can also be adopted at a much larger scale, especially where technology is not readily available and where water resources are confined to a specific space as opposed to being shared. In India, communities mobilize to work towards improved drinking water facilities by learning about drinking-water contamination risks in their homes and the treatment and safe storage of drinking water from the unreliable sources upon which so many depend. In this way, it is easier to even forge partnerships with governments through the relevant ministries (UN-water: 2007). At the national level, policies and governance need to adapt to better account for increased scarcity and address additional uses fairly and equitably. The institutional integration of water policies and increased stakeholder involvement in decision-making processes is paramount to this process and the development of effective conflict-resolution mechanisms will become increasingly important (UN Water, 2007).

Phasakala et al., (2013) further argue that the government emphasizes alternative water management measures such as decentralized water supply systems to increase water availability to households. This is in addition to Muzondi (2014:103) who argues, "in African cities, the unjustifiable water provision and services in informal settlements have meant that populations do not have access to potable water pipes within households". They thus survive water insecurity incidences by using temporary communal taps that are often inconveniently erected at least 200 meters away from homesteads. In this way, they survive water shortages. The FAO (2012) additionally states that alternatives to cope with water insecurity can be divided into supply enhancement, which increases access to conventional water sources and demand management, a set of actions controlling water demand, both of which are policy and management options. Supply enhancement uses large multipurpose dams at the national level, and water accounting is also vital in coping with water insecurity.

The FAO (2012) further explains that no coping strategy can be effective if it is not based on a clear understanding of the hydrological cycle and water accounting which is being promoted as a component of integrated resources management. Gowing (2003) argues that rain water harvesting is

a critical factor, a broad umbrella term that includes all methods of collecting runoff for productive uses to address water security issues as a coping strategy.

At a national level, countries deal with water insecurity by investing in water management which is the practice of making decisions and taking actions on how water should be managed. Other strategies include reducing water consumption, recycling water, buying water storage tanks to store water and fetching water from afar (Foeken et al., 2013). However, Odendaal (2012) cautions that the success of integrated water management strategies depends on striking a balance between human resources and ecosystem protection. This implies the sustainable planning and usage of water resources. Management strategies must take into account saving the environment as well as servicing the human populations. The neglect of either of these deems any methods employed potentially ineffective. Megacities employ five significant strategies to cope with their water challenges under climate change, and these are: reducing leakages in water supply systems, increasing permeable paving, installing storm water retention in new developments, promoting water-efficient appliances, and increasing the capacity of existing storm water drainage (Engel et al., 2011; Li et al., 2015). These interventions are employed at a citywide level and are driven by governments.

2.4 The role of city planning in addressing water insecurity

2.4.1 City planning: The indispensable link in sustainable cities

The world is fast urbanizing, and as the rate of urbanization increases, so does the world's population, mostly in low-income countries and, accordingly, the demand for natural resources, particularly water (UN-Habitat, 2014). Urban growth, to a large extent has been strongly associated with slum growth, which is primarily due to a lack of appropriate planning, and this breeds water insecurity issues because settlements mushroom without a prior consideration for the inclusion of essential services. Additionally, these cities that are urbanizing at a fast rate are failing to carry out forward planning and, as such, are plagued with some issues that could otherwise be quickly dealt with if proper planning is put into place.

Literature shows that city planning, is vital in addressing matters of water insecurity. According to Gleye (2015), city planning refers to planning activities concerned with the entire urbanized area of broad metropolitan regions and activities centering on small urban communities or the central city of a metropolis. Neuman and Smith (2010) further state that city planning has historically been deeply rooted in infrastructure and physical planning, yet the links between infrastructure and city planning through numerous strategies remain non-strategic and non-comprehensive, and this could perhaps be the reason why efforts remain futile in many cities. City Planning serves as a tool to engender sustainable development of cities and regions, which is done through the use of both facilitation and

regulatory tools of planning. Failure to plan therefore leads to many unplanned developments, among them informal settlements. Informal settlements are contextualized as areas requiring municipal planning, and have little or vague public amenities (Kovacic et al., 2016).

On the other hand, Wutich et al. (2016) characterize informal settlements as places where commercial activities are operated outside legal law or government directives. Informal settlements are thus characterized by some level of illegality, a lack of planning basic amenities that are otherwise essential for livelihoods. Without development control, which is an essential aspect of the planning practice as the state uses it to regulate the use and development of land, informal settlements are left to mushroom. These settlements are therefore ultimately unreliable, inconvenient and unsustainable. Development control is thus an efficient mechanism for urban management that ensures that the persistent growth and management of settlements can make for orderliness, improved settlement reflection, healthy and aesthetics (Lekwot and Balasom, 2013). Informal settlement inhabitants tend to be susceptible to exclusion and alienation from service provision in that the water services available for them are devoid of adequate planning. The planning of informal settlements will only come in when the settlement is regularized, bringing in the aspect of settlement upgrading. Aguilar and Lopez (2009) thus argue that one of the problems that the urban poor face concerning access to water is that they are systematically omitted from access to water as a result of, among other factors, public regulations which limit their access to water supply infrastructure. While there is a general awareness that informal settlements have challenges of water insecurity, there is little planning to address the contemporary problems and the expected future demands of the growing population.

Tutu and Stoler (2016) highlight that chronic, intermittent water shortage in urban informal settlements leads to negative perceptions about the role of government, while prompting dependence on alternative sources that may be unsafe and increase risks to the health of the communities. It is, therefore, the moral responsibility of the government to ensure that planning takes place through appropriate urban land use (Winkler, 2011). This includes the siting of the settlements in areas that do not pose threats to underground water recharge areas and or aquifers. Given the nature of informal settlements with their haphazardly built-up areas, laying and extension of main water pipes poses significant challenges and is sometimes impossible (Adams, 2015). Suffice to say, Africa has the least water and sanitation coverage (Goldin, 2010) due to weak institutional arrangements.

Moreover, land-use decisions have long-lasting consequences for drainages, infrastructure planning as well as energy costs related to water supply and treatment. Coping and dealing with water insecurity, therefore, requires effective governance, coordination, and collaboration among a variety of stakeholders and communities. Failure is often driven by a lack of coherent and responsive policy, limited technical capacity to plan for adaptation, limited resources to invest in projects, lack of

coordination and low political will and public interest. The inadequate water supply to settlements signals very little forward planning to address the current problems, let alone the expected future doubling of demands.

2.4.2 City planning, population growth, and water insecurity- the nexus

Wada and Bierkens (2014) assert that water demand is projected to increase by more than 100 percent for many countries in Sub Saharan Africa by the end of the century due to rapid urbanization and increased population growth. Since it is estimated that 66 percent of the population will be in urban centres by the year 2050 (UN, 2018), there will inevitably be an increased need for water resources for various needs, and this implies that the stress on existing water resources if not properly managed will increase by a serious magnitude. This means that as the populations grow so will the demand for potable water and hence the need to plan for a sustainable water supply. Also, the United Nations has established targets for improving the lives of at least 100 million slum dwellers by 2020 by improving water and sanitation. These objectives necessitate global and regional estimations of existing conditions and trends through an associated set of indicators and close examination of what is happening around the globe. Planning for this urbanization and increased populations is therefore cardinal in ensuring that water insecurity is achieved in the future. This implies that all sources of available water will be highly utilized. The abstraction of groundwater resources will increase; the use of surface water sources will also increase to better meet the demands of populations.

Lack of planning causes a random pattern of built-up environment. This haphazard layout of structures means that the essential spaces reserved for laying of water infrastructure, roads, and drainages lead to poor delivery of basic services in informal settlements (Hurskainen, 2004; Douglas, 2008). While planning raises questions of increased cost of services, the lack of planning is capable of causing the depletion of underground water sources due to poor management and causing a risk to national and global development. Water scarcity could result from poor or inadequate water infrastructure. It forces local populations to rely on unsafe drinking water sources such as shallow wells. Consequently, increasing the risk of waterborne diseases such as cholera, dysentery, and typhoid fever. As the settlements continue to grow, so does the demand for potable water. When the supply of water does not meet the growing demands, then water insecurity kicks in.

However, the type of planning that ought to be undertaken is forward planning that is more strategic, proactive and reactive to meeting the future challenges of water insecurity through interactive consultation. The planning whether, at a household or city level needs to be carefully crafted and put aspects of the people, environment, and economy in perspective. Furthermore, a holistic approach to planning, integrating various issues of water and sanitation can also be considered. Realizing that water insecurity is facilitated by anthropogenic activities is also a very important step to planning for

water. In line with this, the new urban agenda emphasizes the need for integrated planning, recognizing that planning does not happen in an isolated space. Therefore, all stakeholders and technocrats of different fields need to come together to comprehensively plan for water security and urban resilience. This type of planning is much more preferred to the 'firefighting' type of planning that only comes on board after disaster strikes and is therefore costly.

Nchito (2007) argues that the siting of unplanned settlements is typically on low-lying land, liable to flooding during the rainy season. The lack of planning is also, to an extent, a form of planning because failure to plan is what causes occurrences to transpire the way they do without any regularization. Peloso and Morinville (2014) further argue that even though pipes are many things: sturdy, visible, traceable, they are only somewhat reliable and accountable, and to be sure they are not suitable to every environment, especially illegal or haphazardly built settlements in the urban or peri-urban areas of the country. There is an essential disjuncture between realities of heterogeneous water access and urban planning designs that hinge on tap water infrastructures and standardized systems of provision (Peloso and Morinville, 2014: 135). According to Drewes et al., (2010), urban and land use planning can be used to improve resilience in cities. This is the situation that prevails in most informal settlements of the global South, and as a result, the water supply is inadequate, and people have to walk long distances to collect their water or rely on unsafe and contaminated water sources.

To avoid contamination, paying particular attention to planning for infrastructure and technology is critical. The lack of planning can lead to inappropriate development that can, in turn, increase people's exposure to flash floods, which heighten risks from inappropriate sanitation options and can result in the contamination of potable water sources. Accordingly, modern policy instruments and institutions must be tailored to cope with growing needs among water insecure households. This calls for professionals to plan for water interventions that are sensitive to the social and cultural context (Webb and Ishkandarani: 1998) for them to be effective instead of applying solutions that do not fit the Global South context. According to Gowing (2003:6), it should be recognized that a “land-use decision is also a water-use decision”. The decision to use land in a particular way can affect the availability or access of water and consequently water insecurity. The decision to have a built-up area on a water recharge zone, will contribute to water insecurity. The less the underground water aquifers get recharged, the less likely groundwater abstraction will be possible. Integrated planning, therefore, safeguards such wetlands and recharge zones to ensure the sustainability of the environment, which will, in turn, supports life forms in a population by averting water insecurity. In addition, as Odendaal (2012) notes, good planning ought to take an integrated approach and be informed by urban realities.

According to the Drewes et al., (2010), urbanization worsens flooding by restricting where floodwaters can go and obstructing parts of natural channels and drains that would otherwise ensure that water is channeled to rivers. This is generally a result of the nature of infrastructure build-up in informal settlements that sees to it that almost every available space is utilized to build a structure in the face of rapid population growth. This infrastructure impedes parts of natural drainages that channel water from settlements. Subsequently, little or no room is left to construct the much-needed drainages and water infrastructure. Communities, therefore, suffer the effects of accumulating rainwater or localized flooding in the area. Idris and Dharmashiri (2015) state that occurrences of water insecurity are not only caused by poor planning of the physical environment, poor management of wastes, inadequate drains for the built-up areas but also the occupation of the floodplain areas. Bruins (2000) therefore, references proactive planning that prepares for multiple futures and changes the course of adverse developments or alleviates the impact of negative consequences of the phenomenon.

2.5 The Concept of Resilience in urban water security studies

Muller (2016) argues that responses to concerns of water insecurity in Global South Cities need to be framed with the idea of urban resilience (SDG 11). Gleick (1994) argue that the concept of water insecurity is not only a function of hazards such as droughts and floods but also a function of a community's governance capacity and resilience in the face of hazards. Subsequently, this forms the basis of the conceptual framework used in this study, the principle of resilience. It is inarguable that the world is undergoing much change, environmentally, economically, socially and demographically. The need for humans to survive breeds, the need to use natural resources from the environment for sustenance. Rapid urbanization and increasing demographics, however, cause resources utilization to subsequently increase, thereby having formidable repercussions on the environment and, resultantly, the humans.

Resilience applies to the ability of an urban system to stay within its "basin of attraction", through an ability to cope with or adapt to impacts and take advantage of opportunities (Meerow et al., 2016). Suffice to say, resilience comes in when a system adopts specific coping strategies, making a system stronger and less vulnerable to shocks. Similarly, Borie et al. (2019) advance the argument that resilience has become the new hope for addressing environment-related risks and urban planning practices are now seeking to incorporate resilience. On another note, some scholars assert that urban resilience involves the capacity of individuals, communities, institutions, businesses, and systems within a city to survive to adapt and grow no matter what kinds of chronic stresses and acute shocks they experience (Borie et al., 2019; Johannessen et al., 2014). Communities with their experiential knowledge and who are usually most affected by water insecurity are a vital component of resilience

as noted by the National Disaster Risk Reduction Framework in the Philippines. For this reason, they must be at the centre of resilience planning. Moreover, Falhenmark and Rockstrom (2008), view resilience as the amount of change a system can undergo and remain the same and further argue that it is fundamental in dealing with water insecurity against droughts and dry spells cardinal for building resilience. This, therefore, ought to be a priority in cities. Despite having the lowest income, they somehow manage to cope with water insecurities and, learning from them would give a much more comprehensive framework for resilience on a much larger scale.

Finally, Johansen and Wamsler (2017) argue that there are three perceived levels of urban resilience in the urban water sector and, these are; i) Socioeconomic, relating to urban water service infrastructure and the entities that manage and govern them ii) hazard disturbance and iii) long term disturbances such as unsustainable resource extraction by the urban water services (Johannssen and Wamsler,2017).

2.6 Policy review: The policy framework in the water sector in Zambia

This section provides an overview of the water policies in Zambia. Water policy is understood as an emerging priority for governments especially given the increasing occurrences of water shortages (Heathcote, 2009). In addition to this, the New Urban Agenda presents a shared vision for a better and more sustainable future in which all people have equal rights and access to the benefits and opportunities that cities can offer (UN-Habitat, 2015). Furthermore, the 2030 Agenda for sustainable development and its Sustainable Development Goals (SDGs) and targets is a commitment to eradicate poverty and achieve sustainable development by 2030 worldwide, ensuring that no one is left behind. Both the SDGs and the New Urban Agenda share the common concept of sustainability of resources for a better world. For this reason, all planning must be aligned to the national and the global agendas to curb the evils of water insecurity. The poor natural drainage of a city or settlement usually determines the risk of flooding (Booth and Bledsoe, 2009). This section is thus essential as it confirms the consistency and effectiveness of policies in ensuring water security. The section, reviews the National Water Policy of 1994 and Water Act.

2.6.1 The National Water Policy of 1994

Before formulating the water policy, Zambia's waters were governed by different ad hoc water user objectives that merely provided principles for the often crisis-prone management and uncoordinated development processes. Therefore, in recognition of the role that water plays in various areas from individual to economic development of the economy, the government recognized the need for the evolution of a water policy that would guide the developments of the conservation management, demand, and supply of the water resources in the country. Therefore, the National Water Policy recognizes the role of water in health, industry, energy, transportation, recreation, and tourism (GRZ

MEWD, 1994). The policy treats water as a limited resource. As such, a scarce resource premised on the fact that the quantities of water available for exploitation and use at affordable prices by many uses are limited by various factors. The policy highlights the water resources bases, which are surface and underground water. Underground water abstraction at the time went on without monitoring its regulation. The policy aims to promote sustainable water resources development to facilitate an equitable provision of adequate quantity and quality of water for all competing groups of users at an acceptable cost and ensuring the security of supply under the varying conditions (Government of the Republic of Zambia Ministry of Energy and Water Development [MEWD], 1994).

The National Water Policy was revised in 2010 to provide a comprehensive framework for sustainable development, management and utilization of resources. The Water Resources Management Act No.21 of 2011 was enacted to provide the legal framework. The revised policy embraces modern water resources management principles and aims to deal with the daunting challenges of poverty reduction. The policy, among other things, also refers to the tariffs, which play a key role in the water sector. These tariffs are based on the principles of fairness and equity and a level of simplicity and transparency, which entail, among other things providing a minimum level of service to persons who are unable to afford the full cost. However, the policy reforms do not ensure that utilities extend water services to the poor communities in low-income areas, as Chitonge (2011) notes. This is the case in most if not all informal settlements of Lusaka where most people, because of their financial status, are unable to pay for the full costs of water and therefore the policy, if strictly implemented gives room for these populations to enjoy the water provision services supplied by the utilities for both consumptive and non-consumptive uses. The policy makes much reference to consumptive water uses such as drinking and cooking as opposed to non-consumptive uses of water such as cleaning and as a result, water supply per day could be insufficient.

Despite the recognition of water for various uses at domestic level, water supply and access remains low. In addition, despite the policy denoting a quantity of 180 litres of water per capita per day for large urban areas like Lusaka, the said amount has been actualized for entire households, specifically 200 litres of water per household and not per capita per day. In reality the policy has not been actualized in informal settlements such as George. The policy has also done little to develop water harnessing infrastructure that would otherwise contribute to curbing water insecurity in the country.

