

**Exploring the challenges and solutions of ageing potable water infrastructure in  
Gwanda Town, Matabeleland South, Zimbabwe**

**by**

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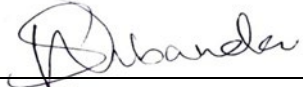
**JANUARY 2022**

## **DECLARATION**

I declare that this full dissertation report submitted to the University of South Africa (UNISA) entitled “*Exploring the challenges and solutions of ageing water infrastructure in Gwanda Town in Matabeleland South Province, Zimbabwe*”; has never been submitted by me or any other person for a degree in any other university and that it is my work and any other author ‘s work herein had been acknowledged.

I declare that this is a true copy of my dissertation, including any final revisions herein as approved by my supervisor.

**Wishes Sibanda**

Signature:  \_\_\_\_\_

## **ABSTRACT**

The ability to access clean potable water is not only a basic need, but it is also a basic human right. In Zimbabwe, communities still live in places where it is a challenge to access potable water, a situation with life-threatening consequences. There are many reasons for this deplorable situation. One key contributing factor to the inadequate water supply is the ageing of water infrastructure systems. The study aimed to understand the challenges imposed by ageing water infrastructure and to investigate possible solutions to the challenges in Gwanda Town, Matabeleland South, Zimbabwe. Qualitative methods were used to gather data from 57 participants including residents, council officials and NGO representatives that were all working and living in Gwanda town. The study reveals that water challenges result from several factors, including but not limited to, corroded pipes leading to water pollution, leaking pipes and taps, vandalism along with limited financial and human resources to repair and maintain the ageing infrastructure. Most of the interviewed participants expressed concern that the ageing water infrastructure systems imposed life-threatening risks and impaired the socio-economic aspects of their livelihoods. It was also concerning that although there were two water treatment plants in Gwanda town, only one was fully functional. Even more striking was the fact that despite these water challenges faced by Gwanda town, there was an absence of boreholes which are often a cost-effective, rough-and-ready alternative. The study recommends multi-organisational solutions that put into account upgrading infrastructure, reporting theft and vandalism to the police, employing water infrastructure inspectors, discouraging illegal connections and community engagement. Access to underground water sources through boreholes should be considered as an alternative to dams. More funding is required to upgrade and repair existing water infrastructure. Residents should also be encouraged through public engagement programmes and other incentives to pay water bills regularly and on time to allow for the implementation of preventive and proactive maintenance measures to improve access to potable water. The study also recommends the adoption of an Integrated Water Resources Management (IWRM) approach in developing policies that will reform the processes of water resource governance and management, as well as promote the development of the Gwanda community. Further research is required to address the effects of population growth and settlement planning on water access in Gwanda town.

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## **LIST OF ACRONYMS AND ABBREVIATIONS**

<b>ZINWA</b>	Zimbabwe National Water Authority
<b>DDF</b>	District Development Fund
<b>NGO</b>	Non-Governmental Organisations
<b>CSIR</b>	Council for Scientific and Industrial Research
<b>AusAID</b>	Australian Government Agency for International Development
<b>UNICEF</b>	United Nations International Children's Emergency Fund

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# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

Potable water provision is an essential component of local authorities in Zimbabwe. It is key in human development and a strategic point in the progression of the country hence water management services are critical. Zimbabwe has been marred with gradual economic decline which in turn has affected the social and political aspects of the citizens, which remain unresolved to this day. The consequences of the economic upheaval have led to the stunt of developmental programmes due to financial challenges, exposing the population to health and environmental risks. Local authorities have been struggling to meet the water demands from their residents due to poor governance and infrastructural collapse. The residents of Gwanda Town, Matabeleland South Province are in a dire situation due to inadequate water infrastructure facilities. This chapter will introduce the background of the study and give context to the problem, establish the basis of the study and highlight the objectives and the significance of challenges imposed by ageing water infrastructure in Gwanda Town.

### 1.2 BACKGROUND OF THE STUDY

Most of the developing countries are characterised with rapid urbanisation with a projection of more than 2 billion city dwellers in the subsequent 30 years. Urbanisation has become a major feature in modern migration trends especially in Africa and Asia (McAuliffe and Ruhs, 2017). “In Zimbabwe, the Local Government system is at the forefront of channelling urbanisation, through a multilevel decentralisation system with the key local institutions of Rural District Councils and Urban Councils that promote general development in their areas” (de Visser, Steytler and Machingauta, 2010).

Urban local authorities/council is the domain of government, that is nearer to the people by being administrative structures officially assigned responsibilities for public service delivery in selected geographical areas (Gideon and Alouis, 2013). Through election, local government officials are chosen by citizens to stand on their behalf and are responsible for ensuring adequate community service delivery. “In essence, governance is cast within an urban critique while remaining cognisant of the global approach; instead of rejecting the notion of governance as an element of neo-liberalism, it becomes a conceptual framework for political change and

progress in the urban areas” (Moore, 2003). Urban governance entails significant engagement amongst the government and civil society in design, decision-making, and project initiatives around urban land, housing, and services matters. It also entails “involvement of citizens with local government in broader policy discussions on municipal budgets and taxes, or socio-economic development initiatives, as well as political participation in the form of voting or by non-political action in the form of policy negotiation, public consultation and participatory city planning” (Moyo *et al.*, 2006).

In developing countries, large cities and unplanned rapid urban growth rates have introduced complex challenges concerned with service delivery, utility and upkeep. Moreover, these changes in demography are taking place under an environment of poor economic growth, increasing debt and severe poverty (Bhattacharya, 2002). Local governments are incapacitated to deal with the increasing need for basic infrastructure, this has dealt a heavy blow in efficient public service delivery exposing the citizens to public health risks. When local government is lacking in providing services it indicates a lack in mediating and regulating development initiatives. Fragmentation in service delivery across a city and unplanned land use patterns become entrenched in the urban city structure which is often determined by class leading to inequalities destabilising societies. Development is focused on cities with high economic potential, poor urban areas receive less public resources (Hastings, 2009). Physical fragmentation in the long run has the result of an ungovernable cities in the long term. “A local tax base necessary for the delivery of services becomes untenable, legitimacy in local government authority is undermined, and increasing vulnerability in local government occurs. This has the effect of undermining democratic capacity at the local and national levels’’. (Hall and Lobina, 2010).

Cities are confronted with the struggle of meeting the water demands of their present and future populations in an era where safe drinking water is becoming scarce globally (Ruiters, 2013). Most developing countries fail to provide portable water due to climate change (prolonged drought) and ageing infrastructure (Hall and Lobina, 2010). Long-term underinvestment experienced by local governments has led to a great state of neglect at the different levels of its organizations and infrastructure leading to reduced water supply and in some cases a standstill. Zimbabwe depends on ageing water infrastructure as most urban area pipes were set up in the early 20th century during the colonial period (Moyo *et al.*, 2006). There is regular pipe bursts and leakage causing water outages in many towns that may last anything between a few hours to weeks, interrupting access to water by residents within the town both for domestic, business

and industrial use (Kumpel and Nelson, 2016). Ageing water pipes lead to loss of portable water and debris introduction, flooding, and outbreaks of water-borne diseases, among other effects (Chambers, 2009). In most developing countries, governments and water authorities have been focussing on more urgent needs, such as expanding their water piping networks to meet the demands of their growing populations and repairing burst pipes (Ruiters, 2013). However, in Zimbabwe due to economic collapse there has been limited developments and repair of existing water infrastructure. Therefore, there is an urgent need for governments to develop sustainable ways of upgrading or replacing the already worn out piping systems that were set up decades ago. Failure to address this challenge will untimely lead to the inability to provide residents with accessible and clean water in the near future when the piping eventually collapses beyond repair. A proactive approach to addressing ageing pipes has been proven to be cheaper in the long run (Clasen, 2012).

Intergovernmental organisations such as the World Bank believe that privatisation of the water sector is the best solution to water challenges facing developing countries (Marin, 2009). The private sector can inject the much-needed capital to address infrastructural challenges with which third world governments are currently faced. The approach has been successful in some developing countries where Western water companies have managed to meet the water and infrastructural needs of the communities they serve (Foshee *et al.*, 2009). However, some African governments are sceptical about inviting foreign private companies to invest in their water infrastructure (Chirwa, 2004). This study investigates the challenges of ageing water infrastructure in Gwanda Town in Zimbabwe, focus on the extent of the problem and possible solutions.

## **1.2.1 DEFINITION OF KEY CONCEPTS**

### **1.2.1.1 WATER INFRASTRUCTURE**

Water infrastructure is vital in ensuring sustainable water supply to communities. Modern advanced water infrastructure helps minimise the water system's amount lost (Hall and Lobina, 2010). Water infrastructure involves what is constructed to pump, divert, transport, treat, store, and deliver water and collect, treat, and discharge storm and wastewater. Governments have upgraded some water treatment equipment after they break down; however, water pipes have in many countries received less attention (Nleya, 2008). A majority of these pipes are underground and subsequently exposed to corrosion over time. The water pipelines in many developing world cities leak and burst regularly costing the authorities a lot of money to replace

one pipe at a time. Due to poor leak detection methods, some underground leaks go unnoticed for years. Coupled with the fact that most parts of Southern Africa receive erratic rainfall, a water crisis will be imminent if no action is taken to minimise the loss of water (Chetty and Luiz, 2014).

#### **1.2.1.2 CHALLENGES**

As defined by Biswas (2004) challenges are problems hindering the successful implementation of something. As a result, such problems are associated with a lack of active response, leading to poor or no delivery of essential services to communities. In this study, challenges are understood as problems contributing to the failure to address the issue of ageing water infrastructure that subsequently leads to poor potable water delivery to Gwanda Town. There is a need to explore those challenges and investigate how these challenges can be solved by relevant stakeholders within the Gwanda Local Water Government, Gwanda City Council, and other relevant NGOs and residents involved in water management in Gwanda Town.

#### **1.2.1.3 SOLUTIONS**

According to Biswas (2004), solutions are defined as suggested answers or responses for solving a problem. These responses can either be complex or simple and may need many or few resources to be successfully implemented. This study will adopt this definition but will expand it a bit. Solutions in this study are understood as suggested or implemented responses for solving problems arising from ageing water infrastructure in Gwanda Town.

### **1.3 PROBLEM STATEMENT**

“The Committee on Economic Social and Cultural Rights, which monitors the implementation of the International Covenant on Economic Social and Cultural Rights (ICESCR), to which Zimbabwe is a party, recognises water as a human right as contained in Article 11 (ICESCR), it guarantees, among other rights – the right to food, clothing and housing” (UN, 1966). This right has also been recognized by other international treaties and statutes such as the Convention on the Elimination of all forms of discrimination against women, stipulating that State parties shall ensure women the right to “enjoy adequate living conditions, including water supply”. Article 24, Paragraph 2, of the Convention on the Rights of the Child, requires State parties to combat disease and malnutrition “through the provision of adequate nutritious foods and clean drinking water” (UN, 1966).

The Constitution of Zimbabwe Section 77 Amendment (No.20) Act of 2013 has enshrined that every person has a right to safe, clean and potable water and sufficient food (Institute of Water and Sanitation Development, 2017). Moreover, the elements of the water rights must be adequate for human dignity, life and health. However, the adequacy of water should not be interpreted narrowly, by mere reference to volumetric quantities and technologies, but it must include availability, quality, and accessibility of water.