2.6.2 The Water Resources Management Act No. 21 of 2011

The Water Resources Management Act cited as the water resources management regulations 2016 emphasizes a holistic approach to water management in which a comprehensive spectrum of demands is recognized and evaluated to assess their priority through various policy measures and strategies. Including, recognizing the critical role of the water sector in the country's overall socio-

economic development, vesting ownership of water resources in the country under state control, and promoting water resources development through an integrated management approach. In addition, defining clear institutional responsibilities of all stakeholders in the water sector for effective management and coordination, developing an appropriate institutional and legal framework for effective management of the water resources and promoting a state of disaster preparedness to mitigate impacts of extreme occurrence of water (floods and droughts), recognizing water as an economic good. The Water Resources Management Authority (WARMA) was formed form this Act and its main purpose is to serve its regulatory body for the management and development of water resources in the whole country.

Informal settlements are characterized by very high population densities. They continue to expand rapidly, therefore, have negative implications on water resources and hence the need to plan for sustainable water supply. This implies that the resources that are available now, if not sustainably used may not be enough or even available shortly. All water plans must be in line with the global goals also known as the Sustainable Development Goals (SDGs) whose ultimate goal is to promote a new worldview, specifically in line with SDG number six. SDG number 6 speaks of sustainable water security by achieving universal access to clean water and basic sanitation and ensure efficient allocation through Integrated Management (Griggs et al., 2013). The goal seeks to ensure availability and sustainable management of water and sanitation for all by targeting issues of universal and equitable access to safe and affordable drinking water. Additionally, reducing pollution levels, Integrated Water Resource Management, protecting and restoring water-related ecosystems and strengthening local participation in improving water and sanitation-related activities and programs.

2.6.3 The Water Supply and Sanitation Act No.28 of 1997

The Act was conceived due to the need for separation of regulatory and executive functions in the water supply and sanitation sector. The Act provided for the creation of the National Water Supply and Sanitation Council (NWASCO) whose core mandate is to regulated the provision of Water Supply and Sanitation (WSS) services in Zambia. Further, the act, since its inception, has failed to provide a well-organized and maintained supply of water to most parts of the country and as such, water crises still loom in urban and peri-urban areas. Particularly, Part V paragraph 30 of the Act states that a utility shall within its service area construct and maintain facilities to the boundary of the customer's property (Water Act, 2011). Moreover, the Act fails to be specific on what property and in what type of settlements. As such, the Act leaves room for misinterpretation. Additionally, if these properties are also inclusive of informal settlements; it implies that the Act is slightly overzealous because informal settlements make this impossible. Finally, the Act does not clearly state the standards that water utilities should follow regarding services. Therefore, it further leaves

room to National Water Supply and Sanitation Council (NWASCO) to localize water standards as set at the international level, causing suggested solutions to fail.

2.6.4 Institutional arrangements in the water sector

2.6.4.1 Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP)

The Ministry of Water Development, Sanitation and Environmental Protection, formerly known as the Ministry of Energy and water Development, was formed to better integrate the responsibilities of water resources management, water supply and sanitation as well as environmental protection.

2.6.4.2 Ministry of Local Government and Rural Development (MLGRD)

The Ministry has the responsibility to support the devolution of authority to its lower levels and support private sector involvement in service provision. It is mandated to coordinate the implementation of Government strategies concerning water supply and sanitation, and solid waste management (Resnick et al., 2019). Its functions further include planning and execution for commercial and private sector actors and overseeing the local authorities responsible for water supply and sanitation.

2.6.4.3 National Water and Sanitation Company (NWASCO)

The NWASCO was formed under the enactment of the Water Supply and Sanitation Act of 1997. The functions of NWASCO include advising the government on water supply and sanitation matters, advising local authorities on commercially viable options, formulation of guidelines and enforcements of standards, providing for the establishment of water supply and sanitation utilities and providing for the efficient and sustainable supply of water and sanitation services. NWASCO regulates commercial utilities.

2.6.4.3 Zambia Environmental Management Agency (ZEMA)

The Zambia Environmental Management Agency **(**ZEMA) is responsible for applying the legal framework for protecting the environment and the control of pollution under the Environmental Management Act of 2011. In addition, ZEMA regulates erosion and discharges caused by uncontrolled storm water, promotes monitoring programs in line with water quality guidelines and standards.

2.7. Conclusion

This chapter discussed that water insecurity manifestations encompass aspects such as water scarcity, inadequate supplies to meet daily water demand, and questionable quality of water sources. Furthermore; the long distances covered to access water and the time that is taken to access the water and climatic factors such as droughts and floods are also aspects of water insecurity. As well as the

lack of infrastructure, and anthropogenic factors such as financial access and energy supply. The chapter further showed that water insecurity is present in many places, and households employ diverse survivalist strategies. For example, water rationing, which is common place in many areas, the storage of water in numerous vessels for later use, the use of unusual and unsafe sources of water. Besides the above-mentioned strategies, one documented atypical strategy used to access water is vandalism. Most informal settlements in the Global South cities are in water vulnerable areas. Despite these communities already suffering from a lack of clean water and sanitation problems, they are susceptible to frequent flooding.

Finally, the chapter establishes the importance of City and proactive planning in the face of water insecurity. The chapter has further established that resilience is vital in the face of a changing environment. This can be achieved partly by learning coping strategies and applying policy measures that directly tackle the issue of resource management towards fulfilling the national development goals and the agenda for sustainable development by 2030. While many research publications on water and urban informality gap exists on conceptualization of water insecurity and how residents of informal settlements cope with this challenge, this study seeks to achieve this by analyzing urban everyday day dynamics using George as a case study and by using water insecurity experiences to generate concept and ideas.

CHAPTER THREE: DESCRIPTION OF STUDY AREA

3.0 Introduction

The study area is the informal settlement of George, which is one of the largest settlements in Lusaka. According to Hunleth (2017), the settlement of George, a previously peripheral rural area, began to develop as a residential area in the 1960s, resulting from the need for accommodation for the numerous people that sought after employment opportunities in Lusaka as the town itself was not designed for a large population.

Hansen (1992) states that the settlement draws its name and origin from George Hadjipetrou, a white man who served in the English army until the end of World War II when he was demobilized. Mr George, as he was popularly known, went into the brick-making business with a few workers who settled near the source of the clay that was used in making these bricks. This small group of people came to constitute what has come to be known popularly as George compound. The settlement was upgraded under the first upgrading supported by the World Bank beginning in 1975 and ended in about 1982. However, this growth has not been matched with improved social services. Additionally, Mulenga (2003) states that a Peri-Urban Housing Section was also created in the Directorate of Housing and Social Services of the Lusaka City Council with the specific mandate of managing the improvement areas. It was also expected to manage any subsequent upgrading programs in Lusaka.

3.1 Location map of George Informal settlement

George settlement is located in the City of Lusaka, which is the capital city of Zambia and is situated in longitudes 28° 13’ and 28° 25’ east of the Greenwich Meridian, and latitudes 15° 20’ and 15°28’ south of the Equator. The City lies 1280 meters above sea level and covers an area of 375 km² of mostly flat relief. Specifically, George lies to the northwest of the Lusaka City Central Business District, in the western side of Matero, as provided for in Figure 1. It is neighbored by Matero, Chunga, Desai and Lilanda settlements.

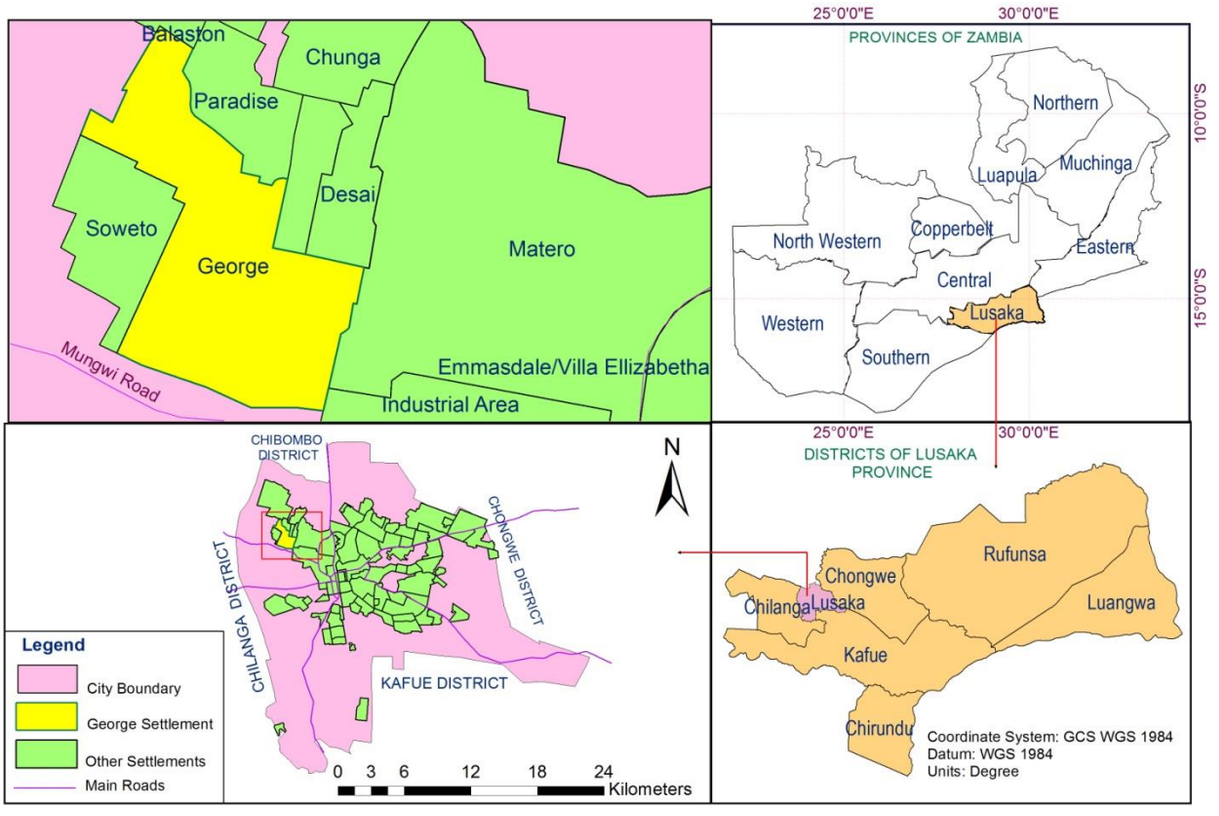

Figure 1: **Location of George settlement**
Source: Author, 2019

3.2 Demographic and Socio-economic characteristics of George

The settlement of George houses more than 60,000 people with over 11,000 households (People's Process on Housing and Poverty in Zambia; 2012). According to the Central Statistics Office (2014), the population of George has grown to 130,000. George, like most of Lusaka, has a young population ranging from 15 to 39 years of age. With the population of Lusaka as a whole projected to continue increasing significantly to 2 million by 2021 from 1.7 million (Lusaka City Council, 2008) the population of George settlement will also increase. "Lusaka has had higher population growth rates than Zambia as a whole." (Mulenga, 2003:4). The median age of the Lusaka population was set at 19 (Central Statistics Office, 2010). The settlement is now estimated to have over seventy thousand (70,000) people, making it one of the biggest slums in Zambia.[2]

The biggest challenge in the George settlement is the lack of social amenities, including water and sanitation facilities, despite its legalization in late 1974. George's challenges include lack of regular income among residents, causing most to strive to sustain their livelihoods in the settlement. The residents additionally have regular sources of income but rather engage in informal trading activities within the settlement. Further challenges for the settlement that also houses a large population

[2] http://upfi.info/projects/community-hall/

include; inadequate social services such as housing, access roads, drainages and electricity. Most of the access roads in existence are in a poor state and are impassable especially during rainy season. Lastly, the majority of the houses are not electrified causing security concerns in the settlement.

3.4 Physical characteristics climate, soil, natural vegetation

Lusaka District, where George settlement is located, is built on a low lying, flat plateau (with a gradient of 0.2%) of highly permeable limestone, which is quickly saturated.[3] George settlement has a karstic topography that renders very good aquifers and makes it easier for residents to dig shallow wells. (Mulenga and McGranahan, 2011). This makes the settlement of George rich in water resources owing to its high-water table. This topography uncoupled with rudimentary infrastructure causes seasonal flooding in the settlement.

Other parts of George are also located on the schist and quartzite and is characterized by shallow groundwater tables[4] . This factor makes it possible for people to dig shallow wells, which are a major source of water aside from the kiosks and individual standpipes that are provided by the water utility company. On the other hand, however, if combined with a high concentration of pit latrines, as is the case, the risk of contamination is increased.

3.5 The rationale for choosing the study site

George is a legalized unplanned settlement in Lusaka with a long history of water insecurity and is home to thousands of vulnerable people in Lusaka. The area was declared improved by the government under the improvement areas act of 1974[5], meaning that development can occur without fear, eviction or demolition. Despite the settlement being upgraded under the first upgrading program in 1975-82 and having undergone various developmental efforts in roads, drainages and water points or communal water taps by organizations such as the world bank, JICA, PPHPZ, the area continue to undergo water challenges. According to Miller et al. (2020), the settlement of George is among those characterized by dense, mostly informal settlement patterns where water access and management are ongoing challenges. Many parts of George have been described by respondents as perennial flooding areas. The area was therefore selected owing to its high vulnerability to water insecurity and the associated development challenges.

[3] http://www.fractal.org.za/wp-content/uploads/2019/01/Policy-Brief-Lusaka-Flooding.pdf

[4] https://www.bgr.bund.de/EN/Themen/Wasser/Projekte/abgeschlossen/TZ/Zambia/geosff_techn_report_1.pdf?__blob=publicationFile&v=3,

[5] Chapter, A. A., & Act, P. Legislation: The Housing (Statutory and Improvement Areas) Act Chapter 194 of the Laws.

3.6 Conclusion

Chapter three provided a brief overview of the study area by stating the location, physical characteristics, demographic and socio-economic characteristics and rationale for choosing the site.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.0 Introduction

In line with the social constructivist position, this research will adopt a qualitative research methodology using a case study approach to establish the determinants of water security in the informal settlement of George, Lusaka. Constructivism is an epistemological view of knowledge acquisition that emphasizes the aspects of knowledge construction rather than knowledge transmission. This includes recording of information conveyed by others, new learning that builds on prior knowledge and enhancement of learning by social interaction and meaningful learning through authentic tasks (Dagar and Yadav, 2016).

The research is an evaluative and interpretive inquiry analyzed using qualitative methods. This study involved constant interactions with community members before and during the data collection, which was one by use of semi-structured interviews using interview guides to understand the nature of the water insecurity in the settlement and how residents survive these instances daily. Participant observation, pictorial evidence and semi-structured interviews were carried out on a face to face basis as data collection methods in the informal settlement of George. The collected data was analysed using content and thematic analysis.

The current chapter presents the following information in the listed order: the case-study research method, appropriateness of the selected method for the research topic, data collection and analysis methods and procedures, limitations and scope of the methods, research validity, and the challenges faced during the study. Lastly, the conclusion to the Methodology chapter and an introduction to the next chapter are presented.

4.1 Case study Research method

A case study method is a long standing research approach in almost all fields of inquiry. Recently, there has been a surge in publications indicating that planning research needs to pay attention to context, to lived reality and to specificity and to detail (Flyvbjerg, 2004,). A case study research method as defined by Yin (1984:23) is an “inquiry that investigates a contemporary phenomenon within its real life context when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used. It involves the analysis of a unit of analysis which defines the minimum level of study.

Similarly, Bogden and Bilken (2003) define a case study as a detailed examination of one setting or a single subject or particular event. A case study involves studying a particular unit in detail and documenting the very minute details therefore making it a comprehensive study and can thus re - emphasize and add more insights to an already existing body of knowledge. The case study research method is largely qualitative and is therefore more appropriate for answering qualitative research

topics by seeking to answer 'what', 'how' and 'why' context bounded research questions (Yin, 2003). Context is very cardinal in any research as it brings out more accurate data that can guide pro-active action. Further, Kumar (2019) argues that a case could be an individual, group, community and this becomes the basis for a thorough, holistic and in-depth exploration of the aspects one wants to find out about. The core aim of a case study is to identify the uniqueness and complexity of a particular case, in this case George settlement of Lusaka.

4.1.1 The relevance of case study approach in this research

Like every other approach, the case study has its merits and demerits as stated subsequently.
The detailed study of just one unit or phenomenon as opposed to multiple is likely to bring out detailed information that is accurate and relevant to a particular subject and can be useful for conceptual generalization. According to Yin (1984), one of the merits of using the case study approach is that the examination of data is conducted within the context of its use. Furthermore, the detailed qualitative accounts produced by case studies help to explore and describe the data in real life environment and also help to explain complexities of real life situations which may not be captured through experiment or survey research (Zainal, 2007), planning has to be informed by specific context.