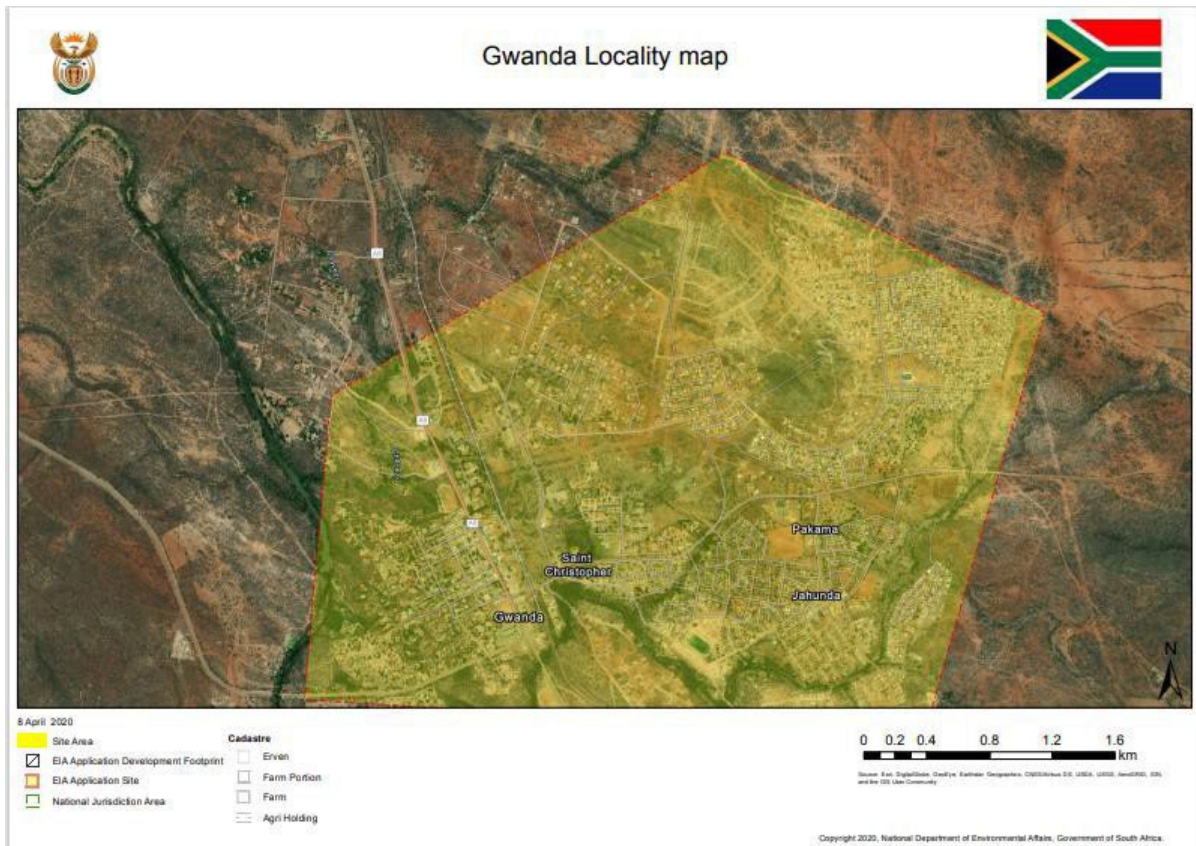
Within urban areas in Zimbabwe, local authorities in Zimbabwe have a mandate under the Urban Councils Act Chapter 29:15 to provide most of the social services. Zimbabwean economic decline had a negative impact on service delivery, operation, and infrastructure under urban local authorities, due to high inflation rates, revenues were depleted hence investments could not be sustained. Major cities have these challenges, but the situation is worse in small towns. The study focuses on Gwanda Town as a small-town case study. In Gwanda, residents have reported that they can go for days without water and there is a high number of pipe burst reports indicating that Gwanda has non-functional or dysfunctional water infrastructure that is interrupting water service delivery and is affecting domestic and commercial activities (Jiménez, Kjellén and Le Deunff, 2015). It is reported that the inadequate water supply is due to the failure of the Zimbabwean government to provide adequate funding for repair and expand existing water supply infrastructure (Gideon and Alouis, 2013). There is inadequate data and research on water supply infrastructure in Gwanda and the causes of water supply and infrastructure failure in the area. The problem has continued for over two decades, suggesting that stakeholders may not accurately understand the nature and severity of the challenge at hand (Jiménez, Kjellén and Le Deunff, 2015). The situation in Gwanda is worsened by the geographical location of Gwanda, it being situated in a semi-arid area has limited its capacity to receive adequate rainfall to assist in water supply coupled with poor water infrastructure. As a result, there is a need to research the challenges imposed by ageing water infrastructure on Gwanda residents. Such research will help in finding solutions that can be implemented to solve the challenges at hand (Scott, 2005). An investigation of the burden of ageing water infrastructure in Gwanda is critical to improving water supply in the area. This research study explored the challenges and possible solutions that can aid in solving the problem of ageing water infrastructure so as to improve potable water supply in Gwanda Town.

#### **1.4 STUDY RATIONALE**

Water as a scarce commodity is essential in sustaining human life and the environment in all aspects of development. The problem of water scarcity is a worldwide challenge that affecting political, social and economic aspects of all individuals with varying extents (Oki and Quiócho, 2020). This study intends to explore the challenges caused by ageing water infrastructure in Gwanda Town and potential solutions that have been or can be implemented to solve these challenges. Its rationale is based on the assumption that Gwanda Town Council, which is an urban local authority, faces challenges relating to maintenance and upgrade of water infrastructure as observed in many urban local authorities in Zimbabwe? (Nhapi, 2015). There has been little or no efforts put forward to solve ageing water infrastructure challenges that harshly impact the livelihoods of residents and the development of Gwanda Town (Jiménez, Kjellén and Le Deunff, 2015). The outcomes of this study will be useful to the Gwanda Local Water Government and Gwanda Town Water Council, and other involved authorities in making policies and informed decisions about ageing water infrastructure and its impact on water supply and water quality.

#### **1.5 STUDY AREA: GWANDA TOWN**

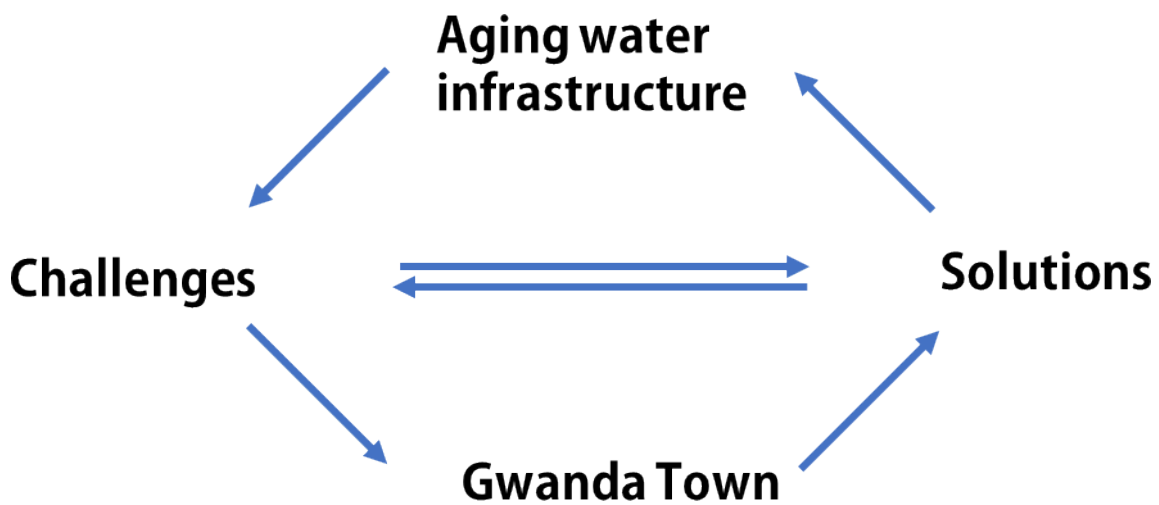
Gwanda Town is found in southern Zimbabwe, located 126 kilometres southeast of Bulawayo, which is regarded as the second largest city of Zimbabwe. The town was founded in 1900, and the name was derived from a nearby hill called Jahunda. The name Jahunda is an original Kalanga name from the Kalanga speaking dwellers who were known as ‘Majaunda’. It is formed by two words ‘Ja’ meaning to ‘eat’ and ‘Unda’ meaning to ‘move or go’ a reference to their nomadic pastoral way of life (PLAN Africa, 2000). Gwanda Town is situated on the Bulawayo-Beitbridge highway (Figure 1), and main centre for South-Western Zimbabwe’s cattle district and agricultural producers. It is also a mining area dominated by asbestos, chrome and gold.



**Figure: 1 Gwanda Local Map.**

**Adapted:** <https://edges.sites.olt.ubc.ca/files/2016/12/Institutional-Map-of-SA-Water-SectorFinal.pdf>

Gwanda is the capital of Matabeleland South Province, it is also amongst the driest areas of Zimbabwe and receives less than 250 mm of rain per annum (PLAN Africa, 2000). As a result, water scarcity is a major concern throughout this area. Figure 2, is a conceptual model connecting the vital conceptions of this study.



**Figure 2: Conceptual model linking the key concepts of this study.**

According to this conceptual model, ageing water infrastructure imposes some challenges on the potable water supply to the people within Gwanda Town.

### **1.6 SIGNIFICANCE OF THE STUDY**

This study intends to contribute to the documentation of challenges facing urban local governments in Zimbabwe regarding service delivery, particularly, looking at water infrastructure. It will be useful to the local governments' policy makers (Councilors) as it will bring out the challenges faced by urban local governments in terms of ageing water infrastructure and offer recommendations to improve the current predicament residents find themselves under. Furthermore, the study is intended to be an important guideline for policy formulation, regarding resource allocation with respect to water supply. Different case studies around the world will be used to provide comparative information that can be useful for Gwanda Town Council and evaluate performance against other urban local governments regionally and globally. The service delivery framework adopted in this study could be of great benefit to Gwanda City Council and other local governments as it will provide a platform for identifying shortfalls and areas to be prioritised for improvement in the current Council's service delivery framework.

This study uses Gwanda Town as the case study; however, the findings and recommendations of this study can be replicated in other urban local governments in Zimbabwe. This study could therefore potentially benefit the Ministry of Local Governments and other stakeholders in local government assessing the overall performance of the local urban governments in Zimbabwe. In essence, future research focusing on the same area can refer to the findings of this study in their works. Moreover, Non-Governmental Organizations (NGOs), donors and development partners who wish to work with urban local authorities could potentially also benefit from this research. The study contributes to the debate around the issue of ageing water infrastructure in Gwanda.

It is envisioned that this study will also help in theoretically assessing the practicality of some possible solutions such as privatisation, public and private partnerships in water infrastructure investment in the case of Gwanda, considering the differences that exist between Gwanda and other areas where the solutions were implemented. There is inadequate data and research on water supply and infrastructure in Gwanda. The findings of this study may inform further studies in the area. The study develops some solutions that can be implemented in Gwanda and small towns in similar predicaments.



## **1.7 AIM OF THE STUDY**

- To explore the challenges and possible solutions of ageing water infrastructure on potable water in Gwanda Town, Matebeleland South, Zimbabwe.

## **1.8 SPECIFIC OBJECTIVES**

1. To identify the severity of ageing of water infrastructure in Gwanda Town, by understanding current efficiency of water treatment processes (dams, water treatment plants) and delivery of water (observed water quality, taps, hand pumps, boreholes) to Gwanda Town.
2. To identify the challenges imposed on residents and local government by ageing water infrastructure on the supply of water in Gwanda Town.
3. To identify possible solutions to deal with these challenges in the study area.

## **1.9 LIMITATIONS AND DELIMITATION OF THE STUDY**

### **1.9.1 LIMITATIONS**

The sample of participants was kept at minimum as this research work addresses controversial issues between local authorities and the residents. Moreover, the selection of participants was not random as researcher was responsible for selecting most survey participants. There were issues with confidentiality as the participants were scared that their identities will be exposed as they were voicing out the local government incompetence. However, the research participation consent form assured participants confidentiality that the participants' identities will be not exposed.

### **1.9.2 DELIMITATIONS**

The research is centred on problems encountered by Gwanda Town Council influencing the decline in service delivery, specifically focusing on ageing water infrastructure. Gwanda was chosen as the study area due to accessibility and language. The research was conducted between 31/03/2018 to 05/04/2018 based on the UNISA ethics committee approval. The researcher conducted research in an ethical manner and held the right to privacy in highest regard. The researcher provided participants with sufficient details about the study in the form of an information sheet and briefing before the interviews. All aspects of the research were carefully explained. IsiNdebele was used for participants who did not understand English very well. The participants had the right to deny responding to questions they did not feel comfortable answering.

## **1.10 CONCLUSION**

This section covered the following: the background to the study, research problem and the purpose of the study. It also included the research objectives and questions, the significance of the study. The delimitation and limitations of the study are covered in this section. The next chapter presents an overview of relevant literature, conceptual framework and theoretical framework of this study.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 INTRODUCTION

This section presents the literature review: an assessment and compilation of information from available peer-reviewed resources to provide a background of the study, providing an overview of the key concepts and ideas formulating the research topic and identify information gaps and limitations of the study. The provision of services to citizens is a fundamental guiding principle of all municipal authorities. Council service delivery is at the centre of local government and is a complex science, art, and business requiring tailor-designed institutions and suitably qualified and experienced personnel at both political and officer levels to run and manage them properly (Jønch-Clausen, 2004).