The case study is appropriate because being an exhaustive study of a bounded social unit, the case study method enables us to understand fully and gain deeper insights, the social pattern of the concerned unit thereby deepening our understanding of issues under study and giving us a clearer insight into life directly as opposed to giving an abstract method (Kotari,2004) and this is what the study seeks to achieve and lastly ,the method is appropriate for answering the "How" and "what" research questions at hand as they require a profound examination of water conditions in informal settlements with regards to water insecurity.

In this research, the method has been used to intensively study and find out exactly what urban water insecurity means for the people living in informal settlements and also to find out the drivers of water insecurity in the context of informal settlements in Lusaka, Zambia. The use of this approach has allowed the study to get to specific lived conditions vis-à-vis urban water systems and services. The approach has enabled a process of scientific inquiry that critically interrogates ways of human survival in conditions of perpetual water. The use of a case study gives deeper insights that are necessary for understanding certain variables of water insecurity in an urban condition characterized by high poverty and significant deficits in urban water infrastructure rises, conditions where people have to contend with life threatening effects of water insecurity.

However, the case study method contains a bias toward verification and has the tendency to confirm the researcher's preconceived notions. This potentially renders the study to be of less scientific value as noted by (Flyvbjerg, 2004), as it is often difficult to summarize the data and develop a general preposition and theory on the basis of specific case studies. The data collection process takes longer because of the colossal amount of data that has to be examined and it may take time for the researcher to verify information and ensure its accuracy. Further, one demerit of case studies is that it is hard to generalize empirical data. This method has been criticized for generating results that are less generalizable than those of large sample, quantitative methods as results from a single case are considered by many as illegitimate for developing scientific theory as argued by Wikfeldt (2016).

4.2 Sampling process and sample size

The study was carried out in the year 2019 between the months January to June. The study had 44 study participants comprising thirty-five (35) respondents from the community and nine (9) key informants from relevant institutions. Having carried out a reconnaissance survey in the area, the community respondents were before the interview requested to participate in the study. The respondents were selected using purposive sampling, a non-probability form of sampling that seeks to select participants strategically so that those sampled are relevant to the research questions being posed (Becker , 2012). In this case, the respondents were selected from among the residents of George settlement, targeting those actively affected and aware of water insecurity matters and included both men and women. Some of the information that influenced the purposive selection of residents was obtained from key members of the settlement that comprised of tap leaders and ward representatives. The community respondents consisted of twenty-eight (28) women of ages 20-40years, three (3) youths ages 15-18years and four (4) men ages 20-55 years. All participants from the community were at the time of the study self-employed and engaged in some form of informal trading within the settlement and at the market. Key informants included six (6) males and three (3) females. In addition, a review of reports from People's Process on Housing and Poverty in Zambia, a Non-Governmental Organization that has done work with regards to incremental housing improvement in the informal settlement was done.

The key informants were also selected purposively from relevant institutions in the water sector based on their affluence in understanding the subject of water insecurity and their practice and associations in the urban water sector. This distribution of respondents and key informants was as follows:

Table 1: Respondents

s/n	Respondent/Institution	Number
i	Community residents	35
ii	National Water Supply and Sanitation Council	1
iii	Lusaka Water Security Initiative	1
iv	Lusaka Water Supply and Sanitation Company	1
v	Lusaka City Council Planning	1
vi	Lusaka City Council Engineering	1
vii	Lusaka City Council Public Health	1
viii	Lusaka City Council Housing	1
ix	Ward Development Committee member	1
X	People's Process on Housing and Poverty in Zambia	1

Source: Field Data (2019)

The sample size of the community respondents was determined using theoretic saturation, which is the idea that one carries on sampling theoretically until a category has been saturated with data or until no new or relevant data seem to be emerging regarding a category (Becker and Bryman, 2012; Strauss and Corbin, 1998)

4.3 Data Collection and Analysis methods

This section highlights the primary and secondary data collection methods employed in the study. According to Creswell et al., (2007), data collection in a case study is characteristically extensive and draws from multiple sources of information. These sources include, interviews, document review, direct observation, participant observation and analysis of physical artifacts (Yin, 2013).

4.3.1 Primary Data

The principle data was collected during numerous trips made to George's settlement of Lusaka in the period June to August 2019. Data was collected through situated conversations between researcher and respondent using semi-structured interviews and direct observations for the community and by the use of an interview guide for the key informants from the various institutions in the water sector. This data was mainly collected using interview guides, observation and field notes.

4.3.2 Secondary Data

Secondary data was collected internet reports and books. Institutional reports such as annual reports from NWASCO, LWSC and census data were used to get a picture of the settlement and guide on the formulated instruments. These documents were accessed from the internet.

4.3.3 Data Collection Techniques

There are several techniques for collecting data, and the techniques used in this study are further discussed below.

4.3.3.1 Observation:

The study used the observation techniques below:

Participant observation: involves active looking, improving memory, informal interviewing, writing detailed field notes and patience. De Munck and Sobo (1998) and Schensul and Lecompte (1999) further define participant observation as the process of learning through exposure to involvement in the day to day or routine activities of participants in the researcher setting.

Indirect observation: According to Ciesielska and Jemielniak (2018), indirect observation is, in a broader sense, a set of methods that allow one to get information about past and present situations that a researcher did not have direct access to while in a narrower sense means the use of a one-sided mirror, a camera or voice recorder to record or observe events in which the researcher does not participate.

Under the observation method, the information is sought by way of the researcher's direct observation without asking from the respondent. The advantage is that subjective bias is eliminated if the observation is done correctly and the information relates to what is happening currently.

Limitations, however, include limited information that is provided by the method as well as unforeseen factors that may interfere with the observational task (Kotari, 2004). The two types of observation were used during the data collection in the study area by informally chatting with residents during general chats outside of the interview schedule. Notes were also written down in a field journal on relevant issues that arose and were relevant to the study during data collection.

Audio recordings were also made using a recorder to capture some complaints and explanations that people had concerning the challenges faced in the water provision to the settlement. Among the issues observed were the unusual water collection sources within the settlement, the non-functional infrastructure, the visible water pipes laid in the ground, the water rationing strategies, and numerous storage containers at various households.

Semi-Structured Interviews: Interviews play a massive role in qualitative research and are used when a researcher wants to gain deeper knowledge about a particular subject. The study used in-depth interviews using semi-structured questions. Follow up questions were further asked depending on respondents' responses for better understanding. The questions were also phrased in a way that allowed the participants to feel free. Therefore, participants had the opportunity to share their experiences with water insecurity and thus accord the researcher the chance to gain a deeper understanding of their issues, thereby making it a suitable method for collecting data.

While the interviews were phrased in an open-ended style, some participants were not open to further discussions, which initially made probing difficult. However, the interviewing and probing skill

became better with the increase in the number of participants that were talked to. This also increased the confidence of the researcher and brought out new knowledge from each participant that was interviewed. This, however called for the researcher to be innovative in the way that questions were asked and to ensure that when an opportunity availed itself, there were light moments of laughter and small talk between the researcher and research participant and those questions were not repeated.

4.3.3.2 Data Analysis

The transcribed materials were analyzed, thereby allowing the researcher to make sense of the responses from the respondents. All transcripts were repeatedly read alongside the recording to ensure that the data was captured as it was presented and in order to create themes and narratives which form the basis for the write up as recommended by Kumar (2019).

4.3.3 Data Management

When conducting any research, data management is a very important consideration. Having conducted research that generated a large volume of qualitative data over a long period of time, it is vital that the information is well managed for credible analysis, interpretation, and reference. According to Miles and Huberman (1994:45), "the main issues related to data management are high-quality data, documentation of just what analyses have been carried out and retention of data and associated analyses after the study is complete". The researcher stored all their recording, transcribed interviews on a secure flash drive and backed them up on the cloud in a secured google drive. Hard copies of transcribed data were also kept.

A professional transcriber transcribed interviews within 72 hours of collecting the data in order to ensure that the data was safely kept. The amount of time given to each interview also facilitated the development of verbatim for all interviews done because this proved to be a daunting task.

4.4 Study limitations

Like any other processes, the research has a few glitches during the period of data collection. These included disruptions during the time of community interviews by neighbors, friends and phone calls and even various duties at people's homes. Thereby resulting in time constraints as more time than was necessary was spent on some individuals, thereby affecting the time frame of the data collection. Furthermore, despite making prior arrangements for interviews, some respondents, due to other commitments, they were unable to focus. It had to take the researcher to skillfully draw them into being cooperation until the interview was done.

All the above-mentioned limitations contributed to making the research costly on the part of the researcher as they had to travel to the study site more times than was planned. Lastly, the appointments made by the researcher with most respondents limited how many people could be

interviewed as these hours fell between 10 hours and 13 hours. This was not enough because participants had other commitments that related to business, cooking lunch and taking the children to school which limited the time for the researcher to be in the field for the day. However, this made certain that the researcher had ample time to prepare physically and intellectually for the following interview. The average time for an interview was 40 minutes, with some interviews lasting up to sixty minutes. This was so because the researcher wanted to ensure that every response was adequately probed to gain details and also for clarification of certain information. This allowed for critical thinking on the part of both the participant and the researcher.

4.5 Research Validity

According to Drost (2011), validity is concerned with the meaningfulness of research components and processes. Furthermore, in line with Weiner (2007)'s views, validity deals with whether the items included in the instruments adequately represent the universe of questions that could be asked. Validity in this research has therefore been applied as a measure of credibility of the study.

In addition, Yin (1994) argues that it is preferable to use triangulation in a case study approach as it improves the validity and integrity of the study. Triangulation implies the multiple observation of the same phenomenon or the convergence of different kinds of evidence gathered in different ways but bearing the same point (Yin, 1994).

Against this background, data validity was achieved based on Yin (2003) recommendations to use triangulation. In this study, the researcher collected and verified the data from several sources and through several research processes, including direct and participant observation, review of various documents, archival records and interviews as identified by Yin (1994) and Stake (1995). Furthermore, the researcher engaged a professional transcriber to transcribe the interviews and sent the transcribed notes to some key informants, comprising NWASCO, LWSC and LCC engineering for review in line with Yin (2003)'s recommendation.

4.6 Ethical considerations

The main ethical principles that were considered in conducting this research were confidentiality and respect for respondents. The researcher, therefore, observed the principle of anonymity for all respondents who wished to remain anonymous. Furthermore, the interview schedules and guides did not include respondents' names for the purpose of confidentiality. Respondents had the right to decide whether they could take part in the exercise, which was clearly stated in the interview schedules. All interviews conducted were recorded upon seeking prior verbal permission from the research participants. The researcher further provided the respondents from the settlement details on the purpose of the research and who will have access to the same information. After which, the participants were then given some time to consider their participation. In addition, the researcher

ensured that there was no romanticization of poverty and deprivation during the data collection processes. Finally, ethics clearance under the Fractal project was used to ensure that the study was in line with acceptable standards in applied research.

4.7 Conclusion

This chapter has discussed the entire methodological process of the study, starting from the case study method approach, its use and relevance in research, and its merit and demerits. The chapter has further stated the data sources and explained the data collection and analysis methods applied in this research. Lastly, the study's limitations and the insurance of data validity was highlighted.

CHAPTER FIVE: RESEARCH FINDINGS

5.0 Introduction

The following chapter presents the findings of the study carried out in George settlement of Lusaka. These findings are analysed in line with the aim and objectives stated in the study, which focuses on the determinants of water insecurity in informal settlements. The chapter is divided into four sections. The first section provides: a brief introduction to the study area; and present findings on the drivers of water insecurity in the informal settlement of George. The second section presents community and national coping strategies to incidences of water insecurity. The third section will present findings on the role of planning in ensuring resilience in the water sector in informal settlements. The last section will be a conclusion of the chapter and an introduction to the next chapter.

The settlement of George was established way before Zambian independence in 1964. "George's development as a residential area began in the early 1960s." (Hunleth, 2017:21). The settlement of George in Lusaka was regularized in January 1977. The settlement was upgraded under the first upgrading supported by the World Bank beginning in 1975 and ended in about 1982. Hunleth (2017) notes that upgrading plans included resettlement and rebuilding of housing, construction of roads, streetlights installation, and trash collection services. In the 1990s, George was considered to be a dense and deteriorating neighbourhood with, a poor population of about 40,000 in accordance with the 1990s census.

In terms of water provision, George compound is serviced by the Lusaka Water Supply and Sanitation Company (LWSC), a quasi-government body with the engineering and commercial departments responsible for this task as it encompasses the peri-urban area. The utility company supplies water to the settlement mainly via the use of boreholes that are located within the settlement and surface water from the Kafue River. The Water Supply and Sanitation Act gave birth to the Lusaka Water Supply and Sanitation Company and as such, governs it. George was initially under a water trust, but later, through some money that was given to the utility, 5 boreholes were sunk, and investments were done to upscale the number of connections in the area. Due to this huge investment, the water supply had to be run by the utility and not the water trust.

5.1 Drivers of water insecurity in George settlement

Although there are many drivers of water insecurity worldwide, these cannot be generalized as they are context-specific. This section presents findings on the underlying drivers of water insecurity unique to the informal settlement of George in Lusaka. It presents the natural, human and financially induced drivers of water insecurity that were established during the data collection in the area of

study and as such, gives a clear understanding of the characterization of the subject matter. These findings will then be interpreted and will be of assistance in generating targeted solutions.

5.1.1 Daily mode of water access

Communal water kiosks, commonly referred to as *"Kajimas*", are only opened once a day between 05:00 hours and 05:30 hours to about 08:00 hours. The term *Kajimas* refers to communal water taps or water kiosks and, the name is derived from the Japanese Kajima Corporation[6], a construction company that was contracted to set up the Water Kiosks in many areas of Lusaka. While less than twenty percent (20%) of residents have individual taps from which their water is collected and make payments for their water through the stepped tariff, over eighty–percent (80%) of the residents of George mostly get their water from communal taps. With the stepped tariff, the water is metered, and the more water one uses, the more expensive. The settlement did not until 2015 begin providing for individual standpipes, and as a result, only about twenty percent (20%) of households own these individual taps. Fetching of water is therefore done daily, and the residents have to queue up in the early morning hours to get their water. The taps are opened only once a day and are closed as soon as every household has drawn their water, usually within the first three hours. Residents of the settlement then have to wait until the following day to fetch some more water.

Fetching water in the early morning hours entails that all residents are at the tap by the stipulated time or earlier and ready to draw the allowable water quantities for the day. The residents of George are nonetheless limited in the amount of water they can draw in a day due to the rules and regulations set by the water utility company, the Lusaka Water Supply and Sanitation Company. This is done to ration the water that is supplied to the settlement with an overall aim of ensuring each household has equal access to water every day. To that effect, each household is allowed to draw 200 litres for the 30 ZMW monthly payment to Lusaka Water Supply and Sanitation Company regardless of the household size.

All residents must use a particular twenty (20) litre bucket to draw their water for uniformity. In this way, it is easier to keep track of how much water an individual will fetch. Each person from a particular household is thus allowed to draw ten 20 litre buckets, translating to 200 litres. Therefore, those households that have ten (10) or more people have to pay double if they need more water. This water is then stored in their homes until the next day at 05:00 hours when the taps are opened again.

The settlement has two systems of fetching water. The first system is one where people are required to pay 30 ZMW monthly. The other system is where people fetch water according to the money they

[6] Community residents use the term 'Kajimas' to refer to communal water kiosks in George- The term Kajimas is derived from Kajima Corporation of Japan, a firm that constructed many water kiosks in Lusaka with funding from JICA- https://www.kajima.co.jp/english/welcome.html, accessed on 10;01/2022

have and can, therefore, have access to this water supply throughout the day as the taps remain open and only close at lunchtime and in the evenings. This gives a chance to those who cannot manage to pay a 30 ZMW to have access to clean water daily. To avoid overdrawing of water on a particular day, residents are asked to inform the tap leaders in advance of their intentions to do their laundry because each household is given five free 20 litres containers for laundry twice a week.

> *"Sometimes we go for two days without water, and therefore each household is allowed to draw only two buckets (40litres) each of water to give a chance to everyone to draw some water. This usually happens in October when underground water levels go down, and it's difficult to pump water."*
>
> *(Interview: Catherine-Tap leader /resident George) 23rd July 2019)*

> *"We pay 30ZMW for our water per month, but there are rules that govern the fetching of water from the 'Kajima'. One can only draw a maximum of ten (20 litres) containers for 30 days within that amount".*
>
> *(Interview: (George resident) 28th June 2019)*

> *"We have various types of consumers in George. There are those with individual connections and those who get water through the various kiosks. The former are metered and get charged through the stepped tariff as regulated by National Water Supply Cooperation (NWASCO) while the later get charged per 20 litres container depending on the supply regime of the day".*
>
> *(Interview: Key informant (LWSC) 9th August 2019)*

5.1.2 Personal behaviours of leaders

The taps are managed by some community volunteers that are engaged by the water utility company that is, Lusaka Water Supply and Sanitation Company and not the community. This management is based on their availability, collaboration with the community structures that is the Ward Development Committees and the promise of a small allowance for their services. These community volunteers are referred to as 'tap leaders' by the community, and are overseen by people that are called zone monitors. The zone monitors ensure that the tap leaders work according to the laws and regulations stipulated by the utility company to provide quality water service delivery in the settlement. However, ten percent (10%) of the research participants alluded to having poor water service in some parts due to what they termed inconsiderate behaviours by some of the tap leaders. In such instances, some tap leaders may open the taps late despite being aware that people are waiting for the taps to be open.

5.1.3 Quantity and demand for water

George settlement has a total of 393 communal standpipes dotted around the settlement constructed by the Japan International Cooperation Agency. The residents who draw water from the water kiosks that allow for a monthly payment of 30 ZMW are entitled to 200 litres of water for their daily use.

At the same time, those who cannot afford to pay the above-mentioned amount, pay 0.5 ngwee or 1 ZMK to draw a container or two daily, which translates to 20 litres and 40 litres respectively. However, given the daily uses that the residents have, ninety-five percent (95%) of them assert that the daily amounts of water that they are entitled to are not enough to cater for their needs. Additionally, household size is an essential aspect that is considered in the sense that while 200 litres may be enough for a small household of 3, it is insufficient for a larger household size of 10 due to the multiple uses as indicated by all research participants. Ninety-five percent (95%) of the interview participants stated that the allowable amount of water to be collected needed to be increased to cater for their daily needs. These daily needs include washing dishes, doing the laundry, drinking, cooking, bathing, cleaning the toilets mopping the floors and washing vegetables. Thirty (30%) of those interviewed stated that if they at least had daily access of 300 litres to 400 litres, they would feel much safer. Alternatively, if there could be no caps on the amount of water drawn in a day and no restrictions on time then the situation would be ideal.

With a population of more than 130,000, George is one of the largest informal settlements in Lusaka. However, the service points and the amount of water provided to the settlement remains the same, despite population growth and increasing demand for water resources. To avoid queuing up for long hours, some people opt to draw just one or two buckets for cooking and then use other potentially unsafe sources for the remainder of the water they need for other uses. In over eighty percent (80%) of the households, there is subsequently a shortage of potable water. Interestingly, even those that draw water from the water kiosks occasionally draw their water from the shallow wells to supplement the water they collect from the kiosks because it is not enough. The participants indicated an average daily water deficit of 100 to 200 litres at household level. This is mainly because of some of the everyday uses that require more water than others.

> *"My business of selling cow hooves requires a lot of water because I need to wash them thoroughly after removing the fur and afterwards clean myself and my surroundings, but it's difficult with the amount we are allowed to draw".*
>
> *(Interview: Amaake Mary George resident 25th June 2019)*

> *"The water is not enough, especially when we are doing the laundry and blankets. We need at least 20buckets (400litres) although it's a matter of storage facilities also. Currently, when we pay the monthly fee, we still buy two extra from the vending taps".*
>
> *(Interview: Ms Gertrude George resident 10th July 2019)*

5.1.4 Distance and time spent to draw water

Since the source of water for over ninety-five percent (95%) of the residents is not at their homes, they have to go to the communal water kiosks for their water. They have to walk on average a distance of 100 metres to access water at the water points. Although some residents have the water points

right at their homes or within less than 10 metres, eighty percent (80%) have to walk a longer distance and have to queue up to wait their turn to draw the water they need. Queues can be as long as 50 people at one '*Kajima*', and how long one stays there depends on the water pressure for the day. In terms of walking time, some residents walk a one way trip of about 30 minutes to draw water because of the two systems that have been put in place.

Certain kiosks are designated for those that pay 30 ZMW and others are just for those who buy water daily also called vending taps. For instance, if one pays 30 ZMW and yet the closest kiosk is one that only allows those that draw water daily, they will have to walk a longer distance to the kiosk that offers them water on a card. This, therefore, increases the walking time that one has to fetch water. Furthermore, groups of people from within the settlement are unable to afford the 30 ZMW monthly or 1 ZMW daily payment to collect their water. These residents rely on shallow wells. Since over ninety-five percent (95%) of shallow wells were buried in light of the 2017 cholera outbreak, the few remaining shallow wells are located afar (over 30 minutes' walk), which implies covering a longer distance to collect this water. In times of water shortages, or erratic water supply caused by failure of water infrastructure and the inability to pump water from the boreholes into storage tanks by the utility, residents of George walk to the next settlements such as Matero that lies about three kilometres away, to collect their water. Residents reported that houses in Matero have individual standpipes. About ten percent (10%) of the George residents own individual standpipes that they utilize to sell water although this is highly discouraged by the water utility.

Figure 2: Residents of George draw water from a kiosk at 05 hours.
Source: Field data, 2019

When people walk to Matero, they state that they get tired because they have to ferry the water needed on their heads and do not use any form of transport to ferry their water. This also means that they may draw water for most of the day and lose out on time vital for business and looking for money. In addition, the children are also affected in that every household member is asked to assist in fetching water for the household to ensure that more water is collected in one trip. School going children are affected and may be absent from classes for that particular day. In George settlement, People who live nearer to water sources such as a kiosks tended to use more water than those who were far away from these sources. The distance factor has direct influence on water access by households.

> *"Despite taking our complaints and taking a picture, the Lusaka Water and Sewerage Company do not fix the taps that are spoilt in good time. In most cases, there are only two out of four taps working and this affects the time we spend to draw water so when we go at 05 hours, and can leave as late as 10 hours, which affects our other economic activities".*
>
> *(Interview: George resident, 11th July 2019)*
>
> *"I struggle to find the 30 ZMW that has to be paid monthly so I draw my water from the vending taps, which are far from here and takes me 40 minutes round trip plus the queues I find there".*
>
> *(Interview: Ba Sarah (George resident) 01st July 2019)*
>
> *"When we run out of water in George for 2 to 3days we walk to Matero to collect water rather than get water from shallow wells and carry it back home on our heads. I also tell my children to be careful about how we use water.*
>
> *(Interview: Ba Christine (George resident) 3rd August 2019)*

5.1.5 Water Quality- Observable issues

Whereas the residents of the settlement claim that their water from kiosks is clean and safe, over ninety percent (90%) are still encouraged by the clinic staff to boil or treat their water with either liquid or powdered chlorine that is occasionally availed to them. Since their water is stored in buckets, sometimes for an even more extended period due to water blues, they treat it with chlorine.

Figure 3: Kiosk stored water in a bucket with unknown sediments
Source: Field data, 2019

However, the very water which appears clean when collected at the taps as it settles has some sediment that appears yellow. Whilst some do not know what the sediments are, others attribute it to the residual which remains after the tanks have been cleaned. On the other hand, others state that the sediment is excess chlorine but still feel it is not safe to drink as it is. Therefore, they boil the water in uncertain times. In some rare cases, which occur mainly during the rainy season, the water that flows from the taps is dirty, meaning it has mixed with rainwater, an indicator that the pipes are broken somewhere. In such instances, the quality of the water that is drawn is clearly of compromised quality.

Residents, therefore, have to treat it or wait for it to settle before they use the refined water off the top. Despite the water from the kiosks looking clean, over seventy percent (70%) of the research participants alluded to water occasionally having a strong smell of chlorine. They further suggested that the chlorine causes the water to taste bitter and cause stomach aches when consumed. Infrequently, the water that flows from kiosks is discolored with few sand particles, which the participants hinted was typically a sign of a vandalized water pipe somewhere in the water infrastructure network.

The study found that whilst some residents, seventy percent (70%) use water from the kiosks that are provided by the water utility companies. The remaining thirty percent (30%) of residents continue to draw their water entirely from shallow wells dotted around the settlement.

Figure 4: Shallow well in George
Source: Field data, 2019

The quality of this water is highly compromised due to the contamination of underground water that emanates from the onsite sanitation that currently exists in George settlement. Based on field observations and narratives from the research participants, the proximity of the pit latrines to the shallow wells is very close. The distances are usually less than 5 metres therefore, there is a lot of underground seepage from the pit latrines to shallow wells mainly because the water table in George is relatively high. Residents assert that the water from the shallow wells is hard as it does not form lather easily when laundry is being done and more detergent has to be used to get the clothes clean. Also, majority (90%) of the research participants said that the water occasionally smells and, therefore, is not suitable for drinking unless they have no other source. Additionally, it was observed that fifty percent (50%) of households use shallow wells in their homes with some shallow wells concealed with flower gardens.

Ninety percent (90%) of the research participants stated that they do not entirely depend on piped water provided at the kiosks because it is unreliable, and therefore, get water from the wells only for non-consumptive uses such as washing and cleaning the house and toilets. Additionally, the participants state that even though the residents of the settlement may not out rightly say this is the case for fear of being castigated, many of them use shallow wells to obtain their water.

Further, ten percent (10%) of the research participants stated that they opt to pay for at least one or two buckets, in which case, the water is used for drinking and cooking purposes. In contrast, water for bathing, laundry, dishes, and cleaning is collected from the shallow wells, an indicator that the water is not of good quality. Moreover, residents of the settlement suffer from diarrhoeal cases each

year. Forty-eight (48%) of residents attest that in some areas of George, cases of diarrhoea do not cease, and this is because of the contaminated water. People have no choice but to drink what is available to them. It is for this reason that the medical officials at the clinic emphasize that the water should be chlorinated.

However, the utility company has a team of operators from the quality control department that collect information from George and constantly monitor the chlorination systems at the utility water purification points situated in George community. Any contamination-related issue is flagged at an early stage.

> *"The water from shallow wells is contaminated! You will find that they dig a well here, but the pit latrine is just next to it. The level of water in the well and the pit latrine mix underground so even if they fetch, they do not realize that the water is dirty and they use it hence too many diarrhoeal diseases".*
>
> *(Interview: Ms Njobvu (George resident) 27th July 2019)*
>
> *"Sometimes the chlorine is too much that the water becomes bitter!"*
>
> *(Interview: (Tap leader/ George resident) 16th July 2019)*
>
> *"Shallow well water is very different from tap water as it occasionally has organisms, is green in colour and smells".*
>
> *(Interview: Ms Mbewe (Tap leader/George resident) 27th May 2019)*

5.1.6 Power supply and water security: The link

All (100%) residents interviewed, and one key informant partially attributed the water scarcity to failure in power supply by the national power company Zambia Electricity Supply Cooperation. When the power supply cuts, the water automatically stops running, and power supply goes off at night it means there will be no water in the morning. The Lusaka Water Supply and Sanitation Company have sunk boreholes within the settlement and it is from here, they pump water to the settlement of George. When pumped from the ground, the water is stored in storage tanks, and treated with chlorine before being released to the settlement. Water shortages are also attributed to the failure of the seemingly very old (data on the age of the infrastructure not known) pumps to pull up enough water for distribution from the ground when there are power failures. On the other hand, when there is enough water in the storage tanks, but there is a power failure, the pumps that run on electricity cannot push water to the settlement, and subsequently the residents suffer the consequences.

> *"What causes water shortages is that the water we draw from the kiosks is pumped by Hydro-Electric power, so when there are regular power outages, it's a major problem because it means there will be no water".*
>
> *(Interview: Ms Phiri (George resident) 3rd August 2019)*
>
> *"When we have no power the whole day, it means that we will not have water the following day".*
>
> *(Interview: Evelyn Namwala (George Resident) 2nd July 2019)*

When there is no power, there is consequently no water. Sometimes our water supply is disturbed due to the power cuts as there is no power to pump water from the boreholes that are present in the settlement by the water utility company".

(Interview: George resident 4th August 2019)

5.1.7 Localized flooding

The settlement of George is sited on an area with a very high water table and was previously used to grow sugarcane hence the name that it earned '*Madimba'*. Due to this fact, the settlement always experiences localized flooding in the rainy season. The research participants asserted that the most affected areas are low lying areas such as zone two, Kwamponda, Kwachidoti and around the Chifundo market, where the water does not dry throughout the year. A look at some of these areas visibly shows the relatively lower landscape compared to other surrounding areas. Other causes of flooding within the settlement are attributed to a lack of drainage and proper roads in the settlement. Drainages essentially help in channeling water away from dwelling places, but within the settlement of George, these are non-existent. Visibly, the settlement has small trenches that aid in averting floods. However, these are not standardized and occasionally collapse rendering them useless. In addition, the settlement has improper roads which also contributes to an aspect of water insecurity which is flooding. The research participants state that the only existing drainages in George are along Commonwealth Road, which runs from east to west on the Northern boundary of the settlement. Therefore, when it rains, flood waters at the centre of the settlement have no outlet. This affects the residents of George by flowing into the houses, collapsing some houses, and further polluting the shallow wells in George by carrying all sorts of waste into the water. A research participant pointed to a house that had collapsed due to floodwaters.

Furthermore, the construction of houses and fences is in such a way that they are placed in an area that should essentially be for drainage or natural flow of water down the slope, thus causing floods. A look at the quality of some houses indicates poor workmanship and poor quality materials. Cracks are visible in the walls, and the bricks that make up the walls are slowly weather-beaten. As much as flooding may increase the quantity of the underground water sources, it affects the water quality. Therefore, the utility company constantly monitors flooding events, especially since they have boreholes that supply water to George settlement. In the settlement of George, some shallow water sources were observed to have dirt such as sticks, plastic bags and bottles, are generally have water with observable solid particles and brownish in color due to increased interaction of shallow well water and floodwater flows.

5.1.8 Climatic factors

Water insecurity is also attributed to the water scarcity in George. Approximately eighty percent (80%) of the residents indicated that although they may have water for most of the year, severe water

shortages begin as soon as it is October. This has been happening over what some term to be the last 5-6 years although others say it goes back to the past 10 years. Additionally, when it does not rain, residents begin to anticipate water problems from October to December. Eighty percent (80%) of the research participants also stated that rainfall patterns have also changed in that the rains are more erratic and there is less rainfall received as compared to previous years. Based on statements by the research participants, heavy rains were in the last decade expected by the 24th of October, but for the past 3 years, substantial rains are not received by the month of December. Therefore, this affects the water supplied by Lusaka Water Supply and Sanitation Company because the water table declines and the utility company pumps are unable to withdraw much water to supply the users of George settlement hence the dire water shortages during this period.

> *"In the drier season just before the rainy season, as one might expect, we have reduced flows, and we have issues with pumps all over the city. The major driver of water insecurity is climate variability because first of all, seasons change which feeds into the overall climate. So, if we have a bad rainfall pattern or we have too much rain, contamination occurs due to various things being carried by that water, but mostly it's the demand again. If we force our water sources to be abstract more than is safe because we are demand-driven, that is the major contributor to water insecurity for future generations".*
>
> *(Interview: Anonymous (Key informant, LWSC) 10th August 2019)*

> *"We experience a lot of water shortages in October because we know that the levels of water at the company drop so we prepare our minds for this".*
>
> *(Interview: Ms Mulenga (George Resident) 5th August 2019)*

5.2 Coping strategies: Narratives from George Settlement

5.2.0 Introduction

Despite the existence of water insecurity in George and their possible implications, the community of George applies several strategies to survive in the face of water insecurity. These strategies range from climate-smart options, water rationing, water storage, the use of shallow wells and other unconventional sources. This section presents the community coping strategies.

5.2.1 Water Rationing

In the context of George, water rationing implies allocating water to the most important uses and ensuring that each household use for the water gets the bare minimum quantity to support it. Acknowledging that the water that is available and accessible to them is not sufficient in most instances, the residents apply a strategy of rationing their water use in several ways. Firstly, one of the strategies the residents employ is bathing less or not bathing at all in some instances where they have entirely no water access for even a day. In such times, bathing is considered a luxury. This act is in the spirit of saving the little water that they have for more urgent needs. The water that should,

in any case, be used for bathing can instead be used for some other use such as drinking or cooking, which is a much bigger need. Bathing is therefore suspended and limited only to the face.

Moreover, washing dishes and doing the laundry is also held off until such a time as there is extra water for use. When they wash the dishes. The water is not thrown away but repeatedly used so that only a little clean water is used to do a final rinse. Although this is not a daily occurrence, the rationing of water is normal practice as the residents have apportioned a certain number of buckets to be used for a particular purpose in the house to stay within the planned water usage and to see to it that one particular use does not suffer. For instance, some allocate two buckets of water for bathing, and everyone in the household must share the two buckets and not go beyond because this could mean using water that is intended for drinking and cooking. Lastly, the residents of George (8% of the research participants) that have space for gardens indicated that they had suspended gardening due to water supply challenges. Instead, they cut out containers and shake-shake boxes where they plant a few vegetables for their nutritional needs as advised by the community-based Non-Governmental Organization that works within George, and these plants can be watered using the wastewater from the house. In this way, they save the water for much more pressing needs. Otherwise, owning a garden is deemed unnecessary and a waste of water because of the prevailing water situation.

> *"Sometimes we do not bath to save water but each use at least a cup to wash our faces and brush our teeth so that at least we look clean until the next time we have a lot of water".*
>
> *(Interview: Mr Tembo (George Resident) 16th July, 2019)*

> *"We ration the water we store by not doing the laundry until we draw some more water so that we can save it. It is a difficult situation".*
>
> *(Interview: Margaret Njobvu (George resident) 8th July, 2019)*

5.2.2 Collecting rainwater as a survival strategy (Rainwater harvesting)

In the rainy season, forty percent (40%) of the community respondents indicated that they always collect rainwater from the roofs to supplement the allowable amount of water they fetch while eight (8%) of the residents interviewed stated they do not collect rainwater at all. Fifty-two percent (52%) said that that they occasionally use rain water but only for non-consumptive purposes such as bathing, washing the dishes, doing the laundry and cleaning the toilets because it is dirty. This is due to the dust that settles on the roof and the garbage that's thrown on roofs at night. However, some residents stated that they wait for the rains to wash the roofing sheets before putting buckets to trap that water. One resident mentioned that rainwater is like "mineral water", meaning it is pure as long as it is left to settle and the settled water is collected and safely stored for drinking.