The study adopts the Integrated Water Resources Management (IWRM) conceptual framework as it provides a holistic approach to water management that promotes the co-ordinated development and management of water and resources to promote efficiency of socio-economic while preserving ecosystems (Agarwal *et al.*, 2000). The primary objective of IWRM is to have all stakeholders involved in water resource supply be considered i.e. land on which rivers run and underground water to water collection, storage, distribution and conservation methods (Agarwal *et al.*, 2000). IWRM is a data based initiative that develops efficiency through information obtained from different stakeholders, hence it functions as a tool for assessment for water processes appraisal and re-evaluation (UN, 2007). Water resources are not universal therefore there is a need to consider all involved to develop strategies that will be efficient to formulate of principles, tools, and guidelines specific for the community in question (Jønch-Clausen, 2004). IWRM is under four principles, Principle 1 is ecological which considers water as a finite resource that is essential for life, environment and development. Human activities around the are should be considered as they affect water distribution (Agarwal *et al.*, 2000; Xie, 2006). Principle 2 is institutional which considers water development and management is a collective task which involves users and policy makers to be active participants in the exercise, considering that it is a human right therefore everyone should be involved (Agarwal *et al.*, 2000). It calls for the decisions to be made in the lowest ranking possible therefore Local Governments are the most appropriate as they are the links between the individuals and the government for decentralisation and participation (Xie, 2006). Principle 3 is gender which considers women having a central role in provision, management, and

safeguarding of water resources as they are the primary care giver in the household. Therefore, women need to be specially considered as they serve as the quality control personnel for water resources and can advise for better water delivery.(Agarwal *et al.*, 2000). Principle 4 is instrument which considers water has an economic assert hence as an economic good where there is competition to access water hence it is essential to achieve financial sustainability to ensure water service provision (Agarwal *et al.*, 2000; Xie, 2006). Therefore, based on the principles IWRM advocate for integration, decentralization, participation, and economic and financial sustainability in water resource management (Xie, 2006). IWRM covers elements of effective water governance such as participation, equity, coordination, inclusiveness, decentralisation and sustainable development to make the most of the economic and social welfare of human life without compromising ecosystem sustainability (Agarwal *et al.*, 2000). IWRM is adaptable and dynamic to cater for changes in the economic, social and environmental conditions.

## **2.2 AGEING WATER INFRASTRUCTURE IN ASIA: INDIAN CASE STUDY**

According to the Organization for Economic Co-operation and Development (OECD, 2010), “cities worldwide face the most acute challenges of service delivery because of fast-growing populations. In many countries, developing countries, in particular, service delivery is a challenge that needs to be addressed given the low quality of service provision and the pressing needs of the poor” (Besley and Ghatak, 2007).

India’s urban population is 377 million and is experiencing rapid urbanisation, it is a model for social services, decentralization and its impact on delivery mechanisms and efficiency due to a huge population. Indian 2011 Census figures reveal that just over 31% of the country’s population is presently living in urban areas, lower than China, Indonesia, Mexico or Brazil (HPEC, 2011). But over 80 million people live below the poverty line in India’s urban centres; a quarter of the total urban population lives in slums (Afridi, 2017). “Informal settlements, informal livelihoods, homelessness, insecurity, various types of pollution and declining green areas are the bane of most Indian cities. Combined with emerging concerns about climate change and the regular occurrence of natural disasters, Indian towns and cities seem to be sitting on a ticking time bomb” (HPEC, 2011).

These results of India’s urban changes pose huge challenges for the country’s planners and policymakers. Since independence nothing much has changed with regards to the formal planning system. Majority of the towns and cities depend on on fixed master plans that are

upon completion are generally almost always outdated. Inflexible development control norms which are defied at every step, and a weak governance system that can neither guide nor enforces, completes the sorry picture (Saigal, 2002). The ineffectiveness of planning has become endemic across Indian cities. Suri (2007) “points out some key drawbacks of the Master Plan, including the limited attention paid to social and economic development aspects, financial resource mobilization for the implementation of the plan, as well as the long time needed for plan preparation and the limited stakeholder involvement. Economic planning or local economic development strategies are rarely incorporated into the spatial planning exercise, resulting in the plans being unrealistic and impossible to implement”.

Moreover, the execution of urban plans in the cities of India is thwarted because most public services are controlled by other parastatal bodies or line departments of governments. According to Suri (2007), local governments are responsible only for solid waste management, maintenance of public spaces, and some basic repair and maintenance of other services such as roads, street lighting and drainage systems.

In the past and currently urban land remains a contentious issue in most Indian cities. Just as urban development and local governance is a government issue under the Indian federal system so is the issue of land. Policy advice and regulation is the responsibility of the central government but it is up to the state governments to implement any central policies or dictates (Banerjee, Gertler and Ghatak, 2002). “One of the major legal instruments that have significantly hindered the development of urban land in the country has been the Urban Land Ceiling and Regulation Act (ULCRA) of 1976, which was applied in cities with populations of 200,000 or more in the year 1971. The key objectives of this Act were to curb the activities of private land developers, to check undesirable speculation, to operate a land bank to keep land prices within reasonable limits and to ensure plan development with special reference to the needs of the poorer segment of the population” (Sivam, 2002).

Even though these objectives were undeniably honourable, the Act led to the freezing of big areas of land in the big cities, presumably for planned development. The sluggish pace of such development, consecutively, led to a shortage of developed land and a rise steeply of prices. The land acquirement also became more and more costly for development authorities and a burdensome procedure fraught with legal action, which nourished the cycle of low supply and high demand (Gandhi, 2012). Thus, the Act shut out the urban poor from the housing market

in most large cities such as Delhi. This has inevitably led to deteriorating urban services, especially with reference to infrastructural development and the provision of cheap housing.

India's rapid urbanization has significantly been due to exceptional urbanization of poverty. There has been a substantial migration of the rural poor to select urban localities in search of employment and livelihood. The influx has driven the development of shantytowns in cities allotting them into formal and informal settlements. The non-recognition of this fact has resulted in the un-planning of planned cities and has contributed to enormous strains on urban infrastructure. In the process, the poor seem to have exchanged rural unemployment for demeaning urban survival. This trend is not peculiar to India but a process witnessed across the entire developing world. It is concerning that cities have not sufficiently noticed this phenomenon and its impact on cities. "It is evident that if cities fail to deal constructively with poverty, poverty would seriously undermine the sustainability of cities. In the cited context, urban India faces daunting challenges. Cities must cope with greater numbers, plan to provide those services, find resources to meet the needs of maintaining and augmenting infrastructure, respond to the urbanization of poverty, preserve their environment and retain their competitive edge" (Unhabitat, 2013).

### **2.3 AGEING WATER INFRASTRUCTURE IN SOUTHERN AFRICA**

Water systems that are not maintained make service delivery less efficient, ageing infrastructure seems to be the largest contributor combined with poor operations by local government authorities (Hutton and Chase, 2016). Infrastructure deterioration is related to little funds apportioned to the water and sanitation sector (Annamraju, Calaguas and Gutierrez, 2001). Developing countries are plagued by corruption leading to inadequate prioritization of sustainable development. Corruption has been and continues to be one of the most significant causes of poverty in developing countries, and its impact on ageing water infrastructure is evident exacerbating financial pressure on the already struggling economies. Moore (2003) asserts that "corruption alters its character in response to changing socio-economic, cultural and political factors". These issues affect corruption and vice versa. It poses a severe threat to public administration and has often resulted in inefficient provision of services. In Zimbabwe, the urban local authorities has come to be known for poor service delivery and corruption. (Sigauke, 2017). Zimbabwe is rated as the most corrupt local government in Southern Africa (Tizora, 2009). The costs of corruption do not only entail the amounts of money squandered or embezzled from government resources but also the effects of absence of provision of basic

services. In addition to negatively impacting service delivery, corruption weakens the credibility of independent institutions and thwarts good governance. Mauro (1995) states that corruption has adverse effects on investment and it lowers economic growth, in the public sector, bribes induce officials to contrive new rules and delays to manufacture crises. Therefore, corruption impedes the state of its available resources that should be used to progressively achieve the full realization of socio-economic rights as funds are mismanaged, misused and misappropriated. Maserumule (2005) argues that corruption has a negative impact on socio-economic rights as it can deny development and quality to the most vulnerable members of society. He also states that this is harmful in developing countries, which have fewer resources, and these are more vulnerable if these resources are wasted or not used effectively and adequately. Furthermore, corruption decreases the efficacy of public administration. It hinders a local authority's capability to utilize its existing resources to attain the complete realization of better repairing water infrastructure. Ageing water infrastructure is not only a phenomenon in Zimbabwe and Africa alone but also in other parts of the world (Ashley and Cashman, 2006). The section below presents how ageing water infrastructure challenged the water potable water in India.

## **2.4 WATER INFRASTRUCTURAL DEVELOPMENT IN ZIMBABWE**

The water infrastructure is understood as engineered systems that channel water (Kloss, Brodник and Rinehart-Thompson, 2018). These early 'water systems' used resources that were easily available that supplied fresh water from surface water bodies and channelled waste water from households to sewages and water treatment plants (Novotny, 2007). Water infrastructure in Gwanda was setup to cater for the small white minority during the colonial period, post-independence as the population dynamics changed, there was no upgrade of the water infrastructure to cater for the growing population (Zachrisson, 2004; Jiménez, Kjellén and Le Deunff, 2015) hence the struggle to deliver portable water for Gwanda residents. Since the year 2000, a combination of socio-economic and political challenges led to the country's infrastructure collapsing with severe socio-economic consequences, which was exacerbated in 2008/9s (African Development Bank, 2013). The Government of Zimbabwe has made some efforts to better water supply and sanitation infrastructures such as the Short Term Emergency Recovery Programme (STERP) (African Development Bank, 2009) and Macro-Economic Policy and Budgetary Framework (MEPBF) (Robertson, 2011) and Medium-Term Plan (2011-2015). All the efforts were futile as the development planning was overtaken by political upheaval and the economic crisis (Machakanja *et al.*, 2014).

## **2.5 CHALLENGES IMPOSED BY AGEING WATER INFRASTRUCTURE IN ZIMBABWE**

According to Makanyeza, Kwandayi and Ikoben (2013), some of the causes or inability to solve the issue of ageing water infrastructure that has subsequently led to poor service delivery in town councils includes meddling by councillors in the administrative running, lack of participation by the general public, infrastructure challenges coupled with lack of expertise and poor alignment of budget in relation to governments expectations. A research by Aminuzzaman, (2010) in Bangladesh showed that some of the serious institutional problems facing ageing water infrastructure at the level of local authorities are experiencing a shortage of the workforce considering the nature of the job (manual labour) local authorities are understaffed. The author also clarifies that “urban local authorities also lack logistic supports like computers and transport and lack managerial capability and resources to design and run innovative service delivery in areas like employment generation, health and education” (Aminuzzaman, 2010, p.12). Additional challenges identified in the research by Aminuzzaman’s was the lack of appropriate rules and regulation, ineffective monitoring, lack of accountability and transparency, political manipulation, non-cooperation from central-government based bureaucracy, limited community understanding, exclusion of women, limited and insecure revenue base, highly centralized project and program design, poor relationship between the administration and elected representatives (Aminuzzaman,2010).

## **2.6 LACK OF ACCOUNTABILITY AND TRANSPARENCY**

A lot of discourse on service delivery exists around transparency and accountability, it is at the core of good governance as it provides the records for previous and future development strategies for an organisation (World Bank, 2004). Accountability for service delivery can be demanded from a wide range of stakeholders i.e. politicians and public figures: appropriate policy adoption and adequate record management, service of providers: monitoring delivery dates and quality of service (McGee, 2010). Lack of accountability is touted as the primary cause of corruption in urban local governments (Lederman, Loayza and Soares, 2005) and according to Kotter (2007), if public officials know that they are not being monitored they are prone to engage in corrupt activities. (Makumbe, 1996) argues that, “authoritarianism is visible in Zimbabwe, the phenomenon covers national and local institutions which leads to limited public participation in decision making, lack of transparency, accountability, observance of the rule of law and violations of human rights in the governance systems. Authoritarianism relates to a form of arbitrary government which uses coercive instruments of the state to expedite its



purposes of monopolizing power while denying rights and opportunities to other groups to compete for that power”. The central government tends to interfere in local issues leading to an undeclared recentralisation of power by coercing local government officers to report to governors, provincial and district administrators and abuse of political power by the Minister of Local Government who constantly dismisses local authority officials (Jonga, 2014).

## **2.7 CENTRAL GOVERNMENT INTERFERENCE**

Madzivanyika (2011) asserts that “efficient and effective provision of services is undermined by a high level of central interference in the decisions of local governments. In 2005, the Minister of Local Government issued a directive that revoked water management functions from Urban Councils and transferred its management to the Zimbabwe National Water Authority (ZINWA)”. Musemwa (2008) states that regressed patterns in water provision and sanitation in urban areas is due to the transfer of water to ZINWA without the necessary accountability mechanisms. The transfer of the Urban Councils function to provide water also reduced the incomes generated by Urban Councils through local taxing halting development programmes. ZINWA failed to perform their mandate effectively, in 2008, the minister responsible for water provision issued another directive handing water provision back to councils because of the poor performance. The announcement of the directive only indicates the nature of volatility in the operations of urban councils despite many alterations to the Urban Councils Act. Unplanned changes retard good planning and development of urban water provision policies and strategies.

The dissolution of councils and dismissal of councillors who Commissions substituted is a common phenomenon in Zimbabwe urban councils’ governance (Human Rights Watch, 2008). (Jonga, 2012) argues that “commissioners are not experts in the administration of local governments/urban councils. The lack of necessary expertise or knowledge results in councillors/commissioners rubberstamping issues raised by employees”. In cases where councillors have been fired for inadequate service provision, mismanagement of council’s assets, funds such as Harare and Mutare cities, the commissions re-appointed in those areas did not improve service delivery. There is added decline of infrastructure and services in these cities.

## **2.8 FINANCIAL CHALLENGES AS A CAUSE OF AGEING WATER INFRASTRUCTURE**

Laws that have a bearing on the revenue collected in Zimbabwe for example, taxes and surcharges cannot be changed by councils, without the approval of the Minister of Local Government. Madzivanyika (2011) explains that “the design of the UCA (Urban Council Act) limits the capacity of UCs (Urban Councils) to raise taxes or tariffs. UCs can only raise, for example, property taxes, surcharges or borrow within limits set by the minister.” Low revenue collections and inability to expand the revenue base affects the final incomes of the council negatively inevitably leading to poor service delivery and ineffective and inefficient responses to public demands or needed investments.

Marumahoko (2010) portrays “Zimbabwe's deteriorating governance in urban areas by providing statistics on revenue generation in the City of Harare. The study illustrated that the City of Harare budgeted to collect revenue to the tune of US\$ 230.09 million in 2010 against an expenditure target of US\$275.63 million, resulting in a budget deficit ofUS\$47.54 million. In addition, the City also had a budget of US\$77.33 million revenue from water against a total budget of US\$230.09 million. The amount targeted was unacceptably low”. Governance woes are exacerbated by the government departments’ who fail to pay for services rendered to them by urban local governments. Ministries are not paying bills to local authorities for the provision of services like refuse removal, water, and sewage facilities.

Against this background, Jonga, (2014) argues that the ministries deprive local governments of substantial revenue that is important for supporting service providers in other locations. Certain strict rules must be put in place to ensure these ministries pay their obligations. The inability by ratepayers to pay their obligations has contributed to the limitations in delivering public and infrastructural services.

The challenge of reduced revenue can be accredited to the domination of central government in total public sector expenditure. Dillinger (1994)noted that “the local share of total public sector expenditure in developing countries is well below 10 %, in contrast to the G5 countries, where the local share ranges from 17 % (France) to 33 % (Japan)”. Low expenditure causes local authorities to assume greater responsibility for services such as health and education, but without the requisite increased funding to meet these responsibilities led to adversities in many local authorities where they are finding it challenging to fund decentralized functions from their current revenue levels. In the long run, this will lead to less investment in development projects to improve urban area service delivery (Marin, 2009). The unbalanced macro-

economic atmosphere in Zimbabwe has adversely affected gross domestic production and investment interests by the private sector because the central government is not provident in making timely fund transfers for local authorities' subsidies.

## **2.9 LIMITED MANPOWER AND HUMAN RESOURCES**

Poor service delivery within local governments in urban areas is also influenced by human resources, according to Chazovachii *et al.* (2012), "these problems include the lack of qualified personnel, technocrats and auditors, lack of skilled personnel makes work susceptible to shortfalls and incorrect recordkeeping in statistics, population and resources compromising transparency and accountability". For example, some casuals were recruited just after the period of hyperinflation when the permanent staff had withdrawn in the Harare municipality, audit reports indicated that there was inconsistent record-keeping (Jonga, 2009). Continuity of service delivery was compromised and councils were advised to employ trained personnel. Audit reports indicated signs of report on the audit of Local Authorities fraud and fund abuse, this has been observed in all local authorities based on the report on the audit of local authorities reporting concerns that governance issues (Chiri Mildred, 2018). There was an outcry from the public that the people elected into office did not have the minimum academic backing to fulfil their duties in the urban councils this has led to inefficiency in social spending programmes, significantly contributing to poverty, inequality (Zinyama and Shumba, 2013).

## **2.10 INADEQUATE PUBLIC PARTICIPATION (PP)**

Public participation is the basis of community development it is a critical component of any policy formulation process, all citizens should participate in the decision making at each development progression stage to yield effective results that cater for everyone (Edoun and Jahed, 2009). Lack of active participation from locals has a bearing on performance of the local authorities. "Public Participation means people discussing, draft plans and development proposals when they are still at the formative stage with the hope of influencing official decisions and action" (Makumbe, 1996). The lack of participation by the public hinders efficient service delivery as urban councils will not be informed on the requirements of the public. One major problem in Zimbabwe's local government authorities and structures is the lack of transparency and social discontent. The prioritization of budget projects or activities is done entirely by the administration and council, often without consultations. The budget consultations are mere presentations of what has already been prepared; the process is not deliberative. Furthermore, "there is corruption, and mishandling of public funds and the

resources are not directed towards the most pressing needs of the poor and the other disadvantaged groups of society” (Mapfumo, 2019). Generally, citizens have moved on being just passive and mere voters and clients, they demand to be effectively and actively involved in their governance (Matamanda and Chinozvina, 2020). The other challenge is that even though all legislative acts promote public participation there are no formal structures to do so and the local governments do not recognise resident associations as a platform for citizen participation (Ndou, 2015). Citizen participation affords a robust foundation for instituting good governance, reinforcing the relationship concerning the government and the governed. Such an association fosters the provision of services at the local level.

Chirisa (2014) states that “people are the principal wealth of the cities and are both the object and the means through which sustainable human development is achieved”. Failure by local authorities to put up with the residents’ needs will repetitively mismatch the demand for the amenities and their provisions, since residents are not keen to be side-lined on issues that directly impact their standard of living.

## **2.11 STAKEHOLDER INVOLVEMENT IN URBAN WATER MANAGEMENT**

Most countries in Southern Africa, such as Zimbabwe, South Africa, Malawi, Tanzania, Zambia and Namibia, have embraced the philosophy of stakeholder participation in water resources management and have introduced laws, which provide frameworks for the establishment of stakeholder water institutions (Manzungu, 2004). “Stakeholder involvement is an essential factor in the successful implementation of water management plans, mainly when efforts are made to resolve competing and conflicting demands in areas facing water scarcity” (Gerasidi *et al.*, 2003).

Paros Island faced the challenge of identifying solutions to the water management challenges and ensuring urban water demand coverage considering the high seasonal tourist influx. Paros officials were struggling to secure an equitable water allocation solution for all water users to avoid and resolve existing and emerging conflicts. Close collaboration among stakeholders was implemented and institutions active in managing water on the island was crucial towards promoting improved water governance, valuing and equitable sharing of water resources (Watkins, 2006). “The process also revealed and identified common perceptions and points of convergence in support of demand management options, socio-economic measures and institutional adaptations. Through the different steps of the process, all stakeholders bridged differences and came to a consensus as a diverse group, advocating soft-path measures and

reforms, encouraging public participation in decision-making and contributing to integrated urban water management planning” (UN-Habitat, 2006).

IWRM has turned into the central paradigm in water resources management (GWP, 2009). The third Dublin principle of IWRM is on participation by all stakeholders in water resource management (SIWI–Independent, 2005). IWRM combines interests, priorities and disciplines as a multi-stakeholder planning and management process for natural resources within the catchment ecosystem, centred on water. In Southern Africa, participation has mainly been an issue as many of the states are revising and implementing new water Acts. The non-urban dwelling citizen has been left out in decision making as political power has more influence than citizen participation when drafting policies. Previous policies in many countries had a mismatch between resource abundance and human settlement, it has been observed that in the majority of the regions people dwell, water scarcity is prevalent (Swatuk, 2005; Dirwai *et al.*, 2021). There is still possibility for analysing how participation is taking place in urban areas, and one such area that needs inquiry is that of tariff setting. Zimbabwe and South Africa are leading in the implementation of IWRM. However, in Zimbabwe IWRM reflects a broader national-level socio-political process and the complex interaction of Zimbabwe with the international community (Manzungu and Derman, 2016).

## **2.12 PRIVATISATION AS A POSSIBLE SOLUTION TO AGEING WATER INFRASTRUCTURE IN SOUTHERN AFRICA.**

Water and sanitation sectors in Southern Africa are crumbling due to a lack of capital. In South Africa, the most developed country in the region, the department of water affairs reported a shortage of R600 billion to address the challenges faced by the water industry (Chetty and Luiz, 2014). The national treasury could only provide half the required money. The discrepancy between the required amount and the amount of money supplied by the national treasury in other Southern African countries is likely to be much higher based on GDP. South Africa was one of the first developing countries to engage the private sector in its water industry. In Mpumalanga province, a private company Silulumanzi managed to replace 8000 metres of broken pipes and installed a further 15 000 metres of new pipes (Park *et al.*, 2009). This managed to improve water access in the covered areas, water outages due to bursts and leaking pipes were common. The privatisation of water supply is under the premise that private companies are better at service delivery and governance hence better outcomes enhancing livelihoods, fulfilling the public-sector mandate. However, inequality in access resources in

countries with colonial history cannot be ignored hence privatisation of water provision challenges basic human right to water (Chirwa, 2004).

In Zimbabwe, it took 20 years post-independence for authorities to be concerned with the water provision shortfall. The urban population had overgrown and the deficit was huge and growing rapidly, there was a need for quick action to solve water and sanitation challenges. It should be noted that the rural area water access was improved, more people had access to portable water (Manzungu *et al.*, 2016). In response to the challenge, the government established the Water Act of 1998 which transferred water supply and sanitation to the national parastatal, Zimbabwe National Water Authority (ZINWA) including water resources forming a substantial part of IWRM of Zimbabwe. The local authorities transferred water supply to ZINWA, the movement challenged the decentralisation initiative and small towns were negatively affected.

### **2.13 WATER PARTNERSHIP IN KARACHI (PAKISTAN)**

Karachi is one of the largest and most densely populated cities in the world. “The Karachi Water and Sewerage Board is the single largest utility solely responsible for municipal water supply and the management of wastewater and sewerage in the city district of Karachi. Karachi experiences a shortfall of 50 MGD (million gallons per day) in water supply, and approximately 250 MGD of wastewater is left untreated. Moreover, it is estimated that about 40% of the water in Karachi is lost through delivery leakages before reaching a point of consumption, and consumers lose another 25% through wasteful consumption” (Karachi Water Partnership, 2009).

### **2.14 CONCLUSION**

This literature review defined water infrastructure and its implications on city residents. It proposed a set of rules guiding an effective service delivery framework. It also identified the challenges faced by urban local governments in addressing ageing water infrastructure in Zimbabwe and India. A successful case study for urban service delivery was examined. Finally, it identified areas where urban local governments are lacking in terms of service delivery. The significant findings of this literature review are that access and quality of services in urban cities in the developing world, including Zimbabwe, are deteriorating. Services are often plagued by poor planning and operating capacity, corruption, inadequate maintenance, and unresponsiveness to user demands. There is evidence that citizen’s participation provides a strong foundation for establishing good governance and aids the delivery of services at the local level. Participation also promotes accountability and helps to legitimize the activities of

the council. A case study of Karachi Water Partnership provides a good example worth emulating if urban service delivery is to be improved.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 INTRODUCTION**

The section indicates how data in this study was collected, analysed and presented. The study methodology is presented in sub-sections as follows: research design, research paradigm, sampling, data collection, data analysis, and ethical considerations. Lastly, a chapter conclusion is provided.

#### **3.2 RESEARCH DESIGN**

A research design is an overall approach for directing a study, it provides a framework containing the plan for the gathering, measurement and analysis of information (Gaus, 2017). It aids in ascertaining the techniques and logistical provisions needed to carry out research. These procedures answer adequately the research questions and underlying hypothesis. A number of different research designs exist, but there are three main categories: “exploratory, descriptive, and casual designs” (Brewer and Crano, 2000). This study will adopt a descriptive research design.