> *"30 ZMW is difficult to come by and pay for water; that is why during the rainy season, we harvest rainwater from the roof to supplement our water needs. We collect the rainwater*

before it touches the ground. We let it settle, filter it and put chlorine. Then we use it for drinking and bathing. It is equivalent to mineral water because the taste is so good and makes the skin smooth".

(Interview: Ruth Shawa (George resident) 7th July 2019)

5.2.3 Use of shallow wells and other unconventional water sources

To supplement their water use, the residents of George turn to use the shallow wells for their water. During the cholera outbreak of 2017, George was flagged a health concern area because of the numerous recorded cholera cases. It was established that the several cases resulted from the consumption of polluted underground water caused by the proximity of the pit latrines to the water sources, more specifically, the shallow wells. This then prompted the government through the local authorities to bury all shallow wells in the settlement. Despite the shallow wells being buried during the cholera outbreak of 2017, some residents have re-dug the wells and are still using them to draw water for their uses.

Others have dug new wells, which they try to conceal from the authorities. Some residents were observed drawing water from the shallow wells despite being visibly dirty. They attested that the shallow well water was dirty and had a bad smell because of the pit latrines just a few metres away. Some research participants indicated that they draw water from the shallow wells because they have no choice. The wells were buried, but they only received relief water during the time of the outbreak. After that, they had no water again hence the re-digging of the wells. The Muslim community within George settlement offers water services from the borehole at the Mosque to those unable to pay for water and rely solely on underground water. However, even this water is contaminated because the residents say it smells. Regardless of this fact, there are still long queues because water is free.

As water is used for running economic activities, there are many residents within the settlement that have businesses that require lots of water, such as the brewing of *Kachasu*, an illicit alcohol. The illicit drink is brewed in 200 litre drums, and clearly, a lot of water is used for the process. However, the source of water for brewing this illicit alcohol is the shallow wells because it is free, there is no need to pay for it. In this way, the only burden they incur is that of drawing water from a distance. Overall, over seventy percent (70%) of the residents use shallow wells because firstly they are free, and are also the only source for those who cannot afford to buy water and wish to maximize profit on their business. They thus supplement their water sources and have unlimited access.

George residents make use of any available water for their use. These range from fetching water from damaged pipes to drawing water from incompletely dug and unused pit latrines and places with water naturally seeping to the surface from the ground.

Figure 5: Women and girls tap water from a broken pipe at the kiosk
Source: Field data, 2019

George being largely unplanned has a constant construction of houses and toilets, and it is a commonplace to find water when the foundation for a structure is being built, and it is such water that becomes useful for the households of George. Since George sits on a very high-water table, water is found within 2 metres or less of digging. Pit latrines are the common form of sanitation found in George. Often, when residents embark on building a pit latrine, they encounter underground water within 2 metres or less of digging. Residents are therefore encouraged by the owners of those digging the pit latrine to fetch as much water as possible from the site. This is in order to have the water levels in the prospective pit latrine, subside before they can resume digging it.

Residents find ways to collect this water if it is not within reach by tying a rope to a container and dropping that in the pit to draw their water. Occasionally, people accidentally damage water pipes as they dig foundations for their homes or as they dig pit latrines since the pipes are not placed deep into the ground or as firms dig to place certain services. This causes water to gush out and cause some localized flooding. In such instances, those residents who are inconvenienced by long distances of 4 kilometres or more or simply cannot afford to pay for water supplied by the utility companies gather around in large numbers and collect the water from the ground for mainly non-consumptive uses. Sometimes due to dilapidated infrastructure, water pipes tend to leak, and water collects at the point of leakage. When this water collects, people use cups and pots to collect water and store it in buckets and or containers for later use. The use of extreme and unusual sources of water is therefore commonplace in the settlement of George. This arises from the reality that piped water access which is perceived as the safest water source, is inadequately supplied to the settlement, the financial

incapability of some households to access it, and the distance and time factors attributed to collecting this water. These unusual sources are also supplementary to the water in George settlement.

> *"Last time we had a pipe that Zambia Electricity Supply Cooperation damaged as they were digging where to put the electricity poles."*
>
> *(Interview: (Ba Gladys, George resident) 20th July 2019)*

5.2.4 Water storage

The study found that the storage of water in buckets within the homes in George settlement is common. Each household ensures that they have water stored up in their homes in not less than ten 20 litre buckets, making it at least 200 litres of water in the event of "water blues". However, other homes store up to twenty 20litre buckets of water which translates to 400 litres of water because they state they would rather have a lot of water than not have any at all despite having small storage space in their houses. Anything that can hold water, such as dishes and bottles, is filled up to store water for the day. There will be no water running from the taps. Others store water in 200 litre drums and any other water storage buckets that are available.

Figure 6: Stored water in buckets at households
Source: Field data, 2019

Whereas ninety-five (95%) of residents store water inside their homes, five percent (5%) store their water in metal buckets outside. Whether there is enough water from the taps or not, the residents still store water. They never stay without water. However, the stored water can also be a source of poor-quality water, especially when the storage buckets are not thoroughly cleaned or water stays for a long time. When water is treated by boiling, it may be put in an un-sanitized container. Additionally, water contamination levels are quite high when water is stored in plastic buckets. It may be safe at the collection point, but one finds contaminants when the domestic water is examined.

"We always make sure that we have water in case we have erratic water supply and shortages. We currently have 25 buckets for water storage and just rotate the water by using the oldest first then refilling them".

(Interview: Esnaya Njobvu (George Resident) 27th July 2019)

"Despite having our standpipe within our yard, we store water in buckets in the house in case water doesn't flow for 2-3days".

(Interview: (Diana Nakazwe, George resident) 30th June 2019)

5.2.5 Vandalism

It was noted that some members of the community purposefully vandalize water pipes that are exposed to the surface to get the water that they need. When they do, many people gather around these places to fetch water because it's free. In addition, the residents that pay 30 ZMW are restricted to fetching five or fewer buckets to give a chance to everyone. This allows them to fetch more water for themselves. However, these broken and vandalized taps may take a long time to repair, causing a lot of water loss to the settlement through non-revenue water. The damage to water infrastructure causes more problems to the water supply to the settlement because each time this happens, the water kiosks run out of water or have little pressure contributing more to the water scarcity. Moreover, the costs of replacing the pipes can be high. Broken pipes also facilitate the pollution of water.

Figure 7: Residents draw water from a vandalized pipe
Source: Field Photo, 2019

"The leakage we have at a nearby tap has been there for many years and has not been fixed yet, and so the water collects at some point, and some residents have been getting water from there. I have heard that some people even drink the same water".

(Interview: Ms Nakazwe (George resident) 27th July 2019)

5.2.6 Water treatment

The research found that George residents are encouraged by the clinic staff from George's clinic to continuously treat their water regardless of the source of the water to protect themselves from waterborne diseases. This is because of the previous cholera outbreak that was experienced in the settlement. Despite the water supplied to the settlement being treated before it is pumped to the residents, the residents still boil and treat the same water with chlorine. Residents indicated that they are given solid chlorine with buckets and proper instruction on how to mix the solution before it is mixed with the water, and this is done on a daily basis. Diarrhoea is a commonly suffered disease in the settlement because of the bad quality of the water that is frequently collected from the shallow wells. The water treatment is, therefore in terms of chlorination and boiling of the water.

Figure 8: Powdered chlorine used by residents
Source: Field data, 2019

> *"Health workers from the clinic give us chlorine for treating our water and also educate us on how to use it so that we protect ourselves from water-borne diseases".*
>
> *(Interview: (Ms Gladys, George resident) 20th July 2019)*

> *"We are told that the water from the utility is chlorinated and indeed sometimes we smell the chlorine but we still chlorinate just in case they didn't do so at the source".*
>
> *(Interview: (Loveness Sibanda, George resident) 4th August 2019)*

5.2.7 Hunting for water from neighbouring settlements

During the rainy season, the floodwaters mix with overflowing pit latrines and flow into the shallow wells that other people depend on, contaminating them. Additionally, some residents and key informants indicated that during the drier seasons (between October and November), water levels are low. As a result, the residents survive by traveling to far off places such as the industrial area and

Matero, a neighbouring settlement that lies about two to three kilometres away from George settlement to fetch their water. No mobile water sources exist in George except during the time of cholera outbreak when the Disaster Management and Mitigation Unit (DMMU) offers relief water. Whereas, Matero is where over seventy percent (70%) of the residents collect their water because they are assured of finding it, they also go as far as the industrial area in dire situations. Residents cover long distances of up to three kilometres to access water. The households complain of spending too much time to access water, a thing that works against them in terms of safety and time. Additionally, the responsibility of fetching water falls to the women and girls as it is deemed their responsibility.

> *"Sometimes when we have water shortages, we keep our ear to the ground and wait to hear from people which areas have water, and that's where we go. Occasionally even when we rush there, we may find that water has stopped flowing and we go may go a day".*
>
> *(Interview: Anonymous (George resident) 30th June 2019)*

5.2.8 Relocations

The localized flooding experienced annually in certain parts of George prompts some of the inhabitants in the particular area experiencing floods to move away from the said area. Specific households essentially flood from within in that water seeps in from the ground, consequently filling the houses with water. In the rainy season, the situation is worse because much water gushes into the house with force. This compels people to relocate to other areas. Additionally, certain areas are relatively lower than others, so they flood and restrict people's movements. This again prompts people to relocate to other areas. Some houses to that effect are unoccupied. The effects of the localized flooding comprise the sinking of some houses and a constant dump environment which causes the occupants of the houses to seek alternative shelter and relocate to higher ground.

5.2.9 Coping strategies for flooding

Urban flooding and water insecurity are directly linked. Urban flooding affects water supply infrastructure, quality of water drawn from shallow wells and people's access to water from kiosks. The Fractal project (2018) establishes that urban flooding in informal settlements reduces the quality of both ground and surface water for Lusaka. This section analyses how people cope with frequent flooding as a means of adaption in George settlement.

To respond to incidences of water insecurity such as floods, George residents build a course of blocks at their doorsteps to create a barricade that stops floodwaters from flowing into the houses because when this happens, household goods are destroyed, and some cases of electrocution have been reported. Furthermore, the ground is raised in places that occasionally flood by putting blocks and

rocks in sunken places to avoid the rainwater from collecting. In visibly low lying areas, sandbags are utilized to block the flow of rainwater surface runoff into the homes. The empty mealie meal and cement sacks are either bought or sourced from neighbours. After that the sacks are filled with sand obtained from surrounding areas and piled on top of each other in the area that has the fastest runoff from higher ground, thereby blocking the water from heading in the direction of the house. In instances where water does flow into the houses, buckets are used to bail the water. Additionally, sweeping water from the plots to make sure it flows away and just reducing the collected water is also widely practised. On the other hand, residents dig small trenches to channel water away from their dwelling places.

Figure 9: Raised doorstep used to prevent flooding water
Source: Field data, 2019

5.2.10 External aid

When there are severe cases of water scarcity, as was the case during the cholera outbreak of 2017-2018, Lusaka Water Supply and Sanitation Company works with other stakeholders such as the DMMU, the Lusaka City Council and the LCC Public Health department. They thus intervene by providing water bowsers, free water as backstop measures besides hyper chlorinating the water to get rid of contaminants. Quality concerns are normally addressed post-flooding. However, this reduces the amount of water that each household gets, and there are conflicts among the residents over this free water.

5.3 Planning and water insecurity

5.3.0 Introduction

This section presents findings on the role of planning in ensuring water security in the settlement of George. George is an unplanned settlement with haphazardly built infrastructure and little space for the construction of roads and drainages.

Furthermore, no development control is exercised in the settlement as residents build without planning permission and further do not require approval from the council. Asked whether the local authority has any presence in the settlement, ninety percent (90%) of the research participants stated that the local authorities are nonexistent and only come to collect garbage occasionally. Further, when asked about what considerations are put into planning for water security, all research participants stated that they do not consider any matters of water insecurity as they plan to or build their houses hence the collapse of houses and the firefighting measures that are employed

Infrastructure in the settlement is vulnerable to vandalism and flooding shocks. Non-standardized drainages and roads quickly get deteriorated because they are improperly constructed with poor workmanship. Additionally, water pipes that are exposed to the surface are vulnerable to vandalism attacks. If this critical infrastructure fails, there are failures in the other systems as well. Vulnerability in the water system can lead to severe economic loss through the replacement and rehabilitation of infrastructure.

Despite over ninety–five (95%) of the plots and houses being numbered, which would imply that the plots are recognized by the council and ministry of lands, there is no planning that takes place and waste is not collected. Residents take reports about various issues that include waste collection, vandalized and leaking pipes to the local authorities, but there has been no response concerning the matter. In addition, when residents of George have incidences of floods, they do not receive aid from anyone. Instead, they depend on one another to cope with these incidences. Sometimes the residents just have to wait until the water comes. The respondents stated that Lusaka Water Supply and Sanitation Company (LWSC) do not quickly attend to broken or vandalized taps. This consequently affects the waiting time of residents as they fetch their water because the number of taps that become available for dispensing water reduces despite the number of residents using the particular kiosks remaining unchanged. The system has been structured so that each resident who pays a monthly fee of 30 ZMW is allocated a particular tap, and they cannot draw from another. However, only a few kiosks have all four taps functioning. Most kiosks have only two out of four taps working.

Figure 10: Non-functional water kiosk in the settlement
Source: Field data, 2019

In the case of George settlement, some kiosks that were set up by the Cooperative for Assistance and Relief Everywhere (CARE) and World Vision during the upgrading of the settlement are currently non-functional and have not been providing water to the settlement, thereby further increasing the queues and time spent by individuals to access the water. There is no concrete plan by the local authorities to collect garbage, which contributes to flooding in the settlement. All the community research participants stated that the council had a deliberate policy to collect garbage in the previous years and later engaged a private company to collect garbage in the settlement. Given the nature of the built-up environment, it was and still is difficult for a garbage truck to manoeuvre the settlement to collect waste and therefore, people have to take their trash to the roadside. Also, the settlement has no drainages that can channel water away from the settlement during the rainy season. Therefore, this contributes to the floods that are experienced in the settlement. About the aspect of water insecurity, most of the residents, over ninety percent (90%) stated that they would be water-secure if each of them had individual standpipes stationed at their homes and if the construction of drainages within the settlement could be facilitated.

The population of George has been increasing. Hitherto, the number of standpipes, has not increased to meet the population and the 393 standpipes initially set up in the settlement have remained the same. The capacity of the water infrastructure so far has not been expanded. Planning with the community is an aspect whose importance cannot be overemphasized. Planning for incidences of water insecurity with the community using sensitization can go miles towards achieving a resilient

and sustainable water sector. The community needs to understand water insecurity using examples and experiences that they can easily connect with. When they buy-in and have a sense of belonging, any interventions are likely to succeed. Some residents complained that they are not consulted over any such matters, and most times, they only see changes occurring without their prior knowledge. The planning for water in George, which houses a substantial urban population has not precisely met the water needs of the population.

Despite the settlement being legalized and declared an improvement area in 1976 (Mulimba, 2007), minimal upgrading has been done in terms of water security. The main road has been upgraded to a four-lane but with inadequate supporting infrastructure such as drainages.

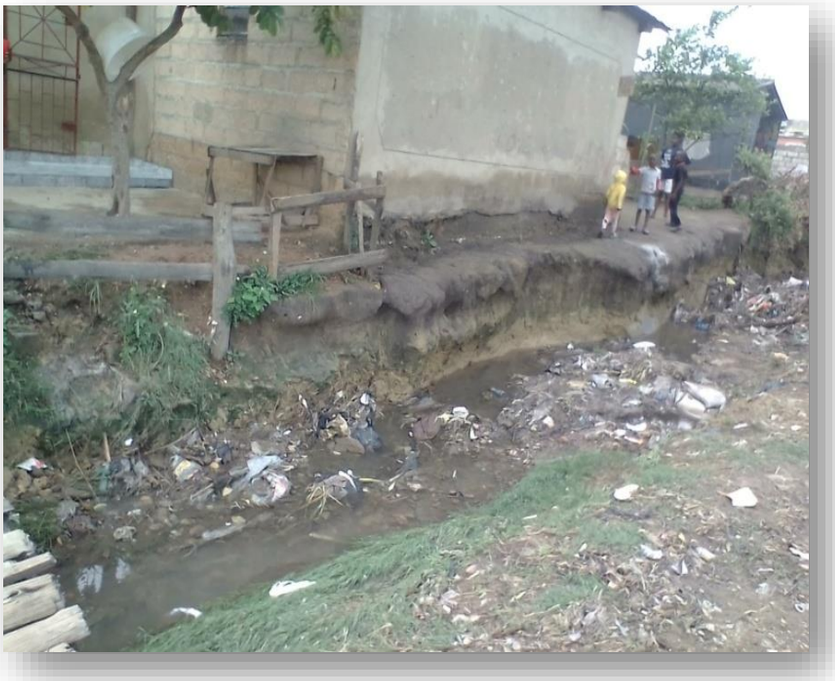

Figure 11: Drainage infrastructure in George settlement
Source: Field data, 2019

The concept of kiosks was introduced in 1993 to cater for the population of George. first installations were in 1993 by Care International. However, the number of communal taps remains the same despite the growing population. The upgrading of the slums should have ideally improved basic services such as water and sanitation, but it has not been done. However, the local authority under the public health department has embarked on a water security program through the Lusaka sanitation program because contamination of water is transpiring as a result of faecal matter. By improving the latrines therefore, water insecurity will be curbed.