#### **3.3 DESCRIPTIVE RESEARCH**

According to Brewer and Crano (2000), “descriptive research is concerned with conditions, practices, structures, differences or relationships that exist and opinions held processes that are going on or trends that are evident”. The researcher used a descriptive research design because it was suitable in addressing the research questions. For example, it helped identify valid answers for the constraints that are a hindrance to addressing the issue of ageing water infrastructure as well as measures or solutions taken by local authorities. As outlined by Brewer and Crano (2000), descriptive strategy is appropriate for the researcher’s study since it is concerned with examining a development of service delivery occurring at a specific place, in this case, Gwanda Town Council.

This study used qualitative research methods described by (Creswell and Creswell, 2017) “as a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The process of research involves emerging questions and procedures, data



typically collected in the participant's setting". Qualitative methodology is appropriate for a kind of study that demands going into where people and their institutions are located (Creswell and Creswell, 2017). Therefore, the use of qualitative methodology enabled the researcher to interact with council officials and develop an understanding of the research question at hand. Face-to-face interaction is useful, especially when the researcher wants to collect enough data using different qualitative research tools to address the research questions.

Qualitative research permits one to appreciate people's knowledge, frame of mind, beliefs and understanding of a specific phenomenon, and in this case, it is the ageing water infrastructure. The study particularly uses this type of research due to the nature of the research questions which solicits attitudes and feelings of the participants. As supported by Strauss (1987) this type of approach permits one to obtain insight on situations beyond what they know. Moreover, the qualitative research method was fitting when the researcher sought freedom to select information-rich participants, documents, or sites that would assist answer the research questions (Creswell and Creswell, 2017). Therefore, qualitative data was generated through in-depth interviews, observations, and scanning of secondary sources.

### **3.4 RESEARCH PARADIGM**

"A research paradigm is the set of common beliefs and agreements shared between scientists about how problems should be understood and addressed" (Brewer and Crano, 2000). In qualitative research, there are two common paradigms that a researcher can adopt: constructivism and interpretivism. For this study, the researcher adopted the constructivism paradigm. Constructivists believe that knowledge is socially constructed; hence it is subjective. They believe that truth is based on the human experience. Therefore, people's beliefs, experiences and perspectives form legitimate reality and knowledge. Constructivists are of the notion that there is no solo truth or reality; hence reality must be understood also interpreted. As a result, constructivists are likely to employ qualitative methods like interviews, observations and focus group discussions to acquire reality or truth (Creswell and Creswell, 2017).

### **3.5 POPULATION ANALYSIS**

#### **3.5.1 POPULATION**

The population is understood as the total group to be investigated or studied, It is uniquely well-defined by the study objectives, consisting of a target population defined as a total of

participants or individuals under investigation from which a sample of the study is drawn (Kumar, 2018). The target population of this study included both female and male members who reside in households under the service of the Gwanda Town Council. According to the 2012 Population Census Report 13 754 of the 20 226 Gwanda residents are provided water by the Town Council. The water and sanitation department of the Town Council has employed 50 personnel and there are 3 individuals from various NGOs dealing with water issues in Gwanda Town and have first-hand knowledge and information about the challenges imposed by ageing water infrastructure in their district and how such challenges have been or can be tackled. They were thus considered key participants of this study.

### **3.5.2 UNIT OF ANALYSIS**

Unit of analysis is explained to be the prime entity the researcher analyses in the study, It is the 'who' or 'what' that is being studied. It can either be in groups, individuals, organisations or social artefacts (Babbie, 2014). In this study used individuals form a defined community serviced by the Gwanda Local Water Council. The sampling used individuals who were willing to participate in the study. In this study, the unit of analysis is the individuals because the researcher is exploring people's perceptions on the challenges and solutions of ageing water infrastructure. Other stake holders that were included were employees of the Local Government and NGOs involved in water and sanitation programmes in Gwanda.

### **3.5.3 SAMPLING**

Sampling entails the selection of participants of the study: it is defined as a small percentage of the target population. The sample size is the number of study participants the researcher requires to collect data from determined by the sampling method (Du Plooy-Cilliers, Davis and Bezuidenhout, 2014). According to (Creswell and Creswell, 2017), sampling involves the selection of participants of the study, as it is essential to understand the population of the study before discussing sampling and its procedures. Hence, the subsection below presents the population of the study. In qualitative research, the sample size is expected to be smaller as there is no exact answer for a particular sample size (Cohen, Manion and Morrison, 2002). The sample size of this study included 57 participants, drawn from residents of Gwanda Town (45) and government entities (5) and NGOs (7) involved in water distribution and management and who also have relevant knowledge on ageing water infrastructure. The results of the study were based on the number of 15 participants that represent Gwanda Town.

### **3.5.4 SAMPLING TECHNIQUE**

This research adopted purposive sampling and snowball sampling. These two sampling techniques are discussed below respectively.

In purposive sampling participants to the study are chosen purposefully grounded by a set or list of characteristics. The technique is driven through the study's aim and objectives, research question, and population characteristics, whether they correspond with the study's aim, objectives, and question (Du Plooy-Cilliers, Davis and Bezuidenhout, 2014). Participants selected through this type of sampling provide relevant information that answers the research questions (Cohen et al., 2011). In this study, participants selected through purposive sampling included personnel from ZINWA, Gwanda City Council, and local NGOs. Participants provided information about the challenges imposed by ageing water infrastructure and suggested solutions that have been and/or put forward to solve these challenges. Eight residents were chosen using the snowball method, which is a non-probability sampling technique. Through this method snowballing was used to select respondents with knowledge on water issues; thus, one respondent led to the other respondent. Gwanda Town employees were chosen for their expertise in the management of water infrastructure, and these were the CEO and the Director of Engineering Services. One ZINWA and 1 EMA officers were also purposively chosen and interviewed. Three representatives of the local NGOs dealing with water issues were also interviewed purposively. Du Plooy-Cilliers, Davis and Bezuidenhout (2014) describe snowball sampling as referral sampling through which study participants suggest or recommend others they know who can also be part of the study and can provide relevant data willingly. It is commonly used when the investigator encounters complications in locating individuals who are part of the study population. Since the researcher of this study was not a resident of Gwanda Town, it was foreseen that it might be difficult for him to locate the exact Gwanda Town residents who are involved in water management and who might be aware of the exact challenges that are imposed by ageing water infrastructure on their livelihoods. As a result, the researcher adopted snowball sampling to select participants among the Gwanda Town residents or community members. Snowballing was done using Local Municipality complaints records and meeting records to identify community members who are engaged with water community issues. Purposive sampling and snowball sampling were selected for the study as it capitalises on obtaining individuals appropriate for the study as individuals from the community have more knowledge on who is more involved in water and sanitation provision to give robust perspective on issues concerned considering that there are limited resources to

conduct the study (Palinkas *et al.*, 2015). The sample size of this study included 57 participants, drawn from residents of Gwanda Town (9) using snowball sampling and government entities (9) and NGOs (7) using purposive sampling involved in water distribution and management and who also have relevant knowledge on ageing water infrastructure. The results of the study were based on the number of 15 participants that represent Gwanda Town.

### **3.6 DATA COLLECTION**

Data collection involves collecting relevant information from study participants using qualitative data collection techniques or tools. Data was collected from both primary and secondary sources. These are discussed below, respectively.

### **3.7 IN-DEPTH INTERVIEWS**

In-depth interviews are a qualitative tool used to collect data. This tool permits the researcher to ask questions from study participants to acquire more knowledge related to their beliefs, perceptions, opinions, and experiences relating to a particular phenomenon. This study used this tool to permit in-depth probing during interviews. Participants were expected to provide information on the challenges they are experiencing, or they had experienced resulting from ageing water infrastructure and any solutions they have, or think can be implemented to solve these challenges. Interview lasted for less than an hour per participant with a number of questions (Appendix 1 and 2). Participants were audio-recorded during interviews. Interviews took place at the participants' offices and households for those who do not have offices to avoid any inconveniences that may affect or disturb the interview. The questions such as finding out the efficiency of boreholes available, the leakages on the pipeline, and the breakdown of the pumps were asked. The questionnaire used, in-depth interviews guide and observation checklist are attached in Appendix 2. To the respondents who did not understand the English Language, the researcher translated the questions to isiNdebele the language that participants were fluent in, the researcher was also fluent in isiNdebele. In-depth interviews offer the researcher a chance to observe non-verbal clues of participants that can be used as additional information that can be analysed and interpreted (du Plooy-Cilliers, Davis and Bezuidenhout, 2014). As a result, this study also used observations to collect data, and this data collection tool is described briefly below.

### **3.8 OBSERVATIONS**

Observation is defined as a powerful, scientific and attentive way of taking note of, listening and viewing a subject or phenomenon as it happens (Kumar, 2018). In this study, this tool was used to capture any ageing water infrastructure types like water pipes and drainages and the physical characteristics of the study area (Appendix 3). The researcher used observation to have evidence of the ageing infrastructure and link it with its challenges to the Gwanda Town residents.

### **3.9 SECONDARY SOURCES**

According to Du Plooy-Cilliers, Davis and Bezuidenhout (2014), secondary sources comprise previously researched, analysed and interpreted data or information. For example, research journals, dissertations, encyclopaedias and books. These can be government documents, documented research books and journals related to ageing water infrastructure and water supply in Zimbabwe, focusing more on Gwanda Town. Secondary sources used in this study, included Zimbabwe Statistical Agency (ZIMSTAT) reports, the Council resolutions, the Zimbabwe Vulnerability Assessment Committee (ZIMVAC) reports, and reports from the print media on water challenges under Gwanda Town Council.

### **3.10 DATA ANALYSIS**

Babbie (2014) defines “qualitative data analysis as the examination of social research data without transforming it into a statistical format. It involves organising and explaining data in terms of participants’ perspectives (Cohen, Manion and Morrison, 2002)”. Data analysis involves the researcher identifying and classifying themes (Blanche *et al.*, 2006). The information obtained from the participants was recoded using an electronic voice recorder which was later transcribed to a word document. The interviews were analysed using thematic approach, which entails identifying, examining and categorising themes and patterns in qualitative data. The thematic analysis involves cross-examining the data set to identify common meaning patterns (Braun and Clarke, 2006). In this study, the researcher organised data and identified common themes and patterns of meaning that were then used in presenting the study's findings.

### **3.11 ETHICAL CONSIDERATIONS**

The researcher received ethics approval from the UNISA Research Ethics Committee (Appendix 4) before he stated conducted the study. The ethics approval certificate ensured that participants sign an informed consent form before participating in interviews. Participants were

informed about the study and that their partaking was entirely voluntary, hence they could pull out from participating anytime. The researcher gave all participants consent forms to sign agreeing to participate in the study. Confidentiality was maintained, and participants' names were not identified; the researcher used pseudo names. Alphabetical letters were used in the study to identify the participants. Collected information will be stored in a safe place protected by a password and only accessible to the chief supervisor for five years, and then it will be destroyed.

In conducting this study participants were assured that all information would be treated confidentially. The identity of participants was therefore kept confidential. Assurance was given that after the study, any information, which could reveal the identity of individuals, who will be subjects of research, would be destroyed.

### **3.12 CONCLUSION**

The research project was conducted in Gwanda local Municipality in Matabeleland South. This chapter outlined the methodology that was followed in the study. It discussed the research design, paradigm, population, unit of analysis, sampling, data collection process and analysis, and the ethics to be considered in the study. The chapter also outlined various ethical considerations that were followed in conducting the study.

## **CHAPTER 4**

### **RESULTS**

#### **4.1 INTRODUCTION**

The research intended to explore challenges and solutions of the ageing water infrastructure of potable water in Gwanda Town. This aim was narrowed into three specific objectives, (1) extent and severity of the ageing of water infrastructure, (2) the challenges this imposes on Gwanda Town residents and (3) possible solutions, which then became the major themes of this study during a thematic analysis. As per thematic analysis, the major significant themes are the severity of ageing water infrastructure in Gwanda Town, challenges imposed by ageing water infrastructure on potable water in Gwanda Town, and solutions to the ageing water infrastructure challenges. Below is a detailed presentation of these themes.