> *"Government must ensure that they prioritize providing water like through kiosks and have a proper water reticulation system besides providing tap stands".*

(Interview: Mr Chikuta (Key informant, PPHPZ) 09th August 2019)

> *The way George is planned affects water security because sometimes a houses are built on water pipes. Therefore, when people are building, a pipe can burst and that creates a disaster which affects those who stay near as they have to move away from the usual place they fetch water from".*

(Interview: John Mukendi (George resident) 5th August 2019)

5.4 Conclusion

Water insecurity in the informal settlement of George manifests in so many ways that range from quality, quantity, distance, and climatic factors. In the face of looming water insecurity, the residents of George have developed various ways of surviving the harsh conditions. Notable of these are those that have to do with demand water use management such as water rationing, water storage, rainwater trapping and using shallow wells and other unconventional water sources. It is clear that this is not only a local issue but is a global one hence the recognition of planning for water security as an essential aspect. Planning ought to be reactive to the needs of the community, and so far, very little has been done to that end despite the legal status of the settlement. Residents and technocrats reviewed that planning or the lack of it can contribute to whether or not water insecurity can continue. The next chapter discusses the research findings in George settlement.

CHAPTER SIX: INTERPRETATION AND DISCUSSION OF FINDINGS

6.0 Introduction

The issue of water insecurity is a globally recognized development challenge. Water insecurity is a major urban development issue, and its implications for sustainable urban development are worse in Global South urban contexts. Existing literature discusses the concept of urban water insecurity based on universal (global) policy standards and propositions. In most cases, existing discourses of water insecurity lack insertion in lived realities of diverse urban contexts. The chapter relates literature debates and concepts with the empirical materials from the case study in George settlement. The remainder of this chapter is structured as follows: section two discusses the factors that structure and characterize water insecurity for people in informal settlements. The third section will be used to discuss and analyze coping strategies that the residents of informal settlements employ. The fourth section will analyse the role of city planning in achieving resilience in the water sector in Southern cities. In the last section, final reflections on the concepts and ideas in urban water insecurity will be given, and the next chapter on conclusions and recommendations will be introduced.

6.1 Countering urban survivalism: Daily encounters with water insecurity in African cities

There is a tendency for urban planning and urban studies to focus on urban development issues based on universal standards. Harrison (2006) refers to the assumed supremacy of Western urban intellectual tradition. However, there is a need to focus on the value-based traditions of the non-Occidental in urban analysis and city planning, the need to dismiss the Occident and the Orient in urban thought and consider African and Southern cities as independent spaces in need of independent analysis and reformation processes. How African cities are interpreted and planned should be based on empirical evidence, the everyday urbanisms of water. Thus, drawing on specific cases such as George becomes very crucial for new urban and planning insights.

6.1.1 Water accessibility: Perspectives on distance and quantity

The study reveals that water access is characterized by difficulties in daily access to potable water due to long distances covered to access the water. This is akin to Habiba et al. ‘s (2013) view that water access is described by distances that are covered in accessing water and the waiting time as well as transportation and storage. This takes into account two key aspects of accessibility which are, the quantity of water available in the domestic environment and the distance to the water point. Similarly, the findings are akin to Nounkeu et al.’s (2019) views on water access, that long distances to a water source that is more than 1000 metres results in poor access. This resonates with the findings in George. This distance has a negative bearing on elderly women, adult women, and girls who are responsible for the fetching of water, causing back problems given the number of trips that are made. This potentially prompts households to use nearer sources that may be unsafe and put their health at

risk. Informal settlements of the global south widely experience this problem. Understanding the distance variable helps ensure that the water access points are placed in reasonable space considering the distances that need to have covered by households.

Additionally, in line with studies done in India, walking long distances take up a lot of time for both walking and waiting time of over 15 minutes. Adams (2018) and UN Habitat (2007) similarly note that waiting times at the kiosk constitute water access. Therefore, there are water insecurity issues where households typically wait long hours in queues as they await their turn to fetch water. Similarly, Nayebare et al. (2014) and Adams (2015), in Malawi, note that long hours can have a bearing on individual livelihoods and businesses on which many depend to sustain their everyday needs as a considerable amount of time is devoted to this daunting task, leaving other equally essential tasks unattended to. Similar to a study on water issues in the urban slums of Kenya by Nygren et al. (2016), the findings equally show that the burden of fetching water falls on the women and girls, thereby affecting their socio and academic development. Therefore, the water insecurity variable of access is closely related to distance and time spent to collect water for a particular day.

The findings indicate that the amount of water that is collected is affected by the above-discussed factors. This is in line with the writings of Nygren et al. (2016), who argue that households with travel times more significant than 30 minutes have been shown to collect increasingly less water. Water access is poor in that it is not satisfactory in meeting the water needs of the residents, as evidenced by the lack of potable pipes (materials used for potable water supply) for drawing water. This is akin to Muller's (2016) views that water supply access in informal settlements is grossly inadequate, especially with the lack of potable pipes within the households. In line with Connor's (2015) argument, this limited access to water also means that people have to prioritize or choose between paying for water, food, schools, food or medicines, which could be a rather difficult thing to do.

Similarly, India indicates cases of inadequate water due to the distance and time taken that eventually causes households to be unable to draw adequate amounts of water compared to those with access to water in a nearby location. These circumstances signal the difficulties faced in accessing potable water as they are a daily occurrence, and they resonate with the writings of Calow (2010). The latter argue that water accessibility is an essential factor in determining water insecurity. Water use limitations set by the utility charged with the responsibility to provide water to the settlement additionally imply that accessing water at any other time, even for emergencies, would be impossible. This ultimately leads to drawing water from unsafe sources, which has other negative implications, such as water-borne diseases. This is in line with studies in Canada that revealed restricted access to

a sufficient quantity of desirable clean water despite the existence of a municipal water system (Goldhar et al., 2013).

6.1.2 Water infrastructure as a lifeline: Seeing through water kiosks

Water infrastructure is the lifeline for water services in urban settlements (Habibian and Minaie, 2018). Informal settlements are particularly in need of essential infrastructure to guarantee clean water supply to the disfranchised masses. The study reveals communal water kiosks as a critical piece of infrastructure for the supply of water with a high dependency ratio from the community, implying the inadequate water distribution systems and water points available to serve the community as a whole. In line with the findings of a study done in Malawi, Adams (2018) argues that water kiosks often are insufficient and have high non-functional rates and therefore provide water irregularity. Following Grey and Sadoff's (2007) argument, most countries that have not attained water security face difficulties because they lack infrastructure stocks with which to manage and deliver water, signaling the importance of infrastructure for water insecurity in urban slums in most Southern cities. Having one trusted source of potable water supply indicates vulnerabilities for water infrastructure failure and triggering of crises.

A kiosk symbolizes water, life and less suffering in slums, as evidenced by the long queues at all the water kiosks that have consequently increased the ratios of people per kiosk. Failure of a kiosk in places like George implies mass water shortages in times of infrastructural failure that could compel the local populations to seek solace in unsafe sources and breed health crises (Graham, 2010). While the findings reveal that the increased number of households and population has increased ratios at the kiosks stirring the need for increased water infrastructural capacity in the settlement, a study done in Kenya’s Rongai settlement illustrates different result. It illustrates that the water kiosks that were set up remarkably changed the living standards of the settlement by reducing the distance that people had to walk to fetch water, reduction of waterborne disease incidences and reduced pressure on their household income as a result of low cost. Thus, George water infrastructure narratives point to the need for both infrastructure delivery and for appropriate water infrastructure management protocols that resonate with the way of life in given contexts.

The examination of other studies and that of George, therefore, reveal that water kiosks may offer some form of relief when it comes to water, but in the event of infrastructure failure, the kiosks become unreliable, offering dirty water and insufficient flow to cater for the settlement needs. To be helpful, there is a need to increase the number of kiosks putting into consideration the populations that are present in the locality. While this may be a panacea for some settlements, it is quite clear that not all settlements can respond to this due to the different morphology of the settlement.

Municipalities' water management in many urban spaces is structured to provide water for a certain number of hours, which prompts survival measures.

6.1.3 When quantity means more than a number: Water Supply Versus Demand

Findings reveal that the quantities of water allowable per household, which is 200 litres per household or firm per day, is grossly inadequate to cater for the needs and various uses that include washing, bathing, cooking, cleaning and drinking, and income-generating ventures such as beer brewing, restaurants, among several other water needs in George. This mirrors Norin's (2011) argument that water insecurity is the lack of sufficient water to meet all requisite needs implying that quantity is an aspect of water security. While stipulated standards by the WHO and United Nations require that individuals need 20-50 litres for their basic needs, the findings in George indicate otherwise as the quantities accessed indicate inadequate water quantities for the sustenance of good health and livelihoods. This is akin to Moe and Rheingans's (2006) argument that adequate hygiene is impossible without enough water arising in waterborne disease. Similarly, Bakker and Kappen (1999) argue that low water quantity leads to low water quality, thereby pointing out the value of having access to adequate amounts of water.

Findings indicate the need for a minimum of at least 300-400 litres of water per household for daily use, although further probing points to the reality of water rationing. Inadequate quantities of water further imply negative effects on the health of girls and women that ideally need more water for their daily health and hygiene (Webb and Ishkardani, 1998). The study establishes that inadequate water forces women to resort to alternative water sources that are often unsafe. The research participants stated that the 200 litres of water they are allowed to fetch in a day falls far short of what is needed and accessible in George. However, it should be noted that the allowable quantity of water in George is in line with the recommendations by the World Health Organization (WHO) as localized by NWASCO. This simply shows the disparity between local water needs and contexts and global standards as they get to be blindly applied in Southern urban contexts. International water standards typically fail to make good impact in guiding water interventions in informal settlements because local contexts in the global South cities differ radically from those in global North cities.

The problem of insufficient water quantities in informal settlements of global south cities is commonplace. In Bolivia, for instance, Hadley and Wutich (2009) argue that elderly women use up to 10 litres per person per week of water for bathing, which essentially translates to 700 millilitres of water, an amount that is not enough for personal hygiene. More water is needed for general health and hygiene purposes. This indicates the difficulties that settlements in other Global South regions also face concerning water insecurity. In line with the findings, Petersen-Perlman et al. (2012) argue that the right quantities of water constitute water security; therefore, ensuring that individuals have

enough quantities of water for their needs would curb matters of water insecurity. However, this also entails that water quantities need to be standardized for all households.

6.1.4 Questionable water quality in water crisis environments

Informal settlements typically experience a water crisis in Africa (Adams, 2018) India, Malawi, Zimbabwe, etc. Gulyani et al. (2005) further state that informal settlements in countries such as Cote d'Ivoire, Nigeria, Ghana, Malawi, Senegal, Tanzania, and Mali share a common problem of inadequate access to safe water. The study findings reveal questionable water quality from sources such as shallow wells, rooftop rainwater, and water tapped from holes dug in the ground. Also, questionable quality from water that collects in places where water pipes have been vandalized as it contains foreign substances. This is akin to Mendel's (2006) findings that the water from shallow wells is often of reduced quality, making it unsuitable for consumption. Rainwater is often collected as water flows from the rooftop, which is a norm in George. It harbors dirt and waste like diapers hence tainting the water collected. Although respondents claimed that this water is used for non-consumptive uses such as cleaning, washing dishes and laundry, some drink the same water as a respondent was observed drinking water directly. This entails that the quality of the water is compromised because clean and good quality water must ideally be clear and free of foreign substances.

6.1.5 Flooding as a manifestation of water insecurity in informal settlements

Floods are a manifestation of water insecurity for people in slums, and similar to a study done by Webb and Ishkardani (1998), floods are one of the most significant issues and drivers of water insecurity in the settlement of George. Floods happen due to the urban form, limited infrastructures such as roads and drainages, consistent with the arguments of Peloso and Morinville (2014) and Nchito (2007). Additionally, in line with Douglas et al., (2008) and Thapliyah (2011), flood potential increases with altered rainfall patterns that lead to flash floods.

Findings suggest that water insecurity is attributed to flooding as floodwaters carry dirt and pollute water sources, such as the shallow wells. Mendel (2006) supports this view by arguing that floodwaters are capable of carrying all sorts of organic waste into homes as well as water sources, especially shallow wells, thus causing reduced water quality, making it unsuitable for consumption and further reducing the amount of potable drinking water. The effects of this include diarrhoea and skin diseases which are a common phenomenon in the settlement. Floods not only cause a shortage of clean water but also cause houses that have been poorly built to collapse. Akin to studies done in Burma and Beijing, the shortage of clean water leads to an aspect of water scarcity as both surfaces, and underground water sources get polluted and are capable of causing a substantial health impact on the residents due to its effects on freshwater sources (Sun et al., 2016). The study has revealed

that these health impacts, such as water-borne diseases, are prevalent in informal settlements such as George.

Standard drainage and road infrastructure and the appropriate siting of housing infrastructure in space are thus cardinal for securing the water sources and must, therefore, be given due attention. The studies from around the globe prove that floods are a driving force of water insecurity, and this realization stirs up the need for action-oriented research and ideas that can ensure that the issues of flooding in informal settlements are adequately addressed.

6.1.6 Walking long distances for water- breaching standards

Findings highlight distance as a critical determinant of water insecurity. Consistent with the study done in Malawi, Adams (2018) argues that water insecurity results from longer distances taken to walk to sources of potable water. Similarly, in a study done in Ethiopia, it was determined that distance plays a huge role in water insecurity as people have to walk very long distances to access their water with round trips of over an hour, especially in the dry season (Stevenson et al., 2012). In their drinking water guidelines, the WHO considers drinking water sources that lie more than 30 minutes away as inaccessible. This is the case for most residents of the settlement under study and the detail is exacerbated by the limited hours of supply.

In line with Ribeiro's (2015) argument, water use varies with distance from the water source in that people that are nearer to water sources use more water than those that live further from the water source. Contrary to the Zambia Water Act's consideration of nearby sources lying within walking distance of 500 metres, households may walk up to six times this distance, covering up to 3 kilometres signaling a weak water supply system. Long distances and repeated trips imply sicknesses, strain, reduced quantities of water, and excessive loss of time that has huge opportunity costs for the entire nation as valuable time is lost to securing water.

6.1.7 Energy-Water security nexus

While water plays an essential role in producing energy through the generation of hydroelectricity and its function in cooling power systems, energy, on the other hand, is critical for the supply of water to consumers. Findings indicate that water and power supply are intricately linked. This is akin to the studies by the UN-Water (2013) and Hamiche et al. (2016); which indicate that water and energy are highly interlinked and necessary in supporting the transportation and availability of each other. Findings reveal that water provision is affected by Hydro-Electric Power (HEP). When there are power cuts (load shedding), pumps shut down and cannot pump water from the utility boreholes to the tanks that store water for the settlement. The power shortages on the other hand are mainly due to the drop in water levels, that are used to turn turbines and produce hydroelectricity, implying that

climate variability and climate change threaten water sources through droughts (Thapliyal, 2011; Calow et al., 2010).

6.2 Survivalist (coping) strategies towards water insecurity

This section presents the findings of the study analyzed against the reviewed literature. It thus discusses the coping strategies to water insecurity with particular reference to global south cities.

6.2.1 Water storage practices and implications on water security

One of the coping strategies established by the study in George is the storage of water for later use, which resonates with Pasakhala et al.'s (2013) findings for a study done on households in Kathmandu valley, Nepal. This study established that water storage was a common tactic practised among households that had shorter periods of piped water provided to them. Similarly, in George settlement, the 3 hours of water supply provided to the settlement tend to prompt households to store up water for later use during the day and when kiosks are dry. Storing of water implies having numerous storage containers and buckets, anything available that can hold water. Households have to ensure that all containers are filled until such a time that they will have access to water. However, the effect of this is often that, water may be stored for a long time and thereby reduce the quality of the stored water (Knight et al., 1992).

Additionally, as highlighted in the study of Nepal, households tended to have a larger number of water supply sources to cope with water shortages and were unable to store enough water. However, studies show that inadequate storage conditions and vulnerable water storage containers such as pots and buckets contribute to increasing microbial contamination and decreased microbial quality compared to either sources of water or water stored in improved vessels (Pandey, 2021; Gartner et al., 2021). This has been documented in studies done in the slums of Africa such as Abidjan, Corte d'Ivoire, Malawi, and Bangladesh and therefore calls for safe household water-storing techniques to evade potential waterborne diseases. While similarities in the cases of George and Kathamandu in Nepal exist, the households in George did not practice other strategies like large water storage tanks and water-efficient retrofit, which proved to be statistically significant with those from Kathmandu. Instead, residents of George just stored water in buckets and drums as it is the form of water storage common and affordable to everyone. This implies constant low quantities and reduced quality of stored water. Exploring larger storage tanks would thus be a solution worth exploring in informal settlements experiencing water insecurity.

6.2.2 Alternative water sources for urban water crisis communities

The study's findings indicate that significant numbers widely supplement their daily water with alternative sources because the water is inadequate. This is consistent with a study done in

Cochabamba Bolivia, an area affected by high levels of water scarcity. Hadley and Wutich (2009;454) argue that, due to lack of sufficient water, "households find alternative water sources such as rainwater, surface water, groundwater wells and private vendors to acquire water for drinking, cooking, bathing and cleaning". The piped water provided to the settlement is not able to fully satisfy the population's water demands which lie beyond what is provided daily. Alternative sources that vary from shallow wells, rainwater harvesting, and vandalism are utilized to supplement the water supply gap and are also free and easily accessible. This is akin to a study conducted in Kazakhstan, where Omarova et al., (2019) advance that an additional rationale for using alternative sources is the availability of cheaper or free sources.

Further, the study's findings indicate that there has been very little input by the government to improve the water situation, which prompts them to seek alternative sources. As one participant claimed, assistance in matters of water insecurity comes through only in instances of cholera outbreaks. This resonates with Pasakhala et al.'s (2013) study in Nepal, where they state that government efforts to address water scarcity are often insufficient therefore making it necessary for households to engage adequate coping measures. These measures include unusual water sources such as breaking pipes, harvesting water from the shallow holes near toilets and rainwater harvesting among others. However, whereas the water collected from some alternative sources may cushion the water needs, the quality of the water is compromised by the dirt that is present and visible in sources such as shallow wells, an indication of the poor quality of water. This dirty water may produce a smell, taste badly when consumed, and potentially contain harmful substances and bacteria.

6.2.3 Vandalism: The atypical coping strategy

The insufficient and limited access to water in the settlement occasionally prompts some members of the settlement to resort to vandalism of water pipes as a way of obtaining water. As discussed by Grey and Sadoff (2007), vandalism events contribute to water insecurity. Adams (2018), in a study done in Malawi, argues that water kiosks are prone to vandalism.

According to the LWSC and Water and Sanitation for the Urban Poor (WSUP) reports, vandalism, in the form of water theft, leads to a direct loss of revenue for the utility through Non-Revenue water and indeed undermines their financial viability by increasing the maintenance and repair costs. This hinders possible water security as infrastructure requires a constant replacement. Furthermore, the users are affected as the amount of water provided to the settlement is reduced due to the frequent service interruptions. NWASCO documents over fifty percent (50%) of non-revenue water, which is water unaccounted for in the sector. This implies that a deeper understanding of non-revenue water in Global South cities needs to be based on people's daily encounters with urban waterscapes in informal settlements. The findings from George show that non-revenue water is not just a function

of ageing infrastructure, but additionally a combination of anger and survival ways of water-stressed individuals.

The heavy reliance of over eighty percent (80%) of research participants on unconventional sources of water as a daily practice implies that there is indeed a shortage of water supplied to the settlement. Akin to the findings in George, Omarova (2019) argues that one of the reasons people look for alternative sources is the scheduled water supply. Other case studies on the Copperbelt indicated that this was necessitated by the need to access safe water, financial incapability, easily visible pipes, ignorance on the importance of securing water infrastructure and losses incurred and sensitization. This could indicate the gap in communication between the water utility and the residents and could mean the utility does not pay much attention to the plight or criticisms of the residents regarding the importance of keeping their water infrastructure guarded. Effects of vandalism include increased Non-Revenue Water (NRW) and reduced customer satisfaction. Thus, this means a need for cooperation between the utility and the residents as both are affected in the process. Increased NRW means reduced water supply, reduced hygiene and sanitation, disease and death (Andy et al., 2014).

6.2.4 Water rationing

As a survival strategy, extreme water rationing strategies are employed to curb matters of water insecurity. However, as in the case of Bulawayo, residents have to forego bathing to save water for the following day or other uses. In contrast, George residents divide the 200 litres of water amongst the most commonly mentioned uses. Such as drinking, cooking, bathing, and cleaning implying that 50 litres of water are allocated to each of the four uses for the whole family per day regardless of the household number. This shows that some other countries and settlements survive by using alternative means of water source and access. Similarly, cases in Nepal and Bulawayo indicate, water rationing is the norm in all big and small cities since cities cannot provide enough portable water for household consumption (Pandey et al., 2019).

6.2.5 Water Vending

Akin to the study's findings, water utilities in African cities fall short in providing adequate water services to populations (Olajuyigbe et al., 2012; Goldhar et al., 2013; Bayliss and Tukai, 2011). This contributes to the need to seek relief from water vendors, which in the context of the study area refers to any person who sells water in the settlement, mostly by those who own individual standpipes. A study done in Accra, Ghana shows that informal traders are widely used to cope with water insecurity circumstances and thus offer considerable solutions to the daily provision of water (Nyarko et al., 2008). While this may be the case in other African cities, informal water vendors in other places are not allowed as this may necessitate exploitation, water contamination and other health concerns due to the absence of proper guidelines (WHO, 2006). This, however, indicates that informal water

vendors can fill a gap in the water supply chain if managed or regulated, an option worth exploring in the informal settlements of African cities. This is additionally an indicator that the relationship between formal and informal networks are primary to water provision. Nonetheless, the practice of buying water from informal water vendors in George is somewhat pricey as compared to buying from the water utility's taps.

Nounkeu et al. (2019) and Hadley and Wutich (2009) advance a coping strategy that was alien to the study of George and that is borrowing water from neighbours and asking water vendors to give water using credit. This provides insight into other ways of coping with water insecurity but at the same time shows that strategies are not universal, and each space can adopt strategies according to the cultural makeup of an area. Once again, context is an essential aspect of dealing with matters of water insecurity.

6.2.6 Water treatment

Safe and reliable drinking water is essential for public health. Poor water quality is one important aspect of water security. The study's findings show that some of the water that is accessed is not safe for direct consumption and as such is treated to improve its quality. If not treated the water is likely to cause diarrhoeal diseases and impact the health of the households in the area. This is similar to studies done in India, where households treat their drinking water to deal with the quality aspect of water insecurity (UN-Water, 2007). Failure to treat water, particularly that from shallow wells that are sited just 2 metres away from the pit latrines offers possibilities of underground water contamination that would cause diarrhoeal diseases. This indicates the poor water quality accessed by households and the need for more robust water treatment methods. The implication of this is that, if not treated by means of boiling or chlorinating, the water can only be used for non-consumptive uses, which still means that households are short of water.

6.2.7 Unusual water sources (Unconventional water sources)

Additionally, water that collects at points of broken water pipes offers another form of water source, which is unlike any study found in the literature. However, this is a poor and somewhat dangerous coping tactic. This is in line with Nounkeu's (2019) argument that water insecurity is associated with poor coping behaviour as it can be a source of harmful disease-causing bacteria. The study reveals that some elderly residents who cannot walk long distances to draw water survive with help from neighbours and others in the community, suggesting the non-inclusiveness of water policies.

6.2.8 Coping with climate factors change (floods and droughts)

6.8.8.1 Coping with Floods driven by increased rainfall

The findings of the study are similar to studies undertaken in Nairobi (Owuor and Mwiturubani, 2021), where households survive flood incidences caused by the rains by bailing out water from their homes, constructing temporary drainages around the houses to channel water away from homes. This mechanism ensures that the underground water sources, which are shallow wells, are not contaminated with sediments. Apart from that, this mechanism ensures that structures that are not built according to buildings standards collapse. Consistent with Nchito's (2007) argument, the siting of infrastructure such as houses in informal settlements blocks water flow and causes floods.

Additionally, the insufficient drainage infrastructure contributes to the floods that occur in George. As noted by Nchito (2007), sandbags are used to create a barrier around the house to reduce the risk of flooding. These strategies are an indicator that the settlement could benefit from more physical planning that would put into effect drainages that are according to stipulated standards. This indicates that matters of flooding are not unique to George but to other urban slums around the world that need to be better planned for with better drainages and roads that can curb the occurrence of floods in the informal settlements of the Global South.

6.2.8.2 Coping with droughts- dry kiosks and shallow wells

Findings suggest that the levels of water insecurity in terms of scarcity increase during October, which in Zambia is the hottest month that records the highest temperatures of up to 31˚C. This is akin to Hadley and Wutich's (2009) study in Bolivia, arguing that water insecurity intensifies in the dry season. This affects some coping strategies, such as rainwater harvesting. After all, they are seasonal, implying that options for coping with water insecurity are decreased for most of the year.

Similar to the findings in George, households in Ethiopia as argued by search for water in areas with better supply to access water. Findings further point toward the use of multiple strategies to survive water crisis situations. This is similar to Parks et al., (2019) findings on Cape Town on residents resorting to water re-use strategies, use of gray water and water restrictions akin to the study of Cape Town.

6.3 The principle of planning before building in spatial planning – insights from George

This section discusses the findings on planning in George's settlement against the literature around water insecurity. George is one of the largest informal settlements in Lusaka and was initially a wetland that once was a source of clay and supported the brick-making business. George's settlement developed without any spatial planning (Rakodi, 1987). The workers that settled near the source of the clay slowly formed a settlement that kept expanding to form the settlement of George (PPHPZ:

2012). Therefore, many people have settled there due to the high levels of informal economic activity and because it was a working-class area with a great majority of its population working in the formal sector, mainly in the industrial areas (Schlyter, 1998).

During the national slum upgrading wave of the 1970s in Zambia, upgrading informal settlements was accepted in 1974 when Zambia finalized arrangements with the World Bank loan for the informal settlement upgrading project. The project aimed at providing services and improving housing for Lusaka's largest settlements, with George being one of them. Through the Housing Statutory and Housing Improvement Areas Act that was introduced in 1974, legislation and upgrading of informal settlements such as George was made possible without plots being formally surveyed and without houses being demolished and rebuilt according to building regulations as stated by Schlyter (1998). The area was thus legalized and declared an improved area by the government in the year 1976, meaning that development could now take place without fear of evictions or demolition. This was the beginning of the current Participatory Slum Upgrading Programme of the UN-Habitat (Source) as provided for in the URP Act of 2015.

Nchito (2007) argues that the siting of unplanned settlements is typically on low-lying land that is liable to flooding during the rainy season. Many parts of George flood every rainy season and this indicates the inadequate infrastructure that is present in the settlement in addition to the deplorable roads. Consistent with Peloso and Morinville (2014), drainage, roads and location of housing infrastructure may impede or facilitate water security, hence the need to have planning designs that hinge on improved and standardized water provision systems.

Aguilar and Lopez (2009) thus argue that one of the problems that the urban poor face concerning access to water is that they are systematically omitted from access to water as a result of, among other factors, public regulations that limit their access to water supply infrastructure. One may argue that the urban poor in slums seem invisible to the planning authorities, hence often omitted from the positive and transformative ambitious city planning forces. The slums are usually visible to opposing forces of evictions and demolitions as cities pursue consequential neo-liberal urban transformation agendas (Winkler, 2011). This type of omission perpetuates water insecurity challenges in Southern cities.

Tutu and Stoler (2016) highlight that chronic, intermittent water shortages in urban informal settlements lead to negative perceptions about the role of government while at the same time prompts dependence on alternative sources that may be unsafe and increase risks to the health of the communities. It is, therefore, the moral responsibility of the government to ensure that planning takes place through appropriate urban land use regulations and infrastructure delivery processes (Winkler,

2011). It is therefore imperative that the state guarantees access to water as it is a right and site settlements in areas that do not pose threats to underground water recharge areas and or aquifers. The findings of the study in George indicates that the increase in populations has significantly impacted the water access in the settlement. This is akin to Jacobsen et al. (2012)'s study in Kenya where failure to spatially organize (physically plan) the settlement, deliver water, and associated infrastructure contributed to a crippling water crisis for hundreds of thousands. Failure to plan and deliver adequate water infrastructure is one major cause of water scarcity in line with arguments by Grey and Sadoff (2007) and Nairizi (2017). They insist on the urgent need for integrated spatial planning and people-led settlement upgrading as ways of reducing water security vulnerabilities for over 1.7 million slum dwellers in the global South cities. The water narratives in George are very similar to those on Jakarta, Lima, and Nairobi, that water security dilemmas are due to limited reach of spatial planning and integrated infrastructure development urban planning. The George case signifies a lack of collaborative city planning among different key actors in the urban and water development sectors. It indicates the need to rethink the theory and practice of city planning in African cities (Watson and Odendaal, 2013).

6.4 Conclusion

This chapter has presented a discussion of the findings. The chapter has discussed the nature of water insecurity in informal settlements by unpacking the perspectives on distance, time and quantity, the questionable water quality, the water-energy nexus and how this affects water insecurity. The chapter further discusses the coping strategies deployed to survive instances of water insecurity.

The chapter advances coping strategies that vary from household, community to national water strategies and argues that both common coping strategies, as well as unusual practices, utilize approaches that include water rationing, water storage, the wide use of alternative sources of water such as shallow wells, rainwater harvesting, vandalism and the use of unusual sources. Lastly, the chapter has presented the aspect of planning before building nonexistent in the settlement and further establishes that city planning is necessary for water security. Informal settlements of the global south's physical availability of abundant water resources in the country do not guarantee populations have easy access to adequately clean and safe water but rather particularly require more strategic physical planning and increased and improved water infrastructure to make this possible.

With Zambia as a whole's yearly population change set at 2.93%[7] per year, the population increase has consequences on the demand for water and hence water insecurity. City Planning and water security are therefore intricately connected. The lack of drainages and roads infrastructure influence water security in that water is unable to be abstracted and distributed effectively to meet demand.

[7] https://www.worldometers.info/demographics/zambia-demographics/

Additionally, the settlement upgrading which fails to integrate water services cannot effectively contribute to attaining water security for the residents of George.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS

7.0 Introduction

Based on the entire process of the research, this chapter presents a summary of the series of debates concerning determinants of water insecurity in the informal settlement of George. The chapter provides an overview of the research processes, research findings and conceptual ideas on water insecurity in George. This chapter is divided into four sections, with the first section being the introduction. The second section presents the reflections on the research methodology used in this study. The third section provides commentary on the key research findings, whereas the fourth section provides recommendations for further work in the urban water sector and finally gives reflections on the chapter.

7.1 A reflection on key research findings

The research findings indicated that the widely used sources of water in the settlement include water kiosks provided by the Lusaka Water Supply and Sanitation Company, shallow wells, boreholes, individual taps, and informal water vendors and other unconventional sources. The findings further indicate that water kiosks are more utilized in the settlement seconded by water vending and, lastly, shallow wells. However, the water from shallow wells is dirty. It occasionally smells, indicating the compromised quality given the short distance between the water source and groundwater, polluting land use activities such as the pit latrines. This has contributed to the waterborne diseases and cholera outbreaks that have previously hit the settlement.

Further, none of the mentioned sources are used independently but is rather supplemented by various other sources, a situation that indicates the fragility of the water sector in this area and in Lusaka in general. This is further confirmed by households attesting to being better serviced with at least 300 to 400 litres of water. Despite new efforts and innovations in the settlement regarding the provision of water by the Lusaka Water Supply and Sanitation Company, the study concludes that water provision remains a significant development challenge for the settlement.

The study findings indicate that residents generally cover an average distance of about 100 metres to collect water from water kiosks, which according to the national standards, is within the acceptable distance of 500 metres to a water source. However, the inconsistent availability of water at the established sources, the kiosks, prompts households to walk further in the search for water, covering even longer distances of up to three kilometres and more. In addition, the waiting time in long queues at the water kiosks contributes to people spending a considerable amount of time that negatively impacts other socio-economic activities and forces them to choose between drawing water and going to work. The findings further indicate the inadequate water points within the settlement, and this leads to long queues. Forms of water infrastructure such as storage, supply and distributive in the

study has thus proven to be a source of poverty, inequality and a hindrance to effective implementation of slum upgrading efforts by Lusaka City Council and the Ministry of Local Government. George remains very poor and spatially disorganized, with George residents basically contending with the effects of water insecurity daily. Thus, it is correct to argue that water crisis is part of daily urban life in George settlement and NWASCO standards on water security fail to resonate with George's realities and guarantee zero security in the area. This shows the need to rethink the idea of replicating global urban development standards and parameters. The study invokes the need to seriously think about the concepts Harrison (2006) discussed on how to think and imagine social and spatial transformation in Southern cities.