#### **4.2 AGEING WATER INFRASTRUCTURE IN GWANDA TOWN**

Zimbabwe is basically a semi-arid country coupled with highly variable rainfall thereby limiting the available water resources (ZINWA, 2017). It also shares many transboundary watercourses with neighbouring countries, limiting the ease with which its water resources can be developed. Nevertheless, despite these obstacles, in the whole of Africa, Zimbabwe established one of the most comprehensive water systems with a storage capacity per capita that is the second-highest in Sub-Saharan Africa. The government and the private sector have developed over 8,000 dams to provide reliable water supplies (ZINWA, 2017). The country also invested heavily in reliable urban water supply (97% coverage in 1990) and wastewater treatment systems covering all major urban centres. However, due to the economic crisis, the government can no longer repair or maintain the ageing water infrastructure systems.

In Zimbabwe, between the periods of the 1980s to 1990s, as the economy collapsed the water sector was no exception, which then led to the ageing of water infrastructure in most areas of Matabeleland South Province, where Gwanda Town is located. According to Berkey (2017), ageing water infrastructure refers to the deterioration of water infrastructure. In this study, ageing water infrastructure is understood as deterioration, decaying and degradation of water infrastructure like pipes, taps, boreholes and hand water pumps that deliver potable water for domestic, agricultural and commercial use. In Gwanda Town, ageing water infrastructure systems that were identified included dams, boreholes, treatment works (water treatment plants), taps, hand water pumps and pipes. These are presented below, respectively.

#### 4.2.1 DAMS

According to participants, there are small dams in Gwanda for agricultural and commercial purposes. However, due to blocked pipes, most water is just stored in these dams, and it ends up evaporating without serving its purpose. In addition, residents are failing to unblock the blocked pipes so that water can be piped into relevant areas. The mentioned dams are Gwanda Dam, Thuli-Manyange Dam and Umzingwane's Mtshabezi Dam. Except for Gwanda Dam, the other two are not located in Gwanda Town, and they also provide water for this region. The dams are characterised by high siltation levels reducing the water capacity of the dam. The dams have not been appropriately managed as they contain litter and possible contamination as some community members conduct various activities such as laundry. This is based on observation of participants not professionals of water services.

#### 4.2.2 BOREHOLES

It was found that residents of Gwanda Town relied less on boreholes for potable water. Most participants raised complaints about borehole water, saying that it is salty and damages their clothes when doing laundry.

*"We can't say we have enough water supply especially because this water is salty, we can't use it for domestic purposes like laundry because it stains clothes. It's too salty to drink and cook tasty food"* (Participant Y).

Based on these issues mentioned above, the functionality of boreholes was found less in Gwanda Town. The individual who raised the point was a female, the IWRM, considers women as essential for quality control and they are the most involved in the daily activities that require water in the household. Functional boreholes were attributed to the trained pump minders who repair boreholes in cases of breakdown in Gwanda Town. **Participant V stated that:**

*"We have trained pump minders who repair boreholes and wells both in-town and rural areas. However, they are few now because some of them relocated, and others died because they were trained way back by District Development Fund (DDF)"*

Participants also mentioned that it was difficult and inefficient for these pump minders to repair broken boreholes because they were not equipped with tools. Combining broken pumps and the saltiness of borehole water has made them unpopular with Gwanda residents.



### **4.2.3 WATER TREATMENT PLANTS**

In Gwanda Town, water scarcity is a serious problem due to combined effects like ageing water infrastructure and climate change issues. Water treatment plants are a critical element in Gwanda Town, and they need to be refurbished as they were showing significant signs of dilapidation. Gwanda Municipality has two water treatment plants, Plant 1 and 2, Plant 1 was built mid-1970s with Plant 2 being built mid-1980s. Plant 1 is working well while Plant 2 is in poor condition, there is no maintenance of the meters, valves and pipes. A trip to Plant 2 there is no maintenance of the meters, valves and pipes, we observed that the sewer pumped into the plant is not treated and there is indication of spill over high is in contact with treated water. There is also build-up of algae combined with grit indication inefficient maintenance of water treatment plant. The state imposes major public health, economic and environmental threats to the Gwanda Town residents. The plants are characterised by leaking cracks rusty pipes and taps in some places there are patches of concrete and plastic to cover-up leaks in to contain the sewage water. One participant said that her water from the tap came out brown and smelling like sewer water one day. When she complained to the council, she was told that the water is fine and safe to drink. This shows that research is lacking and quality control regarding the state of water infrastructure in Gwanda Town.

### **4.2.4 TAPS**

Participants mentioned that ageing pipes are contaminating the water. Residents reported that at times the water from the tap has a red or brown tint, and according to water experts in their town, this is caused by corroded pipes. In addition, in some households, families fail to repair their leaking taps, and others use plastic to fasten and tighten the loose taps. In due time, these plastics decay, leading to the breeding of harmful bacteria that contaminate the water.

### **4.2.5 HAND WATER PUMPS**

Though ageing, it was seen that many of the hand water pumps were working due to technology that made it easier for the community members to repair. They used locally available material, such as old car tyres, to replace the washers and rope guide if they got worn out. According to participants, people were trained in their communities to repair their wells when they wear out. **Participant X** said that:

*'In each community, pump minders were selected (per pump) and trained on how to repair and renovate these pumps in case they are broken. Most of the people have moved to other places and we have lost the people with the technical skills to conduct repairs'*

As a result, aiding a high percentage of functionality. Few pumps were vandalised, and as stated by all participants, with many indicating that the vandalism was as a result of residents who wanted to obtain parts that they so needed for their personal gains.

*“You know in a community you will always have people who are selfish and think for themselves only. You see most of these pumps have been vandalised by some of our residents who took other parts to make hoes, pots and other things they sell”*

said one of the participants who appeared to be so emotionally concerned about this issue  
**(Participants B)**

#### **4.2.6 PIPES**

According to Berkey (2017), metal pipe corrosion is a continuous and severe problem that leads to ion release from the pipes into the water.

Due to certain environmental issues, metal pipes can be seriously corroded based on the soil properties, pipe properties, water chemistry, temperature and abandoned electric currents. In Gwanda Town, it was found that most of these ageing pipes are threatening the water quality by leaching impurities like lead and rust into the water they carry. According to participants from the city town council, underground water infrastructure was installed during the early to mid-1900s and has never been replaced. It was also noted that these constructed pipes have decayed due to ageing and corrosion.

**Participant X** was recorded saying,

*“The underground water pipes have reached their life span and they are no longer fit for piping water. The pipes have an average lifespan of fewer than 50 years but these have exceeded that life span. It is because of corrosion and rust that at times when you open the tap, the water will be reddish and not fit for drinking.”*

In households, one of the participants revealed that most household plumbing fixtures are especially copper or lead. This has been found in older households that have never replaced their plumbing system. It has been found that most of these water infrastructures are ageing, hence affecting both social and economic activities. Gwanda Town’s water infrastructure is deteriorating, thus it needs replacement and upgrading.

### **4.3 CHALLENGES**

Gwanda Town is currently experiencing serious ageing water infrastructure challenges, including inadequate maintenance of ageing water infrastructure systems (boreholes, dams, pipes and taps). All these challenges are presented below respectively.

#### **4.3.1 INADEQUATE MAINTENANCE OF AGEING WATER INFRASTRUCTURE SYSTEMS.**

This study found that dams, pipes, boreholes, and taps in Gwanda Town are inadequately maintained, as revealed by one of the interviewed council employees. In addition, dam and pipe safety inspections have not been undertaken for many years. This has led to increased health problems resulting from the consumption of contaminated water (water contaminated with rust from corroded metal pipes).

According to **Participant S**,

*“Ever since these pipes were installed, no one has ever done any maintenance or replacement procedures. As a result, diarrhoea has been a serious health issue in Gwanda Town because in most cases the water that we drink is contaminated with rust particles from old pipes. In some days we let the kids go to the bush and do their business because our stored water is not enough for cooking and using in the toilet”*

Concerning the issue of water decay, another participant from the town council highlighted that a lack of adequate maintenance of ageing water infrastructure systems has led to the collapse of commercial agriculture and diminishing revenue from raw water sales. This has also resulted in a reduced institutional capacity in the ZINWA and the Gwanda Catchment Council. In addition, blocked pipes have been indicated as another challenge that leads to large quantities of unused stored water being stored in dams and reservoirs. As time goes on, this water loses its quality, and some evaporate due to high day temperatures.

According to ZINWA (2018), it was estimated in 2004 that more than 75% of the projected 47,000 hand water pumps in most Zimbabwe areas were not functioning. This situation has further deteriorated in the entire country. However, Gwanda Town is no exception to this because maintenance and repairs of water supply systems virtually stopped. The government is no longer providing spares, many water point committees which manage various water infrastructure have festered, and pump-minders have not been retained. There is a unanimous agreement in Gwanda Town Water Council that the infrastructure is ageing, and this has

negative consequences on the residents. When asked about the other problems caused by ageing water infrastructure, participants raised several issues.

*“The most common problems we experience from these ageing water infrastructure systems encompass bursting of pipes which lead to prolonged water shortages and water shedding hence there is no adequate water supply to run the home. We are constantly worried about the cleanliness of the water we have to boil the water for drinking and buy more detergents to make the water safe. Considering the economic situation in Zimbabwe we have to spend more on running the household” (Participant Q).*

In support of the -highlighted problem, Participant Q mentioned that these burst pipes have become an ultimate indicator of the poor condition of the pipes. In addition, the town clerk explained that ageing water infrastructure implies that the size of pipes has become overwhelmed by increased population in such a way that the amount they can hold water is only enough for half the entire population. As a result, other residents sometimes collect water from busted pipes, which then pose health-related hazards. Some areas do not receive water as the pressure system is compromised by the burst pipes.

In addition, **Participant T**, a resident, stated that the lifespan of the pipes had caused a long-term challenge.

*“The signs of the ageing water infrastructure are there for everyone to see, we are sitting on a time bomb that can lead to the collapse of the whole system. When the council is asked to provide maintenance information and water treatment logs, the records not available. As a community we raise these concerns to protect ourselves from disease but the lament falls on deaf ears we don’t know whom to consult when the council rejects our plea”*

Based on the provided information, it can be said that all challenges related to ageing water infrastructure are related to the poor government support system. There is a failure to plan and implement an operational maintenance plan. IWRM Principle 2 indicates that institutional structures are pivotal in liaising with the community for their needs in this case however reports are made and the Local municipality is not taking action to improve water supply.

#### **4.3.2 POOR SEWAGE SYSTEMS LEADING TO WATER POLLUTION**

Water pollution has been reported as another serious ongoing problem in Gwanda Town. Sewage treatment plants are bursting and discharging untreated sewage into open water sources like dams, reservoirs and rivers.

One of the participants also identified long and short-term problems that Gwanda Municipality is facing concerning water ageing infrastructure and water supply. He mentioned that,

*“In the current economic environment, we are supposed to be pumping water for 18-20 hours during the hot season but now, we are limited to 7 hours due to poor water infrastructure systems. You can imagine if you were pumping water for 18 hours now you are pumping for 7 hours that’s a challenge to our residents” (Participant Z).*

Some participants also seconded the above statement and said that this challenge is now exacerbated by the current economic crisis where stage 2 load shedding consists of 16-18 hours a day daily. Another challenge of poor water treatment plant faced by the residents of Gwanda Town emanates from the existence of a dual relationship between Gwanda Municipality and ZINWA. **Participant S** said that since 1980, there has not been an expansion of the waterworks or water treatment plants. To further explain the challenges imposed by ageing water infrastructure, the number of projects initiated by the Gwanda Municipality was used as an indicator to show the effects of ageing infrastructure.

All participants were asked to give a total number of water infrastructure programs and initiatives that the local water authority has implemented since 1980 to date. All participants mentioned the five mega-litre reservoir tanks only, which is set to increase water supply and avail water to residents leaving high altitude areas like Spitzkop, which currently have no water. Although they have managed to build these five mega-litre reservoirs to increase storage capacity, it does not cover all areas of Gwanda Town. There have been numerous reports of acute diarrhoea in the community however no studies have been conducted to find the root cause of the problem, community members mention contaminated water sources.

#### **4.4 SOLUTIONS IN ADDRESSING AGEING WATER INFRASTRUCTURE**

This section presents the solutions that were put in place to respond to the problems caused by ageing water infrastructure systems in Gwanda Town. Moreover, it provides solutions that can be implemented (as suggested by participants) to solve the challenges arising from ageing water infrastructure systems in Gwanda Town. These solutions are presented below, respectively.