7.2 Contending with daily water blues in George– A mixed bag of coping measures

Of the key coping strategies that the study highlights are water storage in numerous buckets to prepare for water blues or erratic water supply in the area. The settlement is allowed access to water every morning between 5 hours and 8 hours, and taps are then locked until the following day. Therefore, this implies that the residents only have access to water once a day for a limited number of hours. However, given that water is life and is needed throughout, the residents have to find ways to live their everyday life. This is what leads them to store water for use for the rest of the day. They need to draw water for a few minutes (200 litres within minutes), keep the water and use it for all water needs for a period not less than 24 hours. The stored water is constantly used for various purposes such as cooking, washing dishes, bathing and cleaning, all of which require constant supply of water. However, this has significant implications on the quality of stored water if not replaced within a particular timeframe. Findings indicate that all households, regardless of whether or not they have an individual standpipe, also own buckets and store water in their homes. This is so because the water supply in George is erratic and unreliable. Thus, findings reveal that water rationing is commonplace as a coping strategy in the settlement with extreme measures such as foregoing bathing in order to reserve water for more urgent uses. Laundry and washing of dishes are held off until there is enough water to use. Other survivalist strategies identified in the study include the use of shallow wells despite the realization by households that the quality of the water is poor, rainwater harvesting, which is seasonal, dependent on the rains. Unusual sources are also deployed in extreme cases. In instances of climatic pressures that cause floods, the households use a combination of strategies to cope. These include sandbags that are filled with sand or soil and used to block the flow of water into their homes and shallow wells. However, the method of sandbags is not entirely effective because shallow wells still get polluted with overflowing water and houses collapse or get filled with water that has to be bailed out using buckets. Raising doorsteps and digging small trenches to avert floodwaters are other strategies employed.

Despite George being considered an upgraded settlement, water services and water infrastructure quality shows a crisis-ridden water situation. Findings show that no new infrastructure has been set up since the upgrading by the World Bank to enhance water supply to the settlement and curb floods that are an aspect of water insecurity despite the settlement upgrading that has taken place in the settlement. This is also despite the fact that the population of George has increased to 130,000 according to the 2010 census. The standard of drainages and roads in the settlement are poor and unable to function accordingly, pointing to poor planning practices. Findings show that previous settlement re-planning and upgrading seem to have taken a narrow sectoral approach and ignored the need for an integrated approach. The study indicates that settlement upgrading in George has focused on land tenure alone and left issues of infrastructural services such as water unattended to. Siting of pit latrines is a major driver of water pollution and protection of water sources is not guaranteed by carefully selected sites of various and often competing land uses. Thus, planning seems to have failed to reshape the urban form and improve the water systems of George. This shows that sectoral approaches to settlement interventions cannot yield the desired future for the people living and working in slums. The settlement continues to suffer from various water shocks, whereas the urban water sector systems need to be resilient in order to survive the various shocks that are natural or human-induced. The study's findings confirm that, like various global south cities, the water sector in George is vulnerable to various shocks, which are climate, technological, human (vandalism) related and is therefore far from being resilient.

7.4 Recommendations

Based on the findings of the study, the following recommendations are given in order to address water insecurity in informal settlements.

i. The Lusaka City Council should effectively implement the Lusaka Slum Upgrading and Prevention Strategy- expand. The strategy involves improving the living and environmental conditions of the urban poor. Effective implementation will ensure that a holistic approach is taken and water systems, in particular, are given due attention.

ii. The Lusaka Water Supply and Sanitation Company needs to make huge investments in equal measure in various forms of water infrastructure (Production, Storage and distributive. While water infrastructure is acknowledged, infrastructural investment must cut across all forms. Production infrastructure must equal the storage and distributive infrastructure up to the consumer level in order to boost the supply of potable water.

iii. Through the National Water Supply and Sanitation Council, the government needs to establish decentralized water systems to catchment areas as recommended by Phasakhala et

al. (2013). While the centralized system has been in existence for years based on the need to safeguard human health and quality control, it is both expensive and can be easily affected by climate variability and infrastructural shocks. Decentralized systems characterized by the use of local resources and a multi-level governance system have been seen to enhance water security.

7.5 Areas for future research

There are several areas in need of further critical interrogation to ensure adequate and well-informed water insecurity response by stakeholders such as the state, utilities, regulators, households among others. Based on the findings on George, the following constitute critical areas for further research:

1. Future research needs to determine Water governance in the context of water rights. There is a need to streamline the water rights and service delivery mandate to the local people. How, therefore, can this be done to ensure that people in informal settlements govern water in a way that is sustainable and at the same time mutually benefits them and to achieve desired results in water security.
2. Gender and youth issues in water are to be considered in determining water insecurity. The research finding shows that women are at the forefront of ensuring water security for the households. Future areas of study should therefore interrogate how the gender aspect can contribute to water security.it is suggested that the men and the youth are more integrated into water management for co-ownership and girls can be more noticed as potential water managers
3. Another area of future research the researcher proposes is Public health vis-a-vis water insecurity. As research has indicated, poor water security exposes individuals to health perils. Future research can therefore delve into narrowing the gaps that exist between science and policy to safeguard the world.
4. Building database on the water systems in informal settlements- this can be done through settlement profiling.

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APPENDIX

Date	Interview number

Interview guide for key informants

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The University of Zambia

School of Natural Sciences, Department of Geography and Environmental studies

Master of Science in Spatial Planning

Determinants of Water insecurity in informal settlements: The case of George settlement Lusaka

INTERVIEW GUIDE FOR NWASCO

My name is Dorothy Ndhlovu, a second-year student doing a MSc in Spatial Planning at the University of Zambia. The following interview aims to identify the **"Determinants of water insecurity in informal settlements"**. It will focus on the drivers of water insecurity under the themes Water Supply, flooding and quality. The information collected is strictly confidential and will exclusively be used for academic purposes only and I do not expect cost or harm to you for participating in this interview.

Do you agree to be interviewed?

YES	Yes	**NO**	

Do you agree to be cited/or identified in the research report?

YES		**NO**	

1. Job title of respondent:_____
2. Briefly describe the main responsibilities of NWASCO?
3. Which water providers are responsible for water provision to George settlement?
4. What is the major threat to water security in informal settlements such as George?
5. How does water insecurity manifest itself in informal settlements?

6 How do you determine water security, and what is the threshold?

7. How does the water security threshold for informal areas differ from that set for formal areas?
8. How does NWASCO's determination of water security differ from the water needs of people in George/other informal settlements?

9. How often per year does George experience water insecurity?

10. How does this manifest?

11. How do you respond to incidences of water insecurity in George?

12. How do you ensure that the water providers are compliant in following the statutes/pronouncements/directives by NWASCO?

13. What challenges do you encounter to ensure that residents of George have access to clean and affordable, clean and safe water as stated in your mandates?

14. In your opinion, are the water providers leaving up to their expectations in water provisions?

15. Explain the challenges faced in providing water to George community.

16. How has the provision of water to George improved in the past years?

17. How can water situation be improved in George/informal settlements?

What are your last reflections?

The University of Zambia

School of Natural Sciences, Department of Geography and Environmental studies

Master of Science in Spatial Planning

Determinants of Water insecurity in informal settlements: The case of George settlement Lusaka

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INTERVIEW GUIDE FOR LCC PUBLIC HEALTH DEPARTMENT

My name is Dorothy Ndhlovu, a second-year student doing a MSc in Spatial Planning at the University of Zambia. The following interview aims to identify the**"Determinants of water insecurity in informal settlements"**. It will focus on the drivers of water insecurity under the themes Water Supply, flooding and quality. The information collected is strictly confidential and will exclusively be used for academic purposes and I do not expect cost or harm to you for participating in this interview.

Do you agree to be interviewed?

YES		**NO**	

Do you agree to be cited/or identified in the research report?

YES		**NO**	

1. Job title of respondent: _____
2. What are the major roles and responsibilities of the department?.....
3. What laws or frameworks govern the activities of the department?.....
4. How would you describe water insecurity in informal settlements?.....
5. What issues would you say arise from water insecurity in informal settlements of Lusaka?.....
6. In your view, what are the major drivers of water insecurity in George?.....
7. Do you have works or programme to improve water security in George Settlement?
8. Describe in detail at least ONE incident of water insecurity in George or any informal settlement in Lusaka?- What was it, what caused it and how did the local community respond to the situation?
9. How does the department resolve these issues in informal settlements?
10. What challenges are faced by the department in carrying out their functions?
11. How can planning help in curbing water insecurity in informal settlements?

12. How often does the department interact with the informal settlement of George on issues relating to water insecurity?
13. What in your view causes water insecurity in informal settlements like George?

Do you have any additional comments?

Date	Interview number

The University of Zambia

School of Natural Sciences, Department of Geography and Environmental studies

Master of Science in Spatial Planning

Determinants of Water insecurity in informal settlements: The case of George settlement Lusaka

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INTERVIEW GUIDE FOR LUSAKA WATER SUPPLY AND SANITATION COMPANY

My name is Dorothy Ndhlovu, a second-year student doing a MSc in Spatial Planning at the University of Zambia. The following interview aims to identify the **"Determinants of water insecurity in informal settlements"**. It will focus on the drivers of water insecurity under the themes Water Supply, flooding and quality. The information collected is strictly confidential and will exclusively be used for academic purposes only and I do not expect cost or harm to you for participating in this interview.

Do you agree to be interviewed?

YES		**NO**	

Do you agree to be cited/or identified in the research report?

YES		**NO**	

1. Job title of respondent: _____
2. Briefly describe the organizational structure of LWSC……
3. Who is responsible for water provision to informal settlements?
4. What are the key roles/responsibilities of your institution in water provision to informal settlements?
5. What policies, laws and regulations guide your service provision?
6. Briefly describe the history of water provision to George settlement?

6b. How did Lusaka Water and Sewerage come to provide water in George?

7. How does your company work with the community to provide water in George?
8. How much water is a household entitled to per day?
9. What criteria does LWSC use to determine amount of water accessible to households/businesses per day or per month? (hint: Water need determinants: household size, nature of business, capacity to pay for water, vulnerability, capacity to supply water by LWSC etc).

10. Do the residents of George pay for water provision?
11. What is the payment mechanism for the water in George? (hints: cash at point of drawing, card at point of drawing, card at LWSC office, annual subscription)?
12. If post-paid or pre-paid tariff, why did LWSC choose this type of a tariff?
13. How adequate is the water infrastructure and water supply in George community? (hint: Zero in on the zone of your study).
14. Does the department inspect infrastructure to ensure that it is functioning well?
15. What do you consider water insecurity?
16. Based on your experience and views, what is the major driver of water insecurity in George?
17. In your opinion, what are the major challenges or threats to water security in George?
18. How well does your institution communicate with other actors in the water sector to promote water security for people in George/other informal settlements? Which do you work with closely and why?
19. Are there water quality issues in George and how do they manifest?
20. In your opinion, what can be done to ensure that residents of George are water secure?
21. How does your institution respond to incidences of water insecurity such as flooding, droughts and poor quality of water?
22. How does urban flooding impact water security in George?
23. D you have any materials to share for my reference?

What are your last reflections?

Date	Interview number

The University of Zambia

School of Natural Sciences, Department of Geography and Environmental studies

Master of Science in Spatial Planning

Determinants of Water insecurity in informal settlements: The case of George settlement Lusaka

INTERVIEW GUIDE FOR LUSAKA CITY COUNCIL ENGINEERING DEPARTMENT

My name is Dorothy Ndhlovu, a second-year student doing a MSc in Spatial Planning at the University of Zambia. The following interview aims to identify the**"Determinants of water insecurity in informal settlements"**. It will focus on the drivers of water insecurity under the themes Water Supply, flooding and quality. The information collected is strictly confidential and will exclusively be used for academic purposes and I do not expect cost or harm to you for participating in this interview.

Do you agree to be interviewed?

YES		**NO**	

Do you agree to be cited/or identified in the research report?

YES		**NO**	

1. Job title of respondent: _____
2. What are the roles and responsibilities of the engineering department?
3. What interaction does the Department have with informal settlements?
4. How does the department ensure that the water infrastructure is functioning at full capacity in informal settlements such as George?
5. How often does the department carry out maintenance works on the water infrastructure?
6. Describe the challenges faced in service delivery in informal settlements?
7. How does your Department work with George settlement to improve water security?
8. Describe in detail at least ONE incident of water insecurity in George? What was it, what caused it and how did the community respond to the situation?
9. What processes are followed to have a water supply related challenge fixed in informal settlements?
10. Which areas are not serviced by the department and why?
11. How can planning aid in having a water secure future for informal settlements in Lusaka?

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Date	Interview number

The University of Zambia

School of Natural Sciences, Department of Geography and Environmental studies

Master of Science in Spatial Planning

Determinants of Water insecurity in informal settlements: The case of George settlement Lusaka

INTERVIEW GUIDE FOR PPHPZ

My name is Dorothy Ndhlovu, a second-year student doing a MSc in Spatial Planning at the University of Zambia. The following interview aims to identify the **"Determinants of water insecurity in informal settlements"**. It will focus on the drivers of water insecurity under the themes Water Supply, flooding and quality. The information collected is strictly confidential and will exclusively be used for academic purposes only and I do not expect cost or harm to you for participating in this interview.

Do you agree to be interviewed?

YES		**NO**	

Do you agree to be cited/or identified in the research report?

YES		**NO**	

1. Job title of respondent: _____
2. What are the functions of PPHPZ?_____
3. How do you engage with informal settlements?_____
3. Does PPHPZ have any projects running in the settlement of George?_____
4. Do you have any projects that are related to water service provision?
5. Describe the water situation in George in your view. _____
6. How do residents survive issues of water in George?_____
7. How do you ensure that the community is catered for in terms of water provision?_____
8. Does PPHPZ have any challenges in implementing projects relating to water provision and what are they?
9. What is water insecurity for people living in George Settlement?
10. How do the residents of George cope with instances of water insecurity?
11. What do you attribute water insecurity to in George?
12. How can planning or lack of it contribute towards water insecurity in George?

13. What in your view can be done to improve the water situation in George?

14. Describe the nature of the relationship between PPHPZ and the community in achieving a water secure future?

15. Does PPHPZ as an NGO put to task the service providers and how?

Any additional comments?.....

Thank you for your participation!

Date	Interview number

The University of Zambia

School of Natural Sciences, Department of Geography and Environmental studies

Master of Science in Spatial Planning

Determinants of Water insecurity in informal settlements: The case of George settlement Lusaka

INTERVIEW GUIDE FOR LWSi SECRETARIATE

My name is Dorothy Ndhlovu, a second-year student doing a MSc in Spatial Planning at the University of Zambia. The following interview aims to identify the**"Determinants of water insecurity in informal settlements"**. It will focus on the drivers of water insecurity under the themes Water Supply, flooding and quality. The information collected is strictly confidential and will exclusively be used for academic purposes and I do not expect cost or harm to you for participating in this interview.

Do you agree to be interviewed?

YES		**NO**	

Do you agree to be cited/or identified in the research report?

YES		**NO**	

0. Job title of respondent: _____
1. What circumstances led to the formation of LWSI …….
2. Describe the history (origins and growth) of LUWSI in water security for Lusaka?
3. Describe water security situation in Lusaka's informal settlements?
4. What are the goals and vision of LWSI? ……..
5. Does the secretariat ensure that the rules and guidelines are followed in the settlements? ……
6. How do you define or describe water insecurity?
7. What are the functions of the institution?
8. What are the main responsibilities?
9. What in your view is water insecurity?
10. In your view, what are the major drivers of water insecurity in George?
11. Do you have works or programme to improve water security in George Settlement?

12. Describe in detail at least ONE incident of water insecurity in George or any informal settlement in Lusaka?- What was it, what caused it and how did the local community respond to the situation?
13. What measures are put in place to ensure that there is water security for all?
14. What challenges are faced in collaborating with various stakeholders in ensuring water security?
15. How would you characterize the water situation in George settlement?
16. Does your institution interact with the communities over challenges being faced in George?
17. What strategies do you encourage people to take in relation to water security? Why?
18. Are there any other actors that are working to ensure water security in informal settlements?

Thank you!

Date	Interview number

The University of Zambia

School of Natural Sciences, Department of Geography and Environmental studies

Master of Science in Spatial Planning

Determinants of Water insecurity in informal settlements: The case of George settlement Lusaka

INTERVIEW GUIDE FOR LUSAKA CITY PLANNING

My name is Dorothy Ndhlovu, a second-year student doing a MSc in Spatial Planning at the University of Zambia. The following interview aims to identify the**"Determinants of water insecurity in informal settlements"**. It will focus on the drivers of water insecurity under the themes Water Supply, flooding and quality. The information collected is strictly confidential and will exclusively be used for academic purposes only and I do not expect cost or harm to you for participating in this interview.

Do you agree to be interviewed?

YES		**NO**	

Do you agree to be cited/or identified in the research report?

YES		**NO**	

1. Job title of respondent: _____
2. What is the role of the planning authority in provision of water to informal settlements?
3. How does the Department of City Planning engage with informal settlements?
4. Why do you intervene in areas which are designated informal?
5. What infrastructure is set up for water provision in informal settlements?
6. How adequate in water infrastructure and services in informal settlements, dwell on George community?
7. What measures are put in place to ensure that this infrastructure is protected?
8. What role does the planning authority place to make sure water is provided in George
9. Does the department inspect infrastructure to ensure that it is functioning well?
10. Based on your records/experience in working in George community, how is urban flooding a problem in that community?
11. What is the major driver of urban flooding in George Community?

12. How does your Department intervene to reduce flood risk in George community?
13. How is planning or lack if it a contributor to urban flooding in George community? What do you consider as water insecurity for places like George?
14. In your view, what can be done to ensure that residents of George are water secure?
15. How does your Department respond to incidences of water insecurity such as flooding, droughts and poor quality of water in George?

Do you have any additional comments?

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