##### **4.4.1 IMPLEMENTED SOLUTIONS**

One of the significant initiatives that were implemented was the Gwanda District Integrated Rural Water Supply and Sanitation Project of the years 1995-2000. However, as said by the participants, this project targeted chiefly the rural areas of Gwanda and, to a lesser extent, few

areas in Gwanda Town. Therefore, this study only presents how the project was implemented in Gwanda Town and how it benefited the residents of Gwanda Town.

#### **4.4.1.1 GWANDA DISTRICT INTEGRATED RURAL WATER SUPPLY AND SANITATION PROJECT (IRWSS) (1995-2000)**

Gwanda Integrated Rural Water Supply and Sanitation Project was launched in 1995 and completed in 2000. The initiative is in line with IWRS framework as it seeks to improve water provision based on the requirements of the Gwanda community. It sought to provide a range of new and rehabilitated water and sanitation facilities to the people living in 19 out of the 23 wards of Gwanda District. The approach was to involve and empower communities, decentralise management and seek a flexible and innovative approach wherever possible (PLAN Africa, 2000). The project was supported by the Australian Government (AusAID) in the first instance and then UNICEF-Australia. In addition, UNICEF Zimbabwe played a crucial role in facilitating, supporting and monitoring the project (PLAN Africa, 2000).

According to participants, this project managed to drill more boreholes in rural areas and a few hand water pumps and boreholes in town. The project focused less on Gwanda Town because they believed that residents in town have access to clean piped water, and this water is piped into their households. Of interest to note is the fact that, compared to other development programmes this Gwanda scheme succeeded to attain drilling aims in both rural and urban areas of Gwanda.

#### **4.4.1.2 CONDITION OF THE WATER POINTS DURING SITE VISITS**

Most of the water facilities which were provided under the Urban Water and Sanitation (Urban WASH) programme are still functional. A few water points visited during fieldwork were not functional. *'Some of these pumps and boreholes have remained broken as far back as January 2000'* (**Participant T**). In other cases, water was found to be salty; hence residents abandoned them. **Participant U** explained the effects of saline water and said,

*"We cannot say we have enough water supply because this water is salty. We cannot use it for domestic purposes like washing laundry because it stains clothes. It's too salty to drink as well."*

There are some instances where some of the boreholes and pumps had become hard to pump due to lack of grease. Participants highlighted that while they were cognizant of the necessity for grease, they had not bought any due to financial problems.

Overall, the project was a considerable success, and several added facilities were built through DDF, NGOs, and the initiatives of residents through self-reliance. It was found that the involvement of NGOs in the Gwanda IRWSS project was actively encouraged by support agencies, such as UNICEF and welcomed by the Rural District Council and the District Water Supply and Sanitation committee. The NGOs mandate in the project was in the provision of supplementary facilities externally but however interrelated to the project components. Generally, the NGOs have been vital in increasing within the district the total coverage of safe water supplies and sanitation facilities. In addition, UNICEF assisted Mvuramanzi Trust to present and create awareness of alternative water and sanitation technology designs.

#### **4.4.2 SUGGESTED SOLUTIONS**

To address the challenges imposed by the ageing water infrastructure systems in Gwanda Town, there is a need for a complete overhaul of the piping system, replacing old pipes with bigger sized pipes that can cater to the increasing population and the type of pipes that do not rust. However, this can only work given that the piping system plan has been availed to the Municipality otherwise, without that they have to wait for a burst to replace it. Therefore, they cannot be proactive but reactive. One of particular interest was that if the community and Gwanda Municipality work together, it can work, the residents pay their council tariffs on time and Council uses that money to replace burst pipes. Funding is one of the drawbacks; hence what needs to be done is getting the resources.

*“On the planning aspects, we know what needs to be done, but getting funding to do what needs to be done that’s the issue in implementation” (Participant V)*

*“You will find that we have got reports in our cabinets on what needs to be done at the treatment plant, what needs to be done along with the system, what needs to be done in reservoirs but resources to implement are not there. Residents have to take initiative by paying bills on time so that we can conduct maintenance with the little that we have” (Participant W)*

The long-term solutions identified by the survey participants evolved around increasing water storage capacity. They advocated for building more dams, reservoir tanks and boreholes. With these, more water is harnessed during the rainy people and the more catchment areas the more water there is available across seasons and even in high lying areas. IWRM Principle 4 deals with the economic aspect of water in this case the Local Municipality cannot provide clean

water and maintain infrastructure because water payments are made late or not even made at all therefore it is not feasible to provide water in a sustainable manner.

#### **4.5 CONCLUSION**

This chapter provided results from a survey on ageing water infrastructure systems in Gwanda Town. These included dams, water treatment plants, boreholes, hand water pumps, taps and pipes. Due to ageing, it was found that all of these water infrastructure systems mentioned above are imposing various challenges and risks to human health and economic activities in Gwanda Town. Some solutions have been implemented however it is still far from solving most of its challenges especially ageing water infrastructure systems. The following chapter presents the discussion of the results.



## **CHAPTER 5**

### **DISCUSSION**

#### **5.1 INTRODUCTION**

The study's results are deliberated herein in this section. The results are discussed according to their themes, namely:

- (1) Severity of ageing water infrastructure,
- (2) the challenges this imposes on Gwanda residents,
- (3) possible solutions ageing water infrastructure in Gwanda Town

These themes are briefly discussed below. This study identified five different ageing water infrastructure systems in Gwanda Town, and these include dams, boreholes, treatment works (water treatment plants), taps, hand water pumps and pipes

#### **5.1.1 SEVERITY OF THE AGEING OF THE WATER INFRASTRUCTURE DAMAGE**

Gwanda Municipality is responsible for the distribution of the water to Gwanda residents and it acquires water from ZINWA bulk water supplies through four high level tanks measured by six bulk meters during the time of the interview only two of the bulk meters were working, with no schedule for maintenance/fixing. Hence, the Gwanda Municipality has an estimate of the water they are acquiring making pricing difficult, in many cases municipalities over- estimate to account irregularities which has negative financial impact on residents (Van den Berg and Danilenko, 2017). Gwanda Municipality has two water treatment plants, the challenge of having a poor functioning water treatment plant is that the plant's efficiency cannot be optimised as there are no data collection points to improve efficiency. This also means that the plant has a fixed routine to treat water, this may lead to poor water quality because the quality of raw water (turbidity, flow, chemistry, secondary waste) varies the source steps may need to be adjusted this compromises water quality and delivery and if there is a fault it takes a long time to troubleshoot as it is done manually (Momba, Obi and Thompson, 2009). Mechanical breakdowns take time to fix or not fixed at all owing to the lack of spares plus maintenance programme hence reduced efficiency. The other main contributor to reduced water treatment plant efficiency is intermittent power supply with load shedding lasting up to

16 hours, translating to no productivity affecting water supply. There has not been as system upgrade in both plants hence efficiency levels are reduced. In a 2010 UNICEF report showed that some days the water treatment plant did not pump out any clean water and there was no explanation for the cause and how it could be avoided due to meters and alarms that are not working (UNICEF, 2010). This is still, the case as the survey participants acknowledged that they sometimes go for days without water. Expansion of the urban population caused the Gwanda Municipality to allocate stands however these stands were not serviced and some areas complaining of inadequate water pressure. The Gwanda water system has not been expanded since the colonial error for adequate water supply, the current system has to be upgraded and extended this is a financially demanding exercise that the Gwanda Municipality cannot afford in the near future unless if there is government/NGO intervention. The entire water system infrastructure is compromised.

### **5.1.2 CHALLENGES**

The challenges imposed by ageing water infrastructure systems in Gwanda Town, participants highlighted different problems. They argued that there are various challenges which include:

Lack of parts to maintain:

- hand water pumps for boreholes;
- contaminated water due to corroded pipes;
- leaking pipes and taps,
- vandalism of boreholes by residents as well;
- economic crisis, which led to a lack of financial resources to fix non-functional water treatment plants.

As argued by participants, these challenges are left unresolved, leading to serious human health problems like waterborne diseases and water scarcity. This finding is in line with Schouten and Buyi (2010) and Howard (2011) research findings that globally, more than one billion people lack access to clean, safe drinking water due to a lack of political will to renovate or replace ageing water infrastructure systems.

The assumption was that participants from the water sector and Town Council and other donors related to water management issues (the qualified personnel) in the study region had solid knowledge about these challenges and could respond in detail to questions directed to them as they better understanding on technical issues about ageing water infrastructure and challenges

on potable water provision. Nevertheless, the drawbacks of repair and upkeep are not exceptional to Gwanda Town alone in Zimbabwe, it includes a number of other towns. Eighty per cent (80%) of the total capacity of municipal water supplies shows that at present the level of Non-Revenue Water in the entire country is forecasted at 40% of most water lost through pipe and tape leakages as well sewer water contamination. Bulawayo has reported the same challenges of loses a lot of water throughout the year due to water leaks even though it is not under the service of ZINWA (ZINWA, 2017). The CSIR and CIDB (2007) report also point out the same concerns, water leakages are the most common problems experienced with water reticulation systems in most Southern African countries. Incorrect component assembly during water infrastructure installations, excavating close to the pipes instigating damages, use of inappropriate materials, inappropriate repair procedures, ageing of pipes with illegal connections worsening the situation. Failure to service broken down infrastructure stands as the greatest challenge.

Despite being developed, these developed countries too face challenges of ageing water infrastructure. In the USA, water infrastructure has the following challenges: (a) Lack of substantial reinvestment for the replacement of existing infrastructure; (b) poor maintenance of ageing water infrastructure systems; and (c) poor sewage and water plant systems leading to poor water quality (Heare, 2007). Hunaidi *et al.* (2004) argue that, in Canada the water transmission and distribution networks deteriorate as they age. Eventually, their water tightness decreases, among other reasons, installations in environments surrounded by corrosions, unstable soil conditions, defective construction standards, unstable water pressure, and movement of heavy vehicles causing vibrations. As a result, it is paramount to articulate leakage management around the total quantity of the lost water, leak monitoring mechanism, leak detection and repair, and a pressure monitoring system. Below is a discussion of the implemented and suggested solutions to ageing infrastructure in Gwanda Town.

### **5.1.3 SOLUTIONS**

The challenges of water infrastructure are complex, therefore, inter-organisational plans to deal with them. These include bring to a halt unlawful water connection, open unbiased reporting mechanisms of issues, community participation and participation of leaders, village committees, expertise transmission to local communities, and community ownership of water infrastructures. The participants have faith in that a partnership amongst the municipality, town council, political leaders and the residents would address some challenges of ageing water

infrastructure. Zimbabwe is a developing country hence the primary focus should be meeting the United Nations Millennium Development Goals reducing the number of people without access to basic drinking water and sanitation services (Campbell, 2017)

In support, Sutherland *et al.* (2014) highlighted that the municipality must embark on recruiting and training of more staff to develop technical capacity and supporting the ageing water infrastructure to provide clean and safe water (potable water). The municipality should also offer parts for repairing boreholes and hand water pumps. Some efficient measures include: 1) introducing community-based approaches for the operation and maintenance of their ageing water infrastructure systems, 2) service users' involvement to boost increased efficiency, 3) benchmarking 4) promote awareness, 5) national growth contribution, 6) wastage reduction, and, 7) upgrade the allocation of resources and improved competitiveness as studies from India, Pakistan and Sri Lanka showed (Sohail, Cavill and Cotton, 2005) As quoted in this study, one participant of this Indian-Pakistanian study supports these community-based approaches(Sohail, Cavill and Cotton, 2005: 25), argued that,

*“Every location should have a street committee that will oversee this problem. These committees should also work hand-in-hand with the police. The villagers should also be taught about the importance of protecting water infrastructure from vandalism and theft.”*

Since participants from Gwanda Town highlighted vandalism and theft of parts as one of the severe problems they encounter, the above-stated solution from the Indian-Pakistanian study can also be implemented in Gwanda Town to stop vandalism and theft. In Sub-Saharan Africa, (Sutherland *et al.*, 2014:18) contends that “there is a need for suitable legislation or guiding principles, financially sound mechanisms, skilled personnel, adequate organisational support, and effective management systems which should prevent or least minimise water leaks”. The strategy of privatisation as a solution given the history and the economic state of Africa is rather undesirable at this stage. Privatisation considers the privatised service as a commodity that must be rendered only through a cost-recovery basis, i.e. accessible to persons who can have enough money to meet its cost of production. This path will worsen the legacy of apartheid and annul all the hard work and resources expended ever since the end of the apartheid system.

One of the other obstacles emanating from ageing water infrastructure is the negative effect on household domestic consumption and also insufficient potable water for industrial use. Insufficient water supply has also a negative effect on the economic and commercial sectors as well, including flooding and damage to property, sinkholes and reduced production times in

the manufacturing sector (Vedachalam *et al.*, 2016:1). In this study, more participants alluded to individual water connections as a solution to ageing water infrastructure whilst others emphasized on the need to report to the closest police stations perpetrators who steal infrastructure and the imposition of heavy fines on anyone caught vandalising infrastructure.

The findings pose a serious health threat to the Gwanda community as it is the basis of a productive society as contaminated water sources are a cause of acute, repeat and chronic diarrhoea episodes and other water borne disease due to the use of unprotected water sources (Hunter, MacDonald and Carter, 2010). The community can be exposed to chemical species such as arsenic and fluoride which cause a wide range of hepatic, cardiovascular, skin and renal diseases and associated cancers (Chouhan and Flora, 2010). It can also affect development of by undermining human health community hence limiting productivity for those affected directly and indirectly at both household and country scales (Kumar and Kober, 2012).

#### **5.1.4 CONCLUSION**

The challenges of repairs and maintenance in Gwanda Town are complex. Therefore, they need innovative solutions that comply with national legislation and international conventions stipulated by the government. There should be an adaptation to local socio-economic and political realities to improve access to uninterrupted and inclusive access to water. The IWRM advocates for a holistic management of water resources that engages all stakeholders to make water provision sustainable.

## CHAPTER 6

### CONCLUSION AND RECOMMENDATIONS

#### 6.1. INTRODUCTION

This research work focused on exploring the severity of ageing water infrastructure in Gwanda, Matebeleland South Province, Zimbabwe. Moreover, the challenges imposed by ageing water infrastructure on Gwanda respondents were explored. Subsequently, possible solutions to this predicament were suggested. The ability to access clean water is a human right under the Constitution of Zimbabwe. Therefore, every Zimbabwean, be it in town or rural areas, and Gwanda not being an exception should have access to water.

The right to shelter, clean water, and electricity is one of the pillars of different political parties' election campaigns they may just differ on how they will employ strategies to foster this. “While some advocate for free access to these services, others believe that the beneficiaries need to contribute to providing these services since free access to these services is not sustainable in the long term The political rhetoric of free access to basic needs and rights resonates well in the participant's minds although there are costs involved in the production, transportation where applicable and distribution of these needs and the experiences from around the world” (CSIR and CIDB, 2007, p. 5)

The significance of this study is in its contribution to the appreciation of these challenges and recommends some possible solutions. The conclusions of this study will primarily contribute improvement the living standards of the recipients through the attainment of most the Sustainable Development goals (SDG) to attain SDG 1 of thriving lives and livelihoods there must be provision of clean water since water is life; SDG 2 of sustainable food, security, needs water in the form of water for agriculture and also industrial water to ensure production and reservoir water for non-humans. Similarly, SDG 6 clean water and sanitation refers to sustainable water security emphasises that water is a source of life. It must therefore be secured for sustainability (Le Blanc, 2015; Pradhan *et al.*, 2017; Nkiaka *et al.*, 2021). Furthermore, the research's findings would support Gwanda Town to optimise the cost of production, transportation, and distribution of water pipes and taps to timely repairs and regular maintenance, a partnership between the municipality and communities, awareness of vandalism and community ownership of water infrastructure.

## **6.2. SUMMARY**

This study was premised on three objectives. Firstly, it tried to explore the state of water infrastructure systems in Gwanda Town. Secondly, it investigated the challenges imposed by these ageing water infrastructures and thirdly investigated the better solutions to curb the difficulties highlighted. This descriptive study gathered data through secondary sources, in-depth face to face interviews and observations. The research design utilised the strength of qualitative methods to collect and analyse data. Indeed, the qualitative research collected the participants' experiences, feelings, and viewpoints on the investigation issues. In addition, it used thematic analysis to analyse data. The study found out that most of the water infrastructures in Gwanda was old, dilapidated, and that due to the state the water infrastructure systems are imposing -threatening challenges to residents and economic problems. Such challenges include; lack of parts to maintain broken boreholes, hand driven water pumps, contaminated water due to corroded pipes, leaking pipes and taps, vandalism of boreholes by residents as well and economic crisis, which led to a lack of financial resources to fix non-functional water treatment plants. All these are the challenges imposed by ageing infrastructure on supply of potable water.

This impact on provision of potable water results in the community receiving contaminated water due to corroded pipes, facing serious water shortages, burst sewers running across homes, water related diseases e.g. diarrhoea and in the long run affects disposable income of residents as it is diverted to healthcare and purchase of clean drinking water. Concisely the solutions suggested by the community included the need to bring to halt unlawful water connections, open unbiased reporting mechanisms of issues, community participation and participation of leaders, village committees, expertise transmission to local communities, and community ownership of water infrastructures.

## **6.3. CONCLUSION**

The first objective was to ascertain the state of water infrastructure in Gwanda Town. Evidence conclusively show that most of the water infrastructure in Gwanda Town is old and dilapidated. Most sewer and underground pipes date back centuries ago in the 1900 when they were initially installed. These pipes have not been replaced; only upon bursting or leakages are they repaired. However, rate at which repair is done is also slow due to lack of funds. Other water infrastructure like boreholes and hand water pumps were malfunctioning and still using the old systems. In an age where boreholes are solar driven, it has become difficult to obtain parts

when these aged water systems break down. The water treatment plant is inefficient due to lack of system upgrade and persistent power cuts.

The second objective was to identify the challenges imposed by ageing water infrastructure on the supply of potable water in the area. The challenges identified clearly showed that they were contributing negatively to the supply of potable water in Gwanda Town. Solutions were sought from the community to address these challenges; some solutions were already under implementation, with just a need to support more the systems that have been put in place. Some of the other solutions were suggestions for implementation. Conclusively, if all stakeholders i.e. ZINWA, DDF, NGOs and the private sector collaborate they can implement solutions that can improve water service delivery in Gwanda Town.

#### **6.4. RECOMMENDATIONS**

Identified challenges and suggested solutions to address them, this study recommends the following:

- Employment of artisans who are qualified to do the job or skills transfer to local people who live in the different villages in the water supply division. Employees in the water supply division need to receive regular training to upgrade their skills in the ever-changing work environment.
- Operators and pump minders should be recruited to each location so that services are not halted by their absence. Additional staff should be recruited to remain on standby for emergencies.
- The municipality must assign additional (qualified) maintenance personnel to help in identifying where and when to repair boreholes, taps and hand water pumps; and ensure that infrastructure is secured and protected from vandalism and theft.
- Further research is recommended to understand the effects of ageing water infrastructure on the quality of water using appropriate laboratory techniques.
- The effect of population increase on water infrastructure.



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## APPENDICES

### APPENDIX 1

#### STRUCTURED INTERVIEW QUESTIONNAIRES

##### 1. BIOGRAPHICAL INFORMATION OF RESPONDENTS.

1.1. Gender: Female   Male

1.2. Age:

1	2	3
15-25	26-35	36+



1.3.	1	2	3	4	Education:
	Grade 1-7	O-A level	Diploma/NHC	Degree	

1.4. What is your position in the organization?

**2. THE EXTENT OF WATER SUPPLY IN THE TOWNSHIP.**

2.1. Are you of the opinion that your area is accessing adequate water supply? .....

.....

2.2. What is the frequency of water supply in your area? .....

.....

.....

2.3. Is the provision of water in your area adequate for the community? .....

.....

.....

2.4. Are you of the opinion that the current water supply in your area is worse compared to the previous years? .....

.....

**3. THE PROBLEM OF WATER PROVISION IN YOUR AREA.**

3.1. When did your area start experiencing water shortage?

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.....

.....

.....

3.2. How did it come to the attention of the community that there is water problem?

.....

.....

.....

.....

3.3. Was there any communication from the local water authority or the municipality about the water crisis?

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.....  
.....  
.....

3.4. Are there current communiqués about the way water crisis is being addressed in your area?

.....  
.....  
.....  
.....

3.5 How many days have you spent without water on average based on the knowledge?

**4. CAUSES AND IMPACT.**

4.1. What are the causes of water shortage in your area?

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.....  
.....  
.....  
..

4.2. Aging infrastructure has been highlighted as a cause of water shortage in your area how far true is this?

.....  
.....  
.....  
.....

4.3. Does the shortage of water in your area impact negatively in the development of your area?

.....

4.4. What is negatively impacted by the lack of water in your area? Also, state the severity of this.

.....  
.....  
.....

4.5. Does the shortage of water in your area impact negatively on health?

Yes	No
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4.6. If yes, what negative impacts does water shortage have on the health of the community?  
State the severity of this impact.

.....  
.....  
.....

**5. MEASURES OF ALLEVIATING WATER PROBLEM IN YOUR AREA.**

5.1. Are you of the opinion that the problem can be sorted out soon?

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.....  
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.....

5.2. How do you think the problem of water can be solved in your area?

.....  
.....  
.....  
.....

5.3. What has the City Fathers done to alleviate this problem?

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.....  
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5.4. Do you believe privatisation of the water management and provision can be a solution to this current situation? And why?

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.....

Thank you for taking part.

## **APPENDIX 2**

### **IN-DEPTH INTERVIEW GUIDE**

#### **RESEARCH QUESTIONS**

1. What is your position and experience in ageing water infrastructure?
2. How long have you been working in the water governance system in Gwanda Town?
3. How many water infrastructure projects have been implemented by the local water governance since 1980?

4. What are the challenges that have prevailed within the ageing water infrastructure since 1980?
5. How did the local water governance deal with any problems or challenges associated with ageing water infrastructure?
6. Given the current water and economic crisis in Zimbabwe, what are the challenges prevalent in ageing water infrastructure on potable water in Gwanda Town?
7. What measures are being implemented by the local water governance in response to these challenges in Gwanda Town?
8. As a water governance system, what are your developmental objectives for the enhancement of the water infrastructure for Gwanda Town?
9. How effective are grey infrastructure systems in supplying potable water to local communities in Gwanda Town?
10. How often do you face any challenges or problems related to breaking down or decaying old infrastructure systems in Gwanda Town?
11. How do you solve such problems and who is responsible for the maintenance of these grey infrastructure systems?
12. Do you encounter any challenges when maintaining old infrastructure systems?
13. Do you know of any other NGOs or private organisations involved in restoring ageing water infrastructure in Gwanda Town?
14. If so, who are they and how are they dealing with challenges related to ageing water infrastructure in this community?
15. How is the local community involved in the management of water infrastructure or supply of potable water in Gwanda Town?
16. How effective is the involvement of the local community in the management of water infrastructure or supply of potable water in Gwanda Town?
17. Do you have anything to add or ask pertaining to this interview?

### **APPENDIX 3**

#### **OBSERVATION CHECKLIST**

1. Are there any visible rusting pipes?
2. Is water coming from the tapes clear?
3. Are there any visible pipe leakages?

4. Is there any abandoned water infrastructure nearby?
5. Is there any maintenance of water infrastructure taking place currently?

#### **APPENDIX 4**

#### **ETHICS LETTER**

UNISA GENERAL RESEARCH ETHICS REVIEW COMMITTEE

Date: 09/04/2018

Dear Mr Sibanda

NHREC Registration # : REC-170616-051  
ERC Reference # : 2018/CAES/038  
Name : Mr W Sibanda  
Student # : 47837411

**Decision: Ethics Approval from  
05/04/2018 to 31/03/2019**

**Researcher(s):** Mr W Sibanda  
47837411@mylife.unisa.ac.za

**Supervisor (s):** Mr SB Hlabisa  
018050@unisa.ac.za; 011-471-2894

**Working title of research:**

The burden of ageing water infrastructure in Gwanda, Zimbabwe: Severity of the problem and possible solutions

**Qualification:** MSc Environmental Management

Thank you for the application for research ethics clearance by the Unisa CAES General Research Ethics Review Committee for the above mentioned research. Ethics approval is granted for a one-year period. After one year the researcher is required to submit a progress

*The low risk application was reviewed by the CAES General Research Ethics Review Committee on 05 April 2018 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No field work activities may continue after the expiry date. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

**Note:**

The reference number **2018/CAES/038** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.

Yours sincerely,



**Prof EL Kempen**  
**Chair of CAES General Research ERC**  
E-mail: kempeel@unisa.ac.za  
Tel: (011) 471-2241



**Prof M3 Linington**  
**Executive Dean : CAES**  
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 URERC 25.04.17 - Decision template (V2) - Approve

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## RESEARCH SCHEDULE

First Submission to Supervisor	18 May 2021
Comments from Supervisor	31 May 2021
Submission for editing and receiving comments	15 June 2021 – 15 September 2